# Oral Sessions
# Abstract award winning session: The best selected abstracts submitted to the congress: 0474–0477

## 0474

### EVALUATION OF THE EFFICACY OF CORTICOSTEROIDS IN PATIENTS WITH AN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE RECEIVING VENTILATORY SUPPORT: A PROSPECTIVE, INTERNATIONAL, RANDOMIZED DOUBLE BLIND CLINICAL TRIAL

I. Alía[1], M. Á. de la Cal[1], A. Esteban[1], R. Ferrer[2], F. Molina[3], R. Piñer[4], A. Anzueto[5]

[1]Hospital Universitario de Getafe, Intensive Care Unit, Getafe, Spain, [2]Hospital Parc Taulí de Sabadell, Intensive Care Unit, Barcelona, Spain, [3]Clinica Universitaria Bolivariana, Intensive Care Unit, Medellín, Colombia, [4]Hospital Clinic, Intensive Care Unit, Barcelona, Spain, [5]South Texas Veterans Health Care System, Pulmonary Critical Care, San Antonio, USA

**INTRODUCTION.** The use of corticosteroids to treat acute exacerbations of chronic obstructive pulmonary disease has been endorsed by several medical societies. While there is evidence of an improvement in lung function, the effect on clinical outcomes in patients that require ventilatory support is unclear.

**OBJECTIVES.** Multicenter randomized double blind controlled clinical trial to evaluate the effect of corticosteroids on the duration of mechanical ventilation and the ICU-length of stay in patients requiring mechanical ventilation due to an acute exacerbation of COPD.

**METHODS.** Adult patients admitted to the ICU with a primary diagnosis of COPD exacerbation, defined as the presence of two or more of the following: worsening dyspnea, increase in sputum purulence, increase in sputum volume, and respiratory failure (pH $<$ 7.35 with a $P_aCO_2 >$ 45 mm Hg) who required mechanical ventilation were randomly assigned to "Corticosteroids Group" (intravenous methylprednisolone 0.5 mg/kg every 6 h for 72 h, 0.5 mg/kg every 12 h on days 4 through 6, 0.5 mg/kg daily for day 7 through day 10) or "Placebo Group" (50 mL of intravenous normal saline solution). If the patient did not clinically improved after the third study day, treating physicians were allowed to prescribe systemic corticosteroids and stopped the administration of the study medication. The primary outcome measures were duration of mechanical ventilation, length of ICU stay, and need for intubation in patients treated with non-invasive mechanical ventilation.

**RESULTS.** Of 354 potentially elegible patients, 83 (23%) were enrolled of whom 43 were randomly allocated to corticosteroids group and 40 to placebo group. Non-invasive mechanical ventilation was used in 37 patients (18 assigned to corticosteroids and 19 assigned to placebo). The baseline characteristics of the groups were similar (males 74 vs. 85%; age 69 $\pm$ 10 vs. 68 $\pm$ 11; SAPS II 36 $\pm$ 10 vs. 36 $\pm$ 11; acute exacerbation due to respiratory infection 70 vs. 70%; pH 7.28 $\pm$ 0.11 vs. 7.31 $\pm$ 0.10; $P_aCO_2$ 70 $\pm$ 20 vs. 69 $\pm$ 18 mm Hg; $P_aO_2/F_iO_2$ ratio 230 $\pm$ 82 vs. 191 $\pm$ 70). Open-label corticosteroids were prescribed after third study day in four patients of each group. Duration of mechanical ventilation was 4.5 $\pm$ 3.1 days in corticoids group and 6.9 $\pm$ 7.9 days in placebo group (p = 0.08), length of ICU stay was 7.5 $\pm$ 5.6 days in corticoids group versus 11.0 $\pm$ 10.6 days in placebo group (p = 0.07), and the need for intubation in patients treated with non-invasive mechanical ventilation was significantly reduced in corticoids group (0 of 18 patients vs. 7 of 19 patients, p = 0.008). The frequency of hyperglucemia was higher in corticosteroids group (46 vs. 25%, p = 0.042). There were no differences in mortality and incidence of other adverse events.

**CONCLUSIONS.** Use of corticosteroids to treat exacerbations of COPD patients requiring mechanical ventilation may reduce the duration of ventilatory support, the ICU stay and the need for intubation.

## 0475

### ATROPHY GENE EXPRESSION IS UPREGULATED DURING EARLY CRITICAL ILLNESS AND ASSOCIATED WITH SELECTIVE TYPE-IIA FIBRE ATROPHY

J. Bierbrauer[1], J. Fielitz[2], S. Wiesener[1], S. Spuler[3], C. Spies[1], A. Luther[1], K. Faust[4], J. Spranger[5], S. Weber-Carstens[1]

[1]Charité, University Medicine Berlin, Department of Anesthesiology and Operative Intensive Care Medicine, Berlin, Germany, [2]Charité, University Medicine Berlin, CVK, Department of Cardiology, Berlin, Germany, [3]Charité, University Medicine Berlin, Department of Myology, Berlin, Germany, [4]Charité, University Medicine Berlin, Department of Neurosurgery with Pediatric Neurosurgery, Berlin, Germany, [5]Charité, University Medicine Berlin, Department of Endocrinology, Diabetes and Nutritional Medicine, Berlin, Germany

**INTRODUCTION.** E3 ligases MuRF-1 (muscle ring finger-1) and Atrogin-1 (muscle atrophy F-box) assure substrate specificity of proteins degraded by the proteasome and have been implicated as a common feature of muscle wasting. Pronounced muscle wasting represents a common and serious complication of critical illness and involves various conditions.

**OBJECTIVES.** To evaluate the impact of atrophy gene expression (MuRF-1 and Atrogin-1) on muscle atrophy during early critical illness

**METHODS.** Critically ill patients with SOFA scores $\geq$ 8 on 3 of 5 consecutive days within the first 8 days after ICU admission were eligible for inclusion into this prospective, observational study. Preexisting IDDM or neuromuscular disorder, pregnancy, BMI $\geq$ 35 kg/m$_2$, age $<$ 18 years, or pretreatment $>$ 4 days on other ICU constituted exclusion criteria. Surgical muscle biopsies were taken from vastus lateralis muscles between day 5 and 8 after first SOFA $\geq$ 8 and postprocessed according to standard procedures (isopentane, liquid nitrogen, ATPase/toluidine blue staining, quantification of fibre-type specific median cross sectional area (CSA) with ImageJ-Software). MuRF-1 and Atrogin-1 mRNA expression was quantified by realtime PCR and correlated (Spearman's rho) with type-I, type-IIa and type-IIb specific CSA after normalization to mRNA expression of housekeeping enzyme GAPDH.

**RESULTS.** Of 33 patients enrolled and subsequently biopsied (day 5–8 after 1st SOFA $\geq$ 8), reliable CSA quantification could be obtained for 27 patients. Type-IIa cross sectional area showed a statistically significant negative correlation with MuRF-1 (rho = −0.429; p = 0.026; n = 27; Fig. 1???) and Atrogin-1 (rho = −0.402; p = 0.038; n = 27) gene expression (normalized to GAPDH), which was not observed for type-I or type-IIb muscle fibres.

**CONCLUSIONS.** Animal studies describe preferential expression and induction of MuRF-1 within type-II muscle fibres.(1) To the best of our knowledge, we are the first to describe an association between both elevated atrophy gene expression and type-IIa fibre-selective decrease of cross sectional area in critically ill patients which has been linked to critical illness myopathy. Most impressive, this was observed as early as within the first 10 days after ICU admission. Measures to prevent muscle degradation should be initiated immediately after admission to the ICU.

**REFERENCE(S).** 1. Moriscot AS, Baptista IL, Bogomolovas J, Witt C, Hirner S, Granzier H et al. (2010) MuRF1 is a muscle fiber-type II associated factor and together with MuRF2 regulates type-II fiber trophicity and maintenance. J Struct Biol 170(2):344–353.

**GRANT ACKNOWLEDGMENT.** This study was supported by Grant KFO192, WE 4386/1-1 from the Deutsche Forschungsgemeinschaft.

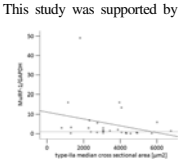


Fig. 1 MuRF-1/GAPDH mRNA expression

## 0476

### TYPE 2 DIABETES, ANTIDIABETICS AND MORTALITY AMONG INTENSIVE CARE PATIENTS: A DANISH COHORT STUDY

C. F. Christiansen[1,2], M. B. Johansen[1], S. Christensen[1], J. M. O'Brien[3], E. Tønnesen[2], H. Toft Sørensen[1]

[1]Aarhus University Hospital, Department of Clinical Epidemiology, Aarhus N, Denmark, [2]Aarhus University Hospital, Aarhus sygehus, Anesthesiology and Intensive Care, Aarhus C, Denmark, [3]The Ohio State University Medical Center, Center for Critical Care, Columbus, USA

**INTRODUCTION.** Although patients with diabetes may be at increased risk of critical illness, recent studies found a similar or lower mortality among diabetic ICU patients compared with non-diabetics [1–3]. Antidiabetic drugs including metformin and insulin may play a role [4], but none of the studies included information on type of diabetes or on antidiabetic treatment. It remains therefore unknown whether these results hold for patients with type 2 diabetes mellitus (T2DM) and whether they depend on preadmission antidiabetic treatment.

**OBJECTIVES.** We examined mortality among ICU patients with and without T2DM, and studied the impact of preadmission antidiabetic treatment on mortality by linking population-based medical databases.

**METHODS.** We identified all adult patients admitted to ICUs at the hospitals in Northern Denmark (population $\sim$ 1.8 million). Diabetics were identified by previous hospital diagnosis of diabetes, diabetes complications, or by redemption of any prescription for antidiabetic drugs. Patients with type 1 diabetes were excluded (n = 286). Data on ICU treatments and comorbidity were also obtained from medical databases. Patients were followed from ICU admission to death, emigration, or up to 1 year after admission. We used Kaplan–Meier method to estimate 30-day and 1-year mortality, and Cox regression analyses, controlling for age, gender, and comorbidity, to compare mortality rates.

**RESULTS.** We included 33,960 ICU patients, 3,752 (11.0%) had T2DM and 30,208 (89.0%) did not have diabetes. T2DM patients were older and had more comorbidities than non-diabetics. They were also more frequently treated with mechanical ventilation (40.5 vs. 34.6%) and renal replacement therapy (6.4 vs. 3.1%).The 30-day mortality was higher in patients with T2DM compared with non-diabetics. However, mortalities in users of metformin or any antidiabetic combination were similar to non-diabetics (See table).

DIABETES, ANTIDIABETICS, AND 30-DAY MORTALITY

| | No Diabetes | Type 2 diabetes and preadmission use of antidiabetic drugs | | | | | |
|---|---|---|---|---|---|---|---|
| | All | All | No antidiabetic use | Insulin | Metformin | Sulfonylurea | Any combination |
| N | 30,208 | 3,752 | 1,054 | 864 | 451 | 622 | 756 |
| Age, median (IQR) | 62 (47–74) | 69 (61–77) | 69 (60–78) | 68 (60–76) | 67 (60–74) | 74 (65–80) | 68.5 (61–74) |
| Male gender, % | 56.2 | 59.8 | 56.7 | 59.3 | 63.2 | 62.7 | 60.6 |
| 30-day mortality (95% CI) | 15.0% (14.6–15.5) | 22.7% (21.4–24.1) | 24.0% (21.5–26.7) | 26.4% (23.6–29.5) | 16.9% (13.7–20.6) | 26.1% (22.8–29.7) | 17.2% (14.7–20.1) |
| Crude 30-day hazard ratio (95% CI) | 1.0 reference | 1.6 (1.5–1.7) | 1.7 (1.5–1.9) | 1.9 (1.7–2.1) | 1.1 (0.9–1.4) | 1.8 (1.6–2.1) | 1.1 (1.0–1.4) |
| Adjusted 30-day hazard ratio (95% CI) | 1.0 reference | 1.2 (1.1–1.3) | 1.2 (1.1–1.4) | 1.4 (1.3–1.6) | 1.0 (0.8–1.3) | 1.2 (1.1–1.4) | 1.0 (0.9–1.2) |

The 1-year mortality was 36.0% (95% CI: 34.5–37.5%) in T2DM and 24.6 (95% CI: 24.1–25.1%) in non-diabetics. Adjusted HR was 1.2 (95% CI: 1.1–1.3) for T2DM overall, but lower for metformin users, adjusted HR = 1.0 (95% CI: 0.80–1.1).

**CONCLUSIONS.** Among ICU patients, type 2 diabetes was associated with an increased 30-day and 1-year mortality compared with non-diabetics; however, metformin users had mortality similar to non-diabetics.

**REFERENCES**. 1. Stegenga ME et al. Crit Care Med. 2010;38:539–545. 2. Vincent JL et al. Crit Care. 2010;14:R12. 3. Graham BB et al. Crit Care Med. 2010;38:16–24. 4. Honiden S et al. Crit Care Med. 2009;37:2455–2464.

## 0477

### PLASMA DNA CONCENTRATION AS AN EARLY PREDICTOR OF OUTCOME IN CRITICALLY-ILL SEPTIC PATIENTS

H.A. El-Akabawy[1], S. Elgengehy[1], W. Radwan[1], A. Rezk[1], A. Alsisi[1]

[1]Critical Care Medicine, Cairo University Hospital, Cairo, Egypt

**INTRODUCTION.** Sepsis is a major cause of morbidity and mortality in the ICU patients. It is associated with cell necrosis and apoptosis. Indeed, plasma DNA levels have been shown to be increased in patients with sepsis [1, 2].

**OBJECTIVES.** To investigate the prognostic value of circulating cell-free DNA in septic patients regarding the clinical course and final outcome and to compare its prognostic value with other commonly used biochemical markers for prognosis of sepsis (CRP and Procalcitonin "PCT") and with the APACHE II and SOFA scoring systems.

**METHODS.** A total of 80 critically ill septic patients were included in a prospective, randomized, single center study. All included septic patients were subjected to the measurement of cell-free plasma DNA concentrations (measured by real-time polymerase chain reaction assay for the $\beta$-globin gene), CRP levels and PCT concentration, all measured on admission to the ICU. APACHE II score was calculated once (24 h after ICU admission) and SOFA score was calculated at baseline and subsequently thereafter everyday until ICU discharge or death. Clinical outcome (duration of stay in the ICU, need for mechanical ventilation (MV), need for inotropic/vasopressor support, need for haemodialysis (HD), and mortality rates were recorded for all patients.

**RESULTS.** The median plasma DNA concentration in the septic patients was 195.7 ng/ml and this was significantly (approximately sevenfold) higher than the DNA concentration in healthy subjects 27 ng/ml, ($P < 0.001$). Septic patients who required MV, inotropic/vasopressor support and HD had significantly higher median DNA concentration compared to those who did not require them (205.6 ng/ml vs. 123.7 ng/ml; $P = 0.006$, 234.6 vs. 114.7 ng/ml; $P < 0.001$, and 244.2 vs. 181.1 ng/ml; $P = 0.001$, respectively). DNA concentration demonstrated a highly significant correlation with CRP concentration ($r = 0.661$, $P < 0.001$), PCT ($r = 0.820$, $P < 0.001$), SOFA score ($r = 0.710$, $P < 0.001$), and APACHE II score ($r = 0.559$, $P < 0.001$). The median plasma DNA concentration in nonsurvivors (38 of 80 patients "47.5%") was 234.8 ng/ml, and this was significantly (approximately twofold) higher than that in survivors 115.5 ng/ml, ($P < 0.001$). Receiver operator characteristic (ROC) analysis of the data indicated a sensitivity of 95% and a specificity of 81% when DNA concentration of 186.5 ng/ml was taken as a predictor of ICU mortality.

**CONCLUSIONS.** This study indicates that the plasma cell-free DNA may be a potentially useful marker for the evaluation of septic patients when admitted to the ICU and for the prediction of their adverse outcomes.

**REFERENCE(S).** 1. Zeerleder S, Zwart B, Wuillemin WA et al. Elevated nucleosome levels in systemic inflammation and sepsis. Crit Care Med. 2003;31:1947–51. 2 Mealkins JE, Marshall JC. The gut as the motor of multiple system organ failure. In: Marston A, Bulkley GB et al. (eds) Splanchnic ischaemia and multiple organ failure. Eondon: Edward Arnold, 1989; pp 339–48.

# Ventilatory management in ARDS: 0478–0482

## 0478

### DO MINIMAL TIDAL VOLUMES REDUCE VENTILATOR ASSOCIATED LUNG INJURY IN EXPERIMENTAL ACUTE RESPIRATORY DISTRESS SYNDROME?

A. Johannes[1], B. Zollhoefer[1], N. Schlegel[2], M. Kredel[1], C. von Kirschbaum[1], N. Roewer[1], J. Brederlau[3], R. M. Muellenbach[1]

[1]University of Wuerzburg, Department of Anesthesia and Critical Care, Wuerzburg, Germany, [2]University of Wuerzburg, Department of Surgery, Wuerzburg, Germany, [3]Hanau Hospital, Department of Anesthesiology, Hanau, Germany

**INTRODUCTION.** Reducing tidal volumes (VT) in patients with acute respiratory distress syndrome has shown to mitigate ventilator associated lung injury (VALI). Yet, alveolar overdistension can still be shown in portions of the lung, possibly perpetuating VALI [1]. By using an arterio-venous extracorporeal lung assist device (av-ECLA) to eliminate $CO_2$, it is possible to further reduce VT [2].

**OBJECTIVES.** We hypothesized that minimizing VT to 3 ml/kg or even 0 ml/kg (lung at rest) in combination with av-ECLA results in the reduction of VALI.

**METHODS.** After approval by the competent authority, lung injury was induced in 24 pigs (52.9 ± 3.6 kg) by surfactant depletion. The animals were randomized into three groups: 1: PCV (VT = 6 ml/kg), 2: PCV + av-ECLA (VT = 3 ml/kg), 3: CPAP + av-ECLA (VT = 0 ml/kg). A recruitment maneuver was performed and the positive endexpiratory pressure (PEEP) was set 3 $cmH_2O$ above the lower inflection point of the pressure–volume curve. During the 24 h protocol a $PaO_2$ of 80–110 mmHg and a $PaCO_2$ of 55–65 mmHg were aimed at.

At the end of the study a histopathologic analysis of the upper and lower lung lobes were performed using the following criteria: inflammation, overdistension, interstitial edema, alveolar exsudation and formation of atelectasis (0 = normal to 3 = severe injury).

**RESULTS.** After pulmonary recruitment, improvement of the $PaO_2/FiO_2$-index was achieved in all groups compared to lung injury ($T_{ARDS}$). The reduction of VT in groups 2 and 3 resulted in a significant deterioration of the $PaO_2/FiO_2$-ratio (225 ± 27 and 169 ± 54 vs. gr. 1: 357 ± 26 mmHg). $FiO_2$ could be reduced significantly in groups 1 and 2 (0.3 ± 0 and 0.47 ± 0.05 vs. 1.0 ± 0 $T_{ARDS}$) whereas this was not possible in group 3 (0.92 ± 0.09). Peak inspiratory pressure was significantly lower in groups 2 and 3 (28 ± 1 and 22 ± 2 vs. gr. 1: 32 ± 2 $cmH_2O$). In the apical lung regions a significant reduction of alveolar overdistension could be shown in group 3 [1 (1–1.25)] vs. group 1 [3 (2–3)]. In the basal lung regions there was a significant increase in the formation of atelectasis in groups 2 and 3 [2 (2–2.25) and 2 (1–2) vs. gr. 1: 0 (0–0)]. Furthermore, inflammation and alveolar exsudation were significantly higher in group 2 vs. 1 [Infl.: 3 (2–3) vs. 1 (0–1), alv. exs.: 2.5 (2–3) vs. 1 (1–1)].

**CONCLUSIONS.** With highly effective $CO_2$-elimination av-ECLA allowed for the reduction of VT to 0 ml/kg. However, VALI did not seem to be reduced in spite of allowing the lung to rest. On the one hand cyclic over distension was reduced in apical lung region, on the other hand inflammation and intraalveolar exsudation increased. Also, minimizing VT resulted in increased formation of atelectasis in spite of high PEEP and thus compromising oxygenation.

**REFERENCE(S).**1. Terragni PP, Rosboch G et al. Am. J. Respir. Crit Care Med. 2007;175:160–6. 2. Muellenbach RM, Kredel M et al. Med. Sci. Monit. 2009;15:BR213–20
**GRANT ACKNOWLEDGMENT.** The study was supported by departmental funds.

## 0479

### THE EFFECTS OF SETTING PEEP AFTER RECRUITMENT MANEUVER ARE BETTER CORRELATED WITH POTENTIALLY RECRUITABLE LUNG THAN INCREMENTAL PEEP, ESPECIALLY IN PRONE POSITION

R. Cornejo[1], J. C. Diaz[2], G. Diaz[1], A. Zamorano[1], C. Repetto[1], D. Arellano[1], W. Neira[1], R. Gonzalez[3], C. Ramos[2], G. Martinez[1].

[1]Hospital Clínico Universidad de Chile, Unidad de Pacientes Críticos, Santiago, Chile, [2]Hospital Clínico Universidad de Chile, Centro de Imagenología, Santiago, Chile, [3]Univerisdad de Chile, Facultad de Medicina, Santiago, Chile.

**INTRODUCTION.** The effects of PEEP depend on the recruitability of lung tissue [1, 2]. Unfortunately, we do not have a strategy at the bedside to estimate the potentially recruitable lung (PRL). In a previous study [1] performed in a mixed ALI/ARDS population with different time on mechanical ventilation (MV), the effects of PEEP in combined physiological variables predicted only with a sensitivity of 71% and a specificity of 59%, whether a patient's PRL was high or low, as indicated by computed tomography (CT). We thought that PRL might be higher in the early ARDS, and that the physiological variables could be better predictors of high PRL in this phase, when the effects of PEEP are evaluated with a decremental approach, especially in prone position.

**METHODS.** 20 ARDS patients with < 72 h of MV, underwent whole-lung CT during breath-holding sessions at consecutive airway pressures of 5, 45, and 15 $cmH_2O$, in both supine and prone position. The percentage of potentially recruitable lung was defined as (Non aerated tissue (NAT) at 5 $cmH_2O$–NAT at 45 $cmH_2O$)/total weigh. The $V_T$ was performed at 6 ml/kg. In ICU, the patients were subjected to the following protocol: a)RM- b)release maneuver-c)15 min at PEEP 5 and d)15 min at PEEP 15 without interposed RM (incremental approach). The same steps were applied interposing a RM before increasing the level of PEEP from 5 to 15 (decremental approach). We analyzed if recruiters patients, as indicated by CT, presented two or three of the following changes: increase $PaO_2$, decrease $PaCO_2$, and decrease (plateau pressure—PEEP) gradient, after increase PEEP using incremental and decremental PEEP setting in both positions. Sensibility (S) and specificity (E) assuming high PRL as > 13%, were calculated.

**RESULTS.** 20 patients, mean age 53 ± 19 years (11 males), 13 medical—7 surgical admissions, APACHE II 20 ± 6, SOFA 10 ± 3, SAPS II 46 ± 8, MV time 44 ± 16 h, $PaO_2/FiO_2$ 165 ± 40, plateau pressure 25 ± 2, compliance 36 ± 8 ml/$cmH_2O$, and mean IAP was 12 ± 4 mmHg. PRL was 16 ± 8% in supine and 17 ± 9% in prone, but maximum recruitment from 5 $cmH_2O$ in supine to 45 $cmH_2O$ in prone was 21 ± 7%. Using an incremental approach to set PEEP, combined physiological variables predicted with a S of 77% and a E of 60%, whether a patient's PRL was high in supine, and with S of 60% and E of 75% in prone. With a decremental approach the variables predicted with a S of 92% and E of 50% whether a patient's PRL was high in supine, and with S of 93% and E of 75% in prone.

**CONCLUSIONS.** Our data suggest that recruiter patients might be estimated, with reasonable sensibility and specificity, evaluating combined physiological variables once setting the level of PEEP after RM, and that this prediction could be better in prone position.

**REFERENCES.** 1. Gattinoni et al. N Engl J Med 2006;354:1775–86.
2. Caironi et al. Am J Respir Crit Care Med 2010;181:578–86.
**GRANT ACKNOWLEDGEMENT:** FONDECYT 11070156.

## 0480

### INFLUENCE OF DIFFERENT PEEP SETTING STRATEGIES ON REGIONAL DISTRIBUTION OF PULMONARY VENTILATION, BLOOD FLOW AND STRAIN IN PORCINE LUNG INJURY

T. Muders[1], H. Luepschen[1], T. Meier[2], R. Pikkemaat[3], S. Leonhardt[3], G. Hedenstierna[4], C. Putensen[1], H. Wrigge[1].

[1]University Hospital of Bonn, Anesthesiology and Intensive Care Medicine, Bonn, Germany, [2]University of Luebeck, Anesthesiology, Luebeck, Germany, [3]RWTH Aachen University, Medical Information Technology, Aachen, Germany, [4]University of Uppsala, Clinical Physiology, Uppsala, Sweden

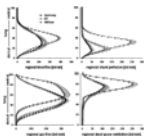
**INTRODUCTION.** Different strategies are used to individually optimize PEEP in lung injured patients. The ARDSnet protocol has been shown to increase both pulmonary shunt perfusion and dead space ventilation, when compared to strategies that are focused on optimizing oxygenation or ventilation delay inhomogeneity, but mechanisms remain unclear. Moreover, mechanical ventilation should avoid factors known to further aggravate lung injury, such as regional strain to the lung (ΔV/V) [1].

**OBJECTIVES.** To evaluate the influence of different PEEP setting strategies on regional distribution of ventilation (V), blood flow (Q) and stain.

**METHODS.** PEEP and $Fi/O_2$ were set according to the ARDSnet protocol in 8 lung injured (oleic acid injection + abdominal hypertension) pigs. Then, lung recruitment and a decremental PEEP trial (30–0 cmH2O in steps of 2 cmH2O was performed. Open-lung-PEEP (OL) (that optimizes oxygenation) and EIT-PEEP (that minimizes regional ventilation delay inhomogeneity measured by Electric Impedance Tomography (EIT)) were identified. SPECT was used to analyse regional V and Q during ventilation with ARDSnet-, OL- and EIT-PEEP, respectively, in ventro-dosal direction. Additionally, regional specific ventilation (ventilation per voxel) was calculated as surrogate for regional dynamic lung strain. Statistics: Repeated measures ANOVA.

**RESULTS.** Global Q was reduced with EIT- and OL-PEEP ($p < 0.05$). Pulmonary shunt perfusion decreased especially in dependent regions, where regional Q was reduced (Fig. 1). Regional V distribution was shifted to ventral lung regions during ARDSnet ventilation when compared to both OL- and EIT-PEEP. In this lung regions ARDSnet-PEEP increased dead space ventilation ($p < 0.05$, Fig 1). EIT- and OL-PEEP increased the volume of the ventilated lung ($p < 0.05$), but regional specific ventilation was lower ($p < 0.05$) and more homogeneously distributed during EIT- and OL-PEEP, when compared to ARDSnet-PEEP ($p < 0.05$).

**CONCLUSIONS.** When compared to the ARDSnet protocol, EIT- and OL-PEEP setting strategies decreased dead space ventilation by redistribution of ventilation to dependent lung regions. However, decrease of shunt perfusion was caused by a reduction of global blood flow. Additionally, EIT and OL-PEEP strategies reduced regional dynamic strain to ventral lung regions by recruitment of dependent, previously non-ventilated lung tissue.



**REFERENCE(S).** Gattinoni et al. (2003) Eur Respir J 47:15 s–25 s.
**GRANT ACKNOWLEDGMENT.** DFG (WR47-1-1).

## 0481

### EFFECTS OF PRONE POSITION IN SURVIVORS TO ACUTE RESPIRATORY DISTRESS SYNDROME

D. Chiumello[1], V. Berto[2], C. Mietto[1], E. Gallazzi[2], A. Marino[2], M. Lazzerini[1], G. Migliara[1], L. Gattinoni[1]

[1]Fondazione IRCCS Ca' Granda, Ospedale Maggiore Policlinico, Anaesthesia and Intensive Care, Milan, Italy, [2]Università degli Studi di Milano, Milan, Italy

**INTRODUCTION.** The ARDS is characterized by the acute onset of severe hypoxemia ($PaO_2/FiO_2$ of 200 or less), bilateral pulmonary infiltrates on frontal chest radiography in the absence of left atrial hypertension [1]. Patients who survived to ARDS are at risk for cognitive and psychological complications, impaired pulmonary function, decreased health-related quality of life and an inability to return to employment or normal activities [2]. The prone position can be used as an adjuvant maneuver to improve gas exchange and reduce the Ventilatory Induced Lung Injury.

**OBJECTIVES.** We evaluated pulmonary and extrapulmonary function in survived patients enrolled in Prone-Supine II Study at 12 months after ARDS.

**METHODS.** Sedated and mechanically ventilated critically ill patients with a diagnosis of ARDS were randomized to supine or prone position for at least 20 h per day until the $PaO_2/FiO_2$ ratio was above 200. After 12 months from ARDS, patients underwent to spirometry, 6-min walking test, arterial blood gas analysis. Quality of life was investigated using the SF-36 test and the Saint George Respiratory Questionnaire.

**RESULTS.** 114 patients were discharged from ICU. After 12 months, 55 patients survived (49%) and 26 patients were evaluated (18 males, 6 smokers, 13 patients proned). The mean clinical characteristics did not differ from discharge not evaluated patients and were: age 55.4 ± 16.9 years, BMI 24.5 ± 3.7 kg/$m^2$ and $PaO_2/FiO_2$ at enrolment 117 ± 38, SAPS II score at admission 36.7 ± 13.5 and length of ICU stay 27.2 ± 18.8 days. Prone patients did not show any difference regarding pulmonary function and 6-min walking test compared to supine patients. Supine patients had a higher $PaO_2$ (93.6 ± 6.2 vs. 86.0 ± 8.5 mmHg, $p = 0.03$) but the ratio between the measured $PaO_2$ and the $PaO_2$ values predicted from age was not different ($p = 0.10$). We did not find any difference in the quality of life.

TABLE 1 SPIROMETRY AND WALKING TEST RESULTS

| | Prone | Supine | p |
|---|---|---|---|
| Median of FRC (% predicted) [interquartile range] | 97 [85–118] | 87 [72–96] | 0.09 |
| Median of forced vital capacity (% predicted) [interquartile range] | 89.5 [80.5–103] | 81 [77–90] | 0.18 |
| Median of FEV1 (% predicted) [interquartile range] | 93.5 [81.5–104] | 81 [70–93] | 0.13 |
| Median of carbon monoxide diffusion capacity (% predicted) [interquartile range] | 99.5 [86–105] | 103.5 [94.5–114] | 0.56 |
| Median of distance walked in 6 min (metres) [interquartile range] | 375 [335–445] | 400 [350–450] | 0.30 |

**CONCLUSIONS.** At 12 months, the pulmonary function, gas exchange and quality of life were acceptable independently of use of prone position.

**REFERENCE(S).** 1. Bernard GR et al. Am J Respir Crit Care Med. 1994. 2. Herridge MS et al. NEJM. 2003.

### 0482

**SETTING OF MEAN AIRWAY PRESSURE DURING HIGH FREQUENCY OSCILLATORY VENTILATION USING ELECTRICAL IMPEDANCE TOMOGRAPHY**

D. Arces[1,2], L. Camporota[1], J. Smith[1], B. Sanderson[1], K. Lei[1].

[1]Guy's and St Thomas' NHS Foundation Trust, London, Department of Critical Care, London, UK, [2]University of Turin, Department of Anaesthesia and Intensive Care Medicine, Turin, Italy

**INTRODUCTION.** Objective methods of setting mean airway pressure (mPaw) during high-frequency oscillatory ventilation (HFOV) have been tested in experimental models of ARDS but are clinically impractical.

**OBJECTIVES.** We studied the capacity of electrical impedance tomography (EIT) to identify optimal mPaw ($mPaw_{EIT}$) compared with the mPaw set clinically ($mPaw_{clin}$) according to our standard protocol during a slow recruitment manoeuvre (SRM).

**METHODS.** Adult patients with severe ARDS underwent a SRM on HFOV by stepwise increases in mPaw by 3 $cmH_2O$ every 10 min up to 50 $cmH_2O$ (inflation phase), followed by 2 $cmH_2O$ decrements every 5 min (deflation phase) until optimal mPaw was established. We used the Goe-MF II EIT system (CardinalHeath ThorScan, OH, USA) and the AUSPEX software (Free University, Amsterdam) for off-line analysis. Cumulative changes in trans-thoracic impedance ($\Delta Z$) at each mPaw were plotted as described by Venegas. Optimal $mPaw_{EIT}$ was calculated based on the pressure at the lower corner (Pcl), and at the points of maximum curvature on the inflation (PMCi) and deflation phases (PMCd) of the$\Delta Z$-Paw curve. $mPaw_{EIT}$ did not influence clinical decisions. Agreement between $mPaw_{clin}$ and the $mPaw_{EIT}$ at the three points of interest (Pcl, PMCi, PMCd) was assessed using the Bland-Altmann method. We used regional values of PMCd to reflect the degree of mechanical lung homogeneity. Two lung indices were calculated to assess regional homogeneity of closing pressures; $LHI_p = [(PMCd_{ventral\ region} - PMCd_{dorsal\ region})/PMCd_{global}]$, and aeration $LHI_{\Delta Z} = [(\Delta Z_{ventral\ region} - \Delta Z_{dorsal\ region})/\Delta Z_{global}]$, with value of 0 representing a homogeneous lung. The study was approved by the local Ethics Committee.

**RESULTS.** Of the 16 SRM a true Pcl($\Delta Z$) could not be determined (i.e., straight line) in 3/16. Bland-Altmann plots showed unacceptably large bias (LOA) in $mPaw_{clin}$ vs. Pcl($\Delta Z$) −12 (−147 to +123) $cmH_2O$; and in $mPaw_{clin}$ vs. PMC($\Delta Z$)i −0.7 (−48 to +47)$cmH_2O$. By contrast, extremely good agreement was found between $mPaw_{clin}$ and PMC($\Delta Z$)d −0.6 (−13 to +12) $cmH_2O$. The bias between the $mPaw_{clin}$ and $mPaw_{EIT}$ was dependent on the regional homogeneity of the lung assessed by LHIp. The more inhomogeneous the lung, the larger the discrepancy between $mPaw_{clin}$ and $mPaw_{EIT}$. Interestingly, following SRM the lung become more homogeneous with changes in LHIp from a median (range) values of −0.009 (−13.7 to +2.1) to −0.006 (−0.5 to +0.9). Regional analysis, showed that a $LHI_{\Delta Z} > 0$ was associated with greater improvements in $PaO_2/FiO_2$ and $PaCO_2$. Setting a $mPaw_{clin}$ lower than the PMCd of the ventral region was associated to negative values of $LHI_{\Delta Z}$ and little or no improvement in gas exchange.

**CONCLUSIONS.** Setting mPaw based on PMCd has the highest agreement with the $mPaw_{clin}$. Their agreement depends on degree of lung homogeneity. This approach has the potential to assess the effect of recruitment manoeuvres at the bedside.

### 0484

**COST-BENEFIT OF A CHLORHEXIDINE IMPREGNATED SPONGES FRO PREVENTION OF CATHETER-RELATED INFECTIONS IN ADULTS ICU PATIENTS**

J.-F. Timsit[1], C. Schwebel[1], A. Vesin[2], L. Bouadma[3], A. Geffroy[4], M. Garrouste-Orgeas[5], S. Pease[6], M.-C. Herault[7], H. Haouache[8], S. Calvino-Gunther[9], J.-C. Lucet[10]

[1]University-Hospital Grenoble/Inserm U823, Medical Polyvalent ICU, Grenoble, France, [2]Inserm U823, Biostatistical department, Grenoble, France, [3]University Hospital Bichat, Medical ICU, Paris, France, [4]University Hospital Bichat, Surgical ICU, Paris, France, [5]Fondation-Hopital St Joseph, Polyvalent ICU, Paris, France, [6]University hospital Beaujon, Surgical ICU, Clichy, France, [7]University-Hospital Grenoble, Surgical ICU, Grenoble, France, [8]Hopital Delafontaine, Polyvalent ICU, Bobigny, France, [9]University-Hospital Grenoble, Medical Polyvalent ICU, Grenoble, France, [10]University Hospital Bichat, Infection Control, Paris, France

**INTRODUCTION.** The Dressing study (1,636 patients, 28,931 catheter-days) compared in a two way randomized factorial design a dressing change every 3 or 7 days and the use of a chlorhexidine impregnated sponge (CHGIS) to be placed at the entry site of the catheter to prevent major catheter-related infection (MCRI) [1]. We found a decrease in MCRI with CHGIS (HR [IC95%]: 0.39 [0.16; 0.93], $P = 0.03$) with a decrease of the MCRI incidence from 1.4 to 0.6‰ catheter-days. We also found that a 7-day scheduled dressing change was not inferior to a 3-day dressing change.

**OBJECTIVES.** To calculate the cost-benefits of the use of CHGIS.

**METHODS.** Cost directly related to MCRI, cost of dressing and of cost of contact dermatitis were prospectively calculated using microcosting method during the original study. The extra-length of ICU stay (LOS) due to MCRI were estimated by the disability model. The account cost of one ICU day was 2,118$. We did not took into account the cost of dying from MCRI. The expected cost associated with each strategies took into account all the costs and expected probability of MCRI in a decision tree according to results of the original study.

**RESULTS.** The median direct cost of MCRI was 792$. The estimated extra LOS due to MCRI was 11 days 95% CI [− 2; 26 days]. The overall cost of one MCRI was 24,090 $. The cost of one dressing was 9.08$ (146 observations) and the cost of one CHGIS was 9.73$. Then, if the basal level of MCRI is as low as 1.4‰ catheter-days, the expected cost-saving associated with CHGIS use was 197$ for the 3 days CHGIS dressings change strategy and 83$ for the 7 days standard dressing change strategy.The use of CHGIS remained cost-effective even if the baseline level of MCRI is as low as 0.35/1,000 catheter-days or if the overall cost of one CRI is not superior to 4,400$.

**CONCLUSIONS.** We conclude that CHGIS is cost effective to prevent MCRI in arterial and central vein catheters in ICU even in baseline level of CRI is low.

**REFERENCE(S).** 1. Timsit JAMA 2009;30:1231–41.

**GRANT ACKNOWLEDGMENT.** French Ministery of health (PHRC 2005).

## Bloodstream and catheter infections: 0483–0487

### 0483

**IMPACT OF PACKED RED BLOOD CELLS AND FRESH FROZEN PLASMA TRANSFUSION ON THE DEVELOPMENT OF BLOODSTREAM INFECTIONS IN THE CRITICALLY ILL**

M. Michalia[1], M. Kompoti[1], P. Peppa[1], F. Nanou[1], M. Charitidi[1], G. Kallitsi[1], P. -M. Clouva-Molyvdas[1]

[1]Thriassio General Hospital of Eleusis, Intensive Care Unit, Athens, Greece

**INTRODUCTION.** Previous studies have investigated the association of packed red blood cells (pRBC) transfusion and ICU-acquired infection, while the corresponding impact of fresh frozen plasma (FFP) transfusion has not been adequately explored.

**OBJECTIVES.** Our study investigated the association of pRBC and FFP transfusion with the development of bloodstream infection (BSI) in ICU patients.

**METHODS.** As a part of a prospective cohort study concerning BSIs in critically ill patients of a multidisciplinary ICU, we selected a patient sample of cases with ICU-acquired BSI and controls (1:1) without BSI (nested case–control design). Controls were matched for age, gender, admission category (medical, elective surgical, emergency surgical, trauma) and admission APACHE II score. ICU length of stay of each control should at least equal ICU hospitalization until the first BSI episode of the corresponding case. FFP and pRBC transfusions prior to ICU admission and during ICU stay were recorded. Patients were categorized according to the number of pRBC transfused (reference category: no transfusion, second category: 1–3 units, third category: 4–6 units, fourth category: > 6 units). Statistical analysis was performed with logistic regression and statistical significance was set at $\alpha = 0.05$.

**RESULTS.** From a prospective cohort (n = 710), 165 pairs of cases and matched controls were formed. Mean age (± SD) was 56.2 ± 18.8 years, APACHE II at admission 20.8 ± 5.7. In the case–control sample, patients with BSI had been transfused with pRBC more frequently than patients without BSI (56.3 vs. 43.7%, respectively, p = 0.002), while there was no significant difference in the rate of previous FFP transfusion. In univariable logistic regression, the occurrence of BSI was significantly associated with pRBC transfusion, pRBC transfusion rate and the implementation of continuous renal replacement therapy during 48 h prior to BSI. Medical history of diabetes mellitus displayed an association of borderline significance with BSI. In a multivariable logistic regression model, pRBC transfusion (as a binary variable, transfused/non-transfused) was significantly associated with the occurrence of BSI: pRBC transfusion odds ratio (OR) = 2.1, 95% confidence interval(CI) 1.3–3.3. In another model with pRBC units as ordinal variable (groups 1 to 4 as above), there was an increasing trend of BSI occurrence with respect to pRBC transfusion rate (reference category:OR = 1.0, second category OR = 2.1, 95% CI 1.2–3.7, third category: OR = 1.8, 95% CI 1.0–3.3, fourth category: OR = 2.4, 95% CI 1.3–4.4).

**CONCLUSIONS.** In our study, pRBC transfusion was significantly associated with a twofold risk of BSI occurrence compared with no transfusion. The risk of BSI increased with the number of pRBC units transfused. In our sample of patients, there was no association between FFP transfusion and development of BSI.

**REFERENCE(S).** 1. Taylor et al. Crit Care Med 2006;34:2302–8.
2. Corwin et al. Crit Care Med 2004;32:39–52.

### 0485

**INFECTIOUS COMPLICATIONS OF SUCCESSFULLY RESUSCITATED CARDIAC ARREST PATIENTS IN THE THERAPEUTIC HYPOTHERMIA ERA**

N. Mongardon[1], S. Perbet[1], V. Lemiale[1], F. Dumas[2], H. Poupet[3], J. Charpentier[1], F. Pène[1], J.-D. Chiche[1], J.-P. Mira[1], A. Cariou[1]

[1]Medical Intensive Care Unit, AP-HP, Cochin Hospital, Paris, France, [2]Department of Emergency Medicine, AP-HP, Hôtel-Dieu Hospital, Paris, France, [3]Department of Bacteriology, AP-HP, Cochin Hospital, Paris, France

**INTRODUCTION.** Patients successfully resuscitated from cardiac arrest (CA) are at high risk of infection related to emergency management, invasive procedures, ischemia–reperfusion and prolonged ICU stay. Recent and wide use of therapeutic hypothermia has raised concerns about an increase of septic complications. No specific reappraisal has been performed on infectious epidemiology since implementation of hypothermia following cardiac arrest.

**OBJECTIVES.** We investigated the incidence and microbiology of infectious complications in cardiac arrest survivors and assessed their impact on morbidity and long-term outcomes.

**METHODS.** Monocentric study (03/2004–03/2008) with retrospective review of a prospectively acquired ICU database focusing on all consecutive patients admitted for CA and surviving more than 24 h. Patients with infection prior to CA were excluded. Diagnosis was performed according to the criteria established by the Centers for Disease Control. All patients' files were reviewed to assess the development of infection.

**RESULTS.** Of 537 patients admitted for CA, 421 patients were included and 281 patients (67%) presented 373 infectious complications. Pneumonia was the most frequent (242 episodes), followed by bloodstream infections (35 episodes) and catheter-related infections (11 episodes). Microbiological documentation was available in 297 infections. If gram negative bacteria were responsible for the majority of infection (66% of septic events), main pathogens were *S. aureus* (57 cases, 19% of all isolates), *E. coli* (51 cases, 17%), *H. influenzae* (37 cases, 12%) and *S. pneumoniae* (28 cases, 9%). Patients with or without infection were not different for age (60 vs. 61, p = 0.56), sex (75 vs. 71% men, p = 0.3), severity at admission (SAPS II: 64 vs. 63, p = 0.77), cardiac etiology for CA (63 vs. 51%, p = 0.1), no-flow (5 vs. 5 min, p = 0.35), low-flow (15 vs. 15 min, p = 0.91) or occurrence of post-resuscitation shock (51 vs. 56%, p = 0.38). Only a shockable rhythm (51 vs. 41%, p = 0.049) and therapeutic hypothermia (82 vs. 72%, p = 0.03) were more frequent in infected patients. Infection was associated with increased mechanical ventilation duration (6 [2–9] vs. 3 [2–5.5], p < 0.001) and ICU length of stay (7 [4–10] vs. 3 [2–7] days, p < 0.001). Nonetheless, there was no impact on either ICU mortality [174 (62%) vs. 92 (66%) patients, p = 0.45] or on favorable neurological outcome [cerebral performance category 1–2: 102 (36%) vs. 47 (34%) patients, p = 0.58].

**CONCLUSIONS.** We report herein the most important descriptive cohort of infections complications after CA. Moreover, this is the first study performed in the therapeutic hypothermia era. Septic complications are frequent after CA and may be even more frequent after therapeutic hypothermia. Despite increase in care burden, long-term and clinically relevant outcomes are not impaired. These data support large use of therapeutic hypothermia in cardiac arrest survivors.

## 0486

### CENTER, PATIENT AND CATHETER-RELATED DETERMINANTS OF CATHETER-RELATED INFECTION IN THE ICU: A MULTICENTER ANALYSIS BASED ON A HIERARCHICAL MODEL

J.-F. Timsit[1,2], A. Francais[1], F. L'hériteau[3], B. Coignard[4], A.-G. Venier[5], P. Jarno[6], J. Fabry[7], A. N'guyen[7], A. Lepape[7], A. Savey[7]

[1]Inserm U 823, Team 11, Outcome of Mechanically Ventilated Patients, Grenoble, France, [2]University Hospital, ICU, Grenoble, France, [3]C-Clin Paris Nord, Paris, France, [4]InVS, Paris, France, [5]C-CLIN Sud-Ouest, Bordeaux, France, [6]C-Clin Ouest, Nantes, France, [7]C-Clin Sud Est, Lyon, France

**INTRODUCTION.** Education, training, and continuous quality improvement programs are essential to decrease catheter-related infections (CRI) [1]. The respective part of endogenous and device-related risk factors by ICUs has not been studied in a large population.

**OBJECTIVES.** To evaluate risk factors of catheter infection with particular emphasize on local bundle of care in a panel of 51 ICUs (7,188 patients, 8,626 central vein catheters (CVC)) during two 6-month periods in 2007 and 2008. The incidence of colonization and CRI was 6.1 and 2.2 per 1,000 CVC-days.

**METHODS.** Prospective data collection according to the French REA-RAISIN protocol of center-based, patient-based and catheter-based data. A questionnaire was filled by investigators during the first and the second part of the study to evaluate the procedure of catheter insertion, catheter care and removal. A hierarchical logistic model was used to evaluate risk factors of CRI (SAS 9.1, MLWin softwares).

**RESULTS.** Forty-two (84%) of the ICUs were medical-surgical and 15(29%) from university hospitals. Forty-six (90%) had a written procedure for catheter insertion, known and well followed in 38 cases. The bundle were considered followed by local investigators: Surgical aseptic condition at catheter insertion (100%), systematic catheter removal when no longer needed (41%), avoiding of femoral route (74%), preference of sub-clavian route (67%), systematic catheter culture (72.5%), blood culture in case of sepsis in all cases including decision to forego life sustaining therapy (63%). Cutaneous antisepsis was 10% aqueous PVI (61% in 2007, 52% in 2008), 5% alcoholic PVI (34% in 2007, 39% in 2008), or an alcoholic-CHX derivate (5% in 2007, 9% in 2008). Brun-Buisson [2] (80% of the centers) and Maki [3] (20%) culture technique were used.

**Factors associated with CRI were**: Three patients-related variables: History of immunosuppression (OR = 1.4, p = 0.02), Medical patients (OR = 1.6, p = 0.03), Trauma (OR = 2.5, $p < 0.001$), 2 catheter-related var.:not subclavian (OR = 2.1, $p < 0.001$), duration of CVC maintenance ($p < 10^{-4}$). Two other variables were center-related: use of Brun-Buisson method (OR = 2.6, p = 0.005) and antisepsis; Alcoholic-PVI (OR = 0.68, p = 0.01) and alcoholic-CHX (OR = 0.68, p = 0.1) decreased the CRI rate as compared to aqueous PVI.

**CONCLUSIONS.** In a large multicenter study, risk factors of CRI were related to patients' conditions, accessible to an improvement program (preference of subclavian access, use of an antiseptic solution containing alcohol) or only due to the method of culture used. A quantitative catheter culture by increasing culture sensitivity increased the CRI rate. The case-mix issues and the method of culture should be taken into account to assess the risk of CRI within centers.

**REFERENCE(S).** 1. Pronovost et al. NEJM 2006.
2. Brun-Buisson et al. Arch Intern Med 1987
3. Maki et al. NEJM 1977.

**GRANT ACKNOWLEDGMENT.** Educational unrestricted grant Ethicon.

## 0487

### ACQUIRED BLOODSTREAM INFECTION IN THE ICU: MICROBIOLOGICAL DIAGNOSIS AND MORTALITY

J.R. Prowle[1], J.E. Echeverri[1], E.V. Ligabo[1], G.C. Taori[2], T.M. Crozier[2], G.K. Hart[1], K.M. Tony[3], B. Mayall[4], P.D. Johnson[5], R. Bellomo[1]

[1]Austin Health, Intensive Care Unit, Melbourne, Australia, [2]Monash Medical Centre, Intensive Care Unit, Melbourne, Australia, [3]Monash Medical Centre, Department of Microbiology, Melbourne, Australia, [4]Austin Health, Department of Microbiology, Melbourne, Australia, [5]Austin Health, Department of Infectious Diseases, Melbourne, Australia

**INTRODUCTION.** Acquired bloodstream infection (BSI) is though to be associated with increased morbidity and mortality in ICU patients [1]. However, the clinical significance of BSI is likely to vary with microbiological diagnosis [1] and the relative incidences of different infections are likely to vary between differing clinical environments [2].

**OBJECTIVES.** To examined the frequency and classification of ICU-acquired BSI and their effect on hospital mortality in two Australian teaching hospitals.

**METHODS.** All ICU admissions of > 72 h were considered. Data were available from 1998–2009 in one centre and 2003–2009 in the other. Baseline demographics, admission illness severity and co-morbidity data were obtained from ICU admission databases. Microbiological diagnoses were obtained from pathology department electronic records. Survival was defined by hospital discharge or status at 90 days. ICU-acquired BSI was defined by a positive blood culture taken after day 3 in ICU; two cultures were required in the case of saprophytic skin commensals.

**RESULTS.** We identified 6339 ICU admissions lasting > 72 h. 330 of these were complicated by BSI, and in 44 admissions > 1 species was isolated during the course of the ICU stay. For statistical analysis pathogens were categorised into taxonomic groups. Five groups accounted for 94% of novel microbiological isolates. The effect of BSIs on subsequent survival from the time of diagnosis was examined in a Cox proportional-hazard analysis controlling for baseline demographics and admission illness severity.

MICROBIOLOGICAL DIAGNOSIS AND MORTALITY

| Microbiological isolate | Percentage of admissions (%) | Unadjusted mortality (%) | Cox hazard ratio for death after time of BSI | p value |
|---|---|---|---|---|
| None | 94.8 | 23 | | |
| Gram -ve Bacilli | 1.5 | 38 | 2.13 | <0.0001 |
| Staphylococcus aureus | 1.5 | 42 | 2.07 | <0.0001 |
| Coagulase -ve Staphylococci | 1.3 | 28 | 1.23 | 0.36 |
| Enterococci | 0.9 | 34 | 1.49 | 0.10 |
| Candida spp. | 0.8 | 69 | 4.60 | <0.0001 |

**CONCLUSIONS.** Only bloodstream infection with *S. aureus*, Gram −ve Bacilli and Candida were statistically associated with death. *S. aureus* and Gram −ve BSI occurred equally frequently and appear equally adverse. Collectively these three forms of BSI complicated fewer than 4% of ICU admissions. Thus, while important on an individual basis, their impact on survival in the entire cohort is small. In this ICU population, interventions to prevent acquisition of specific BSIs may need to be to be targeted in order to demonstrate a measurable therapeutic effect.

**REFERENCE(S).** 1. Garrouste-Orgeas M, Timsit JF, Tafflet M et al. Excess risk of death from intensive care unit-acquired nosocomial bloodstream infections: a reappraisal. Clin Infect Dis. 2006;42:1118–26. 2. Vincent JL, Rello J, Marshall J et al. International study of the prevalence and outcomes of infection in intensive care units. JAMA. 2009;302:2323–9.

**GRANT ACKNOWLEDGMENT.** Austin ICU Research Fund.

# Sepsis: From microcirculation to outcome: 0488–0492

## 0488

### MYOCARDIAL METABOLISM AND FUNCTION DURING INDUCED ENDOTOXAEMIA AND HEMORRHAGIC SHOCK IN A PORCINE MODEL

B.A. Brand[1], C. Norin[1], L. Ihrman[1], M.S. Chew[1]

[1]Skåne University Hospital, Malmö, Department of Intensive Care Medicine, Malmö, Sweden

**INTRODUCTION.** Heart function is often compromised in septic shock. The underlying mechanisms for this have not yet been elucidated but the old paradigm of hypoxia as the cause is now largely refuted. Recent evidence suggests that myocardial metabolism is altered in endotoxaemic shock, however this remains poorly investigated. It is also unknown whether endotoxaemic and septic shock produce specific changes that are not seen in other types of shock.

**OBJECTIVES.** The aim of this study was to investigate how myocardial metabolism is altered in septic and non-septic (hemorrhagic) shock. The main hypothesis is that sepsis is associated with specific changes in myocardial metabolism compared to hemorrhagic shock.

**METHODS.** 19 female pigs, weighing 32–41 kg was used in the study, randomized to 3 groups: control (C) n = 6, endotoxaemic shock (S) n = 7 and hemorrhagic shock (H) n = 6. Interstitial myocardial pyruvate, lactate and glucose were measured using microdialysis (MD). Pulse-induced contour cardiac output (PiCCO) and pulmonary artery catheters were used for hemodynamic monitoring and blood sampling. Epicardial echocardiography was performed for systolic/diastolic measurements, hemodynamics and visual assessment of contractility.

**RESULTS.** Both sepsis and hemorrhage groups had alterations in hemodynamic parameters, although heart rate was, unexpectedly, not significantly increased in the hemorrhage group. Positive myocardial:blood lactate gradients were seen early during the experiment. Septic and hemorrhagic shock produced distinct myocardial metabolic patterns. Marked decreases in myocardial glucose were observed in the endotoxin group, reaching near-zero concentrations towards the end of the study-period whereas they remained relatively stable in the hemorrhage group. Increases in myocardial pyruvate were seen in all animals, and very high concentrations were observed in the endotoxin group. Despite increases in interstitial lactate and the presence of shock, there was no evidence of myocardial anaerobic metabolism, with normal LP ratios seen in all animals.

**CONCLUSIONS.** The metabolic patterns in the myocardium is different in septic shock versus hemorrhagic shock.

**REFERENCE(S).** Chew MS, Johansson A, Anderson C, Ersson A, Tønnesen, E. Decreases in myocardial glucose and increases in pyruvate but not ischaemia are observed during porcine endotoxemia. Acta Anaesthesiol Scand. 2008;52(7):959–68.

**GRANT ACKNOWLEDGMENT.** Scandinavian Society for Anesthesiology and Intensive Care Medicine.

## 0489

### BLOOD TRANSFUSIONS RECRUIT THE MICROCIRCULATION IN ON-PUMP CARDIAC SURGERY PATIENTS, BUT NOT IN SEPTIC PATIENTS

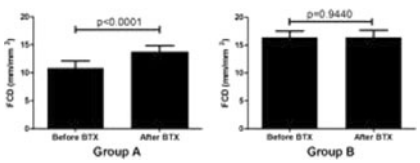
B. Ayhan[1], K. Yürük[2], J. Bakker[1], B.A.J.M. de Mol[3], C. Ince[1,2]

[1]Erasmus Medical Center, Intensive Care Medicine, Rotterdam, Netherlands, [2]Academic Medical Center at the University of Amsterdam, Translational Physiology, Amsterdam, Netherlands, [3]Academic Medical Center at the University of Amsterdam, Cardiothoracic Surgery, Amsterdam, Netherlands

**AIMS.** The goal of red blood cell transfusions (BTX) is to correct for anemia and to enrich oxygen delivery to regional parenchymal cells dependent on the microcirculation. Hemorheological alterations and damaged host microcirculation (e.g. endothelial cells, glycocalyx layer) in septic patients could affect the ability of transfused red blood cells to correct for anemia and to improve microcirculatory recruitment. For this reason, comparison between two illness profiles was conceived to evaluate the efficacy of BTX in critically ill patients. The aim of this study was to determine the impact of BTX on sublingual microcirculation in on-pump cardiac surgery patients versus septic patients.

**METHODS.** 18 patients were selected for this study; 9 on-pump cardiac surgery patients (Group A) and 9 septic patients (Group B). Baseline sublingual microcirculation functional capillary density (FCD) was assessed prior to BTX using sidestream dark field (SDF) imaging and repeated again 30 min after completion of the BTX protocol.

**RESULTS.** In on-pump cardiac-surgery patients BTX caused an increase in FCD (Fig. 1), while in septic patients FCD remained unaltered (Fig. 2).




**CONCLUSIONS.** BTX in on-pump cardiac surgery patients were effective in improving microcirculatory perfusion by improving the number of functional microvessels. However, BTX in septic patients was unable to increase FCD and restore microcirculatory function.

## 0490

### PERSISTENCE OF HIGH VENOUS-TO-ARTERIAL CARBON DIOXIDE DIFFERENCE DURING EARLY GOAL-DIRECTED THERAPY COULD BE RELATED TO MULTIORGAN DYSFUNCTION IN SEPTIC SHOCK

G.A. Ospina-Tascón[1], D.F. Bautista[1], M. Umaña[2], J.D. Tafur[1], A. Gutiérrez[1], P.A. Moncada[2], A.F. García[1], C.A. Ordóñez[1], M. Granados[1]

[1]Fundacion Valle del Lili, Intensive Care Medicine, Cali, Colombia, [2]Fundacion Valle del Lili, Emergency Department, Cali, Colombia

**INTRODUCTION.** Venous to arterial carbon dioxide difference (Pv-a$CO_2$) could reflect the adequacy of blood flow during shock states. However, time-course of Pv-a$CO_2$ and their relationship with organ dysfunction has not been widely characterized. We proposed to describe the association between Pv-a$CO_2$ evolution during early phases of resuscitation and multiorgan dysfunction in septic shock.
**METHODS.** Patients with a new septic shock episode admitted to ICU were included. Early resuscitation and general management were guided according Surviving Sepsis Campaign recommendations. Time 0 (T0) was set when a central venous catheter was inserted to guide reanimation. We draw blood samples for arterial-venous gases at T0 and 6 h after (T6). Pv-a$CO_2$ was calculated as the difference between venous $CO_2$ and arterial $CO_2$. A value of Pv-a$CO_2$ $> 6$ was considered as high. SOFA score at day-2 and day-3 were described for 4 groups: 1. Persisting high Pv-a$CO_2$ (high at T0 and T6) 2. Increasing Pv-a$CO_2$ (normal at T0, high at T6) 3. Decreasing Pv-a$CO_2$ (high at T0, normal at T6) 4.Persistently low (normal at T0 and T6). Evolution over time was assessed by analysis of variance followed by a Student's *t* test with Bonferroni correction for multiple comparisons.
**RESULTS.** Sixty septic shock patients were analyzed. Mortality rate was 36.7%. There were no differences in the amount of fluids or vasoactive dose administered at T0 and T6. No significant differences in Scv$O_2$ for the 4 groups at T0 were found (one-way ANOVA, p $= 0.68$). Patients with persistent high Pv-a$CO_2$ at T0 and T6 had a significant higher SOFA score at Day-2 and Day-3 than patients with normal Pv-a$CO_2$ at T0 and T6 (one-Way ANOVA, day-2: p $= 0.03$; day-3: p $< 0.01$) (Figs. 1, 2).

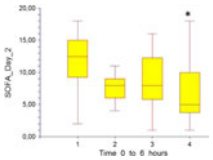



Fig. 1 SOFA day-2

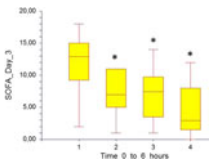



Fig. 2 SOFA day-3

**CONCLUSION.** Persistence of high Pv-a$CO_2$ difference during the early reanimation of septic shock is related to significant higher multiorgan dysfunction. Pv-a$CO_2$ could be used as perfusion goal during early phases of resuscitation of septic shock.

## 0491

### TISSUE FACTOR 603A/G AND PAI-1 4G/5G POLYMORPHISMS IMPROVE THE RISK ASSESSMENT OF DISSEMINATED INTRAVASCULAR COAGULATION DURING SEPTIC SHOCK

A. Soummer[1], Y. Lemanach[2], B. Sauneuf[1], V. Bardet[1], C. Rousseau[1], F. Pène[1], J.-D. Chiche[1], J.-P. Mira[1]

[1]Cochin Hospital, Paris, France, [2]Pitié Salpêtrière, Paris, France

**INTRODUCTION.** Among sepsis-induced organ failures, disseminated intravascular coagulation (DIC) seems to be associated with a bad outcome. Septic coagulopathy precedes multiple organ failure and continued coagulopathy during sepsis increases the risk of new organ failure and ultimately death [1]. However no common biological or clinical risk factors are currently available to predict the occurrence of DIC during sepsis. Recently, a growing understanding of the importance of genetic background in the pathogenesis and outcome of sepsis led to the identification of an expanding array of genetic biomarkers. Many genetic variants of the coagulation system have been associated with higher risk of shock, ARDS or mortality, but surprisingly, in our knowledge, they have not been studied in the setting of adult septic coagulopathy [2]. Tissue Factor (TF) and Plasminogen Activator Inhibitor-1 (PAI-1) are pivotal players in the pathogenesis of DIC.
**OBJECTIVES.** We thought to evaluate if the knowledge of single nucletotides polymorphisms of TF and PAI-1 improved a clinical-based risk assessment of DIC in septic shock patients with Net Reclassification Improvement (NRI) method [3].
**METHODS.** We analysed 635 adults Caucasians patients with septic shock admitted in a single French University Hospital with a large comprehensive and prospective data-base. TF and PAI-1 were genotyped for all patients. Improvement of the prediction given by the knowledge of SNP of PAI-1 and TF was evaluated. The model was adjusted on age, sex, SOFA, SAPSII, comorbidities, immunosuppressive treatments, nosocomial sepsis, site of sepsis and microorganism.
**RESULTS.** Among the 635 analyzed patients, 103 presented a DIC. DIC patients had worse outcome with more organs failures and higher mortality rate than others: 72.8 versus 43.8% ($p < 0.001$). DIC increased the risk of developing ARDS (OR $= 1.8$ $p < 0.05$), the need of renal replacement therapy (OR $= 3.6$ $p < 0.001$), multiple organ failure (OR $= 4.2$ $p < 0.001$) and in-ICU death (OR $= 4.3$ $p < 0.001$). The DIC-risk assessment was dramatically improved by the knowledge of SNPs. The AUC of the clinical based model was 0.67 and reached 0.71 ($p = 0.04$) with the knowledge of SNP. This resulted in an appropriate risk reclassification of patients with a NRI $= 0.29$ 95% CI [0.07–0.49]; $p = 0.007$ and the integrated discrimination improvement was IDI $= 0.014$ 95% CI [0.004–0.02] $p = 0.005$.
**CONCLUSIONS.** DIC worsens the prognosis in adult septic shock patients. PAI-1 and TF genotypes knowledge help to estimate risk for DIC. This may allow clinicians to better screen high-risk patients for furthers clinical trials in order to define early specific therapeutic targets.

**REFERENCE(S).** 1. Dhainaut JF. Crit Care Med. 2005;33(2):341–8.
2. Texereau J. Crit Care Med. 2004;32(5 Suppl):S313–19. 3. Pencina MJ. Stat Med. 2008;27(2):157–72.

## 0492

### LEUCYL/CYSTINYL AMINOPEPTIDASE RS4869317 TT GENOTYPE IS ASSOCIATED WITH INCREASED 28-DAY MORTALITY OF SEPTIC SHOCK

T.-A. Nakada[1], J.A. Russell[1], H. Wellman[2], J.H. Boyd[1], E. Nakada[1], K.R. Walley[1]

[1]University of British Columbia, Critical Care Research Laboratories, Heart + Lung Institute, St. Paul's Hospital, Vancouver, Canada, [2]Sirius Genomics Inc., Vancouver, Canada

**INTRODUCTION.** Leucyl/cystinyl aminopeptidase (LNPEP) is a key gene for regulation of plasma levels of vasopressin, which is an essential peptide hormone regulating cardiovascular homeostasis and is an adjunctive vasopressor therapy for septic shock. Whether genetic variation of LNPEP is associated with altered outcome of septic shock is unknown.

**OBJECTIVES.** To determine whether single nucleotide polymorphisms (SNPs) of LNPEP are associated with altered outcome of patients with septic shock.

**METHODS.** Two cohorts of patients with septic shock were studied: derivation cohort: a single center (St. Paul's Hospital, SPH) (n $= 589$); validation cohort: Vasopressin and Septic Shock Trial (VASST) (n $= 616$). Patients in the derivation cohort were genotyped for 230 SNPs of the LNPEP gene. Patients in the VASST replication cohort were genotyped for the LNPEP rs4869317 SNP. The primary outcome variable was 28-day mortality. The secondary outcome variables were vasopressin clearance and, in a third cardiac surgical cohort (n $= 977$), locus-specific heritability of serum sodium concentrations.

**RESULTS.** Patients with septic shock who had TT genotype of LNPEP rs4869317 SNP had increased 28-day mortality (compared with patients who had AA/AT genotype) in the derivation cohort (51.0 vs. 34.5%, adjusted hazard ratio [HR] 1.58, 95% confidence interval [CI] 1.21–2.06, $P = 7.0 \times 10^{-4}$) and in the replication cohort (38.6 vs. 29.6%, HR 1.37, 95% CI 1.04–1.81, $P = 0.026$). The association of the TT genotype with increased 28-day mortality was observed in patients who did not receive vasopressin infusion (SPH, $P = 1.5 \times 10^{-4}$; VASST, $P = 0.053$), but not in those who received vasopressin infusion (SPH, $P = 0.65$; VASST, $P = 0.35$). Patients having the TT genotype had increased plasma vasopressin clearance compared to AA/AT genotype in the VASST cohort ($P = 0.028$). Genotype of rs4869317 accounted for more than 80% of the variance of serum sodium concentration (locus-specific heritability $= 0.80$) in cardiac surgical patients.

**CONCLUSIONS.** The TT genotype of rs4869317 LNPEP was associated with increased 28-day mortality and vasopressin clearance in septic shock and contributed substantially to serum sodium regulation in cardiac surgical patients.

**GRANT ACKNOWLEDGMENT.** Heart and Stroke Foundation, and Sirius Genomics Inc.

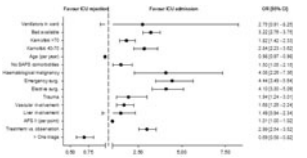
# Looking out of the ICU door: 0493–0497

## 0493

### REASONS FOR REFUSAL OF ADMISSION TO INTENSIVE CARE AND IMPACT ON MORTALITY

G. Iapichino[1], D. Corbella[1], C. Minelli[2], G.H. Mills[2], A. Artigas[3], A. Pezzi[1], M. Baras[4], C.L. Sprung[4], ELDICUS STUDY GROUP
[1]Dipartimento di Anestesiologia, Terapia Intensiva e Scienze Dermatologiche, Università degli Studi di Milano, Milan, Italy, [2]Departement of Critical Care, Anaesthesia and Operating Services, Royal Hallamshire and Northern General Hospitals, Sheffield, UK, [3]Critical Care Center, CIBER Enfermedades Respiratorias, Sabadell Hospital Parc Tauli, University Institut, Autonomous University of Barcelona, Barcelona, Spain, [4]The Hebrew University, Hadassah School of Public Health, Hadassah Medical Centre, Gerusalem, Israel

**OBJECTIVES.** To identify factors influencing triage decisions and investigate whether admission to the intensive care unit (ICU) could reduce mortality compared with treatment on the ward.
**METHODS.** Multicentre-cohort study in 11 university-hospitals in 7 EU countries, evaluating triage decisions and outcomes of patients who were either ICU-accepted or refused and treated in ward. Confounding in estimation of the effect of ICU admission on mortality was controlled by use of a propensity-score approach, which adjusted for the probability of being admitted. Variability across centres was accounted for in both analyses of factors influencing ICU admission and effect of ICU admission on mortality.
**RESULTS.** Eligible were 8616 triages in 7877 patients referred for ICU. Despite 46% of triaged patients being $> 65$ years, "too old" was only 6% of the reasons for refusal. Variables positively associated with the probability of being admitted to ICU are in Figure. The area under the model ROC curve was 0.83 (95% CI: 0.81–0.84), Hosmer–Lemeshow test p $= 0.300$.



Variables associated with ICU admission

ICU admission was associated with a significant reduction of both 28- (OR $= 0.73$; 95% CI $= 0.62$-$0.87$) and 90-day mortality.The benefit of ICU admission increased substantially in patients with greater severity of illness.

EFFECT OF ICU ADMISSION ON 90-DAY MORTALITY

| Patients at first triage (n = 6,763) | OR [95% CI] | p value | Patients triaged only once (n = 6,231) | OR [95% CI] | p value |
|---|---|---|---|---|---|
| All | 0.79 [0.66–0.93] | 0.005 | ALL | 0.82 [0.68–0.98] | 0.030 |
| SAPS II ≤ 23 | 0.72 [0.47–1.08] | 0.113 | SAPS II ≤ 23 | 0.79 [0.50–1.25] | 0.315 |
| 23 < SAPS II ≤ 36 | 0.95 [0.71–1.26] | 0.713 | 23 < SAPS II ≤ 36 | 1.01 [0.74–1.38] | 0.913 |
| SAPS II > 36 | 0.67 [0.51–0.90] | 0.007 | SAPS II > 36 | 0.67 [0.49–0.91] | 0.012 |

In the sensitivity analysis restricted to patients triaged only once during their hospital stay, the 28- and 90-day mortality (overall mortality of 29%; ICU-admitted 28%, refused 39%) were in line with those of the main analysis. Mortality of patients rejected because they were "too well" (n $= 348$) was 12 and 18% at 28 and 90 days, respectively, while in patients rejected because they were "too ill" (n $= 219$) and "too ill-too old" (n $= 33$) mortality was 77 and 81% at 28 and 90 days, respectively.

**CONCLUSIONS.** Intensivists tend to avoid ICU admission of patients judged not severe enough for ICU or likely to have a very poor outcome and they tend to admit surgical patients more readily than medical patients. Admission to ICU was associated with a reduction of both 28 and 90-day mortality, particularly in patients with greater severity of illness at the time of triage.

**GRANT ACKNOWLEDGMENT.** Supported by the European Commission contract QLK-CT-2002-00251.

## 0494

### HOSPITAL-WIDE SURVEY OF THE USE OF CENTRAL VENOUS CATHETERS

L. Sandoz[1], W. Zingg[2], C. Inan[1], V. Cartier[1], B. Walder[1]

[1]Geneva University Hospitals, Anaesthesiology, Geneva, Switzerland, [2]Geneva University Hospitals, Infection Control Programme, Geneva, Switzerland

**INTRODUCTION.** Central venous catheters (CVC) are indispensable medical devices in acute patient care. Few data exist on indications for CVC use.

**OBJECTIVES.** We conducted an observational, hospital-wide prospective cohort study to quantify the indication for CVC over dwell time, to detect differences in CVC use in ICU and non-ICU settings.

**METHODS.** All adult patients receiving a non-tunnelled CVC in the University Hospitals of Geneva were prospectively included. All catheters were identified daily via a hospital-wide, electronic data management system. Catheters use was observed by on-site visits, healthcare workers interviews and screening of patients charts during 3 months. Categorical variables were compared using the Chi-square test; continuous variables were compared using the Wilcoxon rank sum test.

**RESULTS.** A total of 378 CVCs were inserted in 292 patients, accounting for 2,704 catheter-days. Of these, 93% CVCs were multi-lumen catheters and 70% were placed in the intensive care unit (ICU). Median dwell time (interquartile range [IQR]) was 5 [2–9] days overall, and 4 [2–7] and 8 [3–15] in the ICU and non-ICU settings. Eight central line-associated bloodstream infections were detected for an overall incidence density of 2.9/1,000 catheter-days (1.6/1,000 in the ICU and 4.1/1,000 in non-ICU settings). The mean number of specified indications for CVC use per day was 1.7 (1.9 for ICU and 1.5 for non-ICU; $p < 0.001$). The most frequent reason (49%) for catheter use was prolonged (> 7 days) antibiotic therapy followed by parenteral nutrition (22.3%). Hundred-thirty catheter-days (34 in the ICU and 96 in non-ICU settings) among 30 CVCs (7.9%) were unnecessary. The proportion of unnecessary catheter use was 4.8% [4.0–5.7] overall, 2.7% [1.9–3.8] in the ICU and 6.6% [5.4–8.0] in non-ICU settings.). Thirty-five on-site visits (8.3%) in non-ICU settings revealed that neither the nurse nor the treating physician knew why the catheter was in place.

**CONCLUSIONS.** CVCs in the ICU and non-ICU settings represent distinct catheter populations with different characteristics and risk factors for adverse outcome. ICU catheters have a short dwell time but are utilized more often, while catheters in non-ICU settings show a reverse characteristic. Prevention measures targeting catheter care are more likely to be successful in non-ICU settings.

## 0495

### FIVE YEARS EXPERIENCE WITH A MEDICAL EMERGENCY TEAM IN A 500-BED TEACHING HOSPITAL

I. Meynaar[1], H. van Dijk[1], M. Verheijen[1], L. Dawson[1], S. Sleeswijk Visser[1], P. Tangkau[1]

[1]Reinier de Graaf Hospital, ICU, Delft, Netherlands

**INTRODUCTION.** It is widely recognized that hospitalized patients are at risk for unexpected and unrecognized deterioration of vital functions resulting in increased and unnecessary morbidity and mortality. Medical emergency teams (MET) are activated by hospital staff triggered by changes in vital parameters. In our hospital a MET system was implemented in 2004.

**OBJECTIVES.** To evaluate outcome of patients for whom the MET was activated.

**METHODS.** The Reinier de Graaf Hospital is a 500-bed teaching hospital with a 10-bed mixed intensivist-led ICU. In the MET procedure, hospital staff, nurses and doctors, are instructed to score any patient on the ward with suspected deterioration using a scoring card (Table 1). If a patient has 3 points or more, the ward physician is required to examine the patient and start initial treatment within 30 min. The MET, consisting of intensivist and ICU nurse, is activated if the patient's own doctor judges this to be necessary or when initial treatment does not reduce the score within 30 min. The MET will visit the patient at the bedside and either give treatment advice or transfer the patient, for instance to the ICU. Each MET activation is recorded in a database for evaluation purposes. We studied all MET calls between 2005 and 2009. To study mortality only the first MET call for each patient was evaluated.

**TABLE 1** MODIFIED EARLY WARNING SCORE CARD

| | 3 | 2 | 1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| Heartrate | | <40 | 40–50 | 51–100 | 101–100 | 111–130 | >130 |
| Systolic blood pressure | <70 | 70–80 | 81–100 | 101–200 | | >200 | |
| Respiratory rate | | <9 | | 9–14 | 15–20 | 21–30 | >30 |
| Temperature | | <35.1 | 35.1–36.5 | 36.6–37.5 | >37.5 | | |
| Consciousness | | | | Alert | Verbal | Pain | Unresponsive |
| Urinary output in last 4 h | | | | | <75 ml | | |
| $SaO_2$ | | | | | <90% despite oxygen | | |
| Extra | | | | | Worried about the patient | | |

**TABLE 2** OUTCOME OF MET ACTIVATION IN 982 PATIENTS

| | Number of patients | Hospital mortality |
|---|---|---|
| Transfer to ICU | 475 | 125 (26%) |
| Treatment continues on ward with treatment advice from MET | 274 | 43 (16%) |
| Treatment continues on ward with change of resuscitation code | 85 | 57 (67%) |
| Transfer to OR, coronary care or other hospital | 73 | 10 (14%) |
| No treatment changes or transfer after MET call | 64 | 6 (9%) |
| Patient dies during MET visit with or without CPR | 11 | 11 (100%) |
| Total | 982 | 252 (26%) |

**RESULTS.** Between 2005 and 2009, the MET was activated 1071 times for 982 individual patients. The mean age of the patients was 65.8 years (SD 18), 583 (55%) were male. The mean MET score was 5.9 (SD 2.2). Results of the MET activation are presented in Table 2.

**CONCLUSIONS.** The patients identified in the wards by the MET procedure are indeed at risk. Transfer to the ICU is necessary for more than half of the patients, advice on treatment while the patient stays in the ward is necessary for most of the remaining patients. Overall hospital mortality is 26%.

## 0496

### ANALYSIS OF WORKLOAD OF A MEDICAL EMERGENCY TEAM: OVER A YEAR IN A DISTRICT GENERAL HOSPITAL IN THE UK

A. Low[1], T. Pawade[2], J. Sonksen[1], D. Pandit[1]

[1]Russells Hall Hospital, Critical Care, Dudley, UK, [2]Russells Hall Hospital, Acute Medicine, Dudley, UK

**INTRODUCTION.** In October 2008 a Medical Emergency Team (MET) was set up in our 770 bedded hospital, driven by the realisation that our acutely ill patients needed to be rapidly identified and reviewed. The changing shift patterns of doctors following the European time Working Directive (EWTD) has made the need for prompt senior review at the bedside, 24 h a day, even more imperative.

**OBJECTIVES.** To assess the workload of the MET calls and subsequent patient outcomes over a 12 month period. The number of cardiac arrests and survival to hospital discharge was used as end points.

**METHODS.** We collected data prospectively during each MET calls via a Critical Care Outreach database (MedICUs-Outreach, Mela Solutions Ltd, UK). Outcome data was obtained retrospectively using Trust databases and ICNARC data.

**RESULTS.** A total number of 880 patients were audited over a 12-month period, and we demonstrated a significant and sustained 40% reduction in cardiac arrests. On average there are 2 MET calls per weekday and 3 per day at weekends, increasing to 4 on bank holiday Mondays. On average the MET team is at the bed-side for 30 min during a mid-week daytime call and 60 min out-of hours. Survival to discharge data was analysed after dividing patients into 4 main groups, based on whether they remained on the ward, (with or without a DNAR order), were admitted to a high dependency unit or were admitted to ICU. Admission to a level 2 or 3 area was considered a surrogate marker of a reversible critical illness in a patient with potential for recovery. 30 patients were admitted to ICU following the target MET call, of which 19 (63%) survived to discharge from hospital. 85 patients went to level 2 care (high dependency) of which 51 (60%) were discharged from hospital. Of 552 patients who stayed on the ward with no DNAR or critical care admission at the time of the target MET call, 292 (52%) were discharged from hospital. Finally of the 213 patients who were managed on the ward with DNAR completed by the MET, 171 (80%) died. In-hospital cardiac arrest prior to ICU admission dropped from 6.9 to 1.2% during the study period.

**CONCLUSIONS.** The MET team has made a significant contribution to reducing cardiac arrests, and has resulted in prompt critical care admission, with good outcomes. However this comes at a cost as in terms of senior staff man-hours (2–4 man-hours per call) Appropriate DNAR orders placed earlier by parent teams would significantly reduce the workload our MET team. We are now targeting further educational programmes to feedback information to parent teams. Anecdotal evidence suggests the high mortality amongst patients who remain on the ward without DNAR order reflect the it not only contains relatively well patients with minor physiological abberations but also a significant proportion of patients in whom the MET felt survival was unlikely and escalation of treatment would not influence outcome.

## 0497

### ROLE OF A MEDICAL EMERGENCY TEAM IN TRIAGE OF SEPTIC WARD PATIENTS: A FIVE YEARS SINGLE CENTER RETROSPECTIVE STUDY

P. Calzavacca[1], A. Schneider[1], D. Jones[1], G.K. Hart[1], R. Bellomo[1]

[1]Austin Hospital, Intensive Care Department, Heidelberg, Australia

**INTRODUCTION.** Sepsis is common in hospitalised patients and contributes to morbidity and mortality. Severe sepsis is associated with an in-patient mortality of approximately 40%. Hospital Medical Emergency Teams (MET) were introduced to identify and treat acutely unwell ward patients in order to reduce serious adverse events. We hypothesised that the MET might play a role in triaging septic patients. Accordingly, we performed a retrospective observational study to evaluate what proportion of MET calls was associated with septic patients, and their disposition after MET review.

**OBJECTIVES.** To estimate the proportion of MET reviews involving septic patients and management by the MET as well as outcome of such patients.

**METHODS.** We obtained Hospital Research Ethics Committee approval. We performed a retrospective observational study over 5-year (August 2005–March 2010) in a single tertiary Australian hospital. We obtained information on demographics, details of MET review and hospital outcome.

**RESULTS.** We analysed 4508 MET reviews in 3354 patients over a 5-year period. Overall 177/3354 (5.3%) of MET patients had sepsis. Table 1 summarizes major epidemiological findings after exclusion of patients with limitations of medical treatments (LOMT) in non septic MET patients and in septic patients. The three most common MET triggers in septic patients were respiratory distress, multiple physiological derangements and neurologic impairment, accounting for more than three quarters of activations in septic patients. Fluid resuscitation was performed in 44 patients, vasopressors were used in 13 patients. Non-invasive ventilation was commenced in 10 patients. Pneumonia was the most common cause of sepsis and it was diagnosed in 45 patients. Twelve patients had septic shock at the time of MET review, four died.

FIVE YEARS MET REVIEWS ATER EXCLUSION PT WITH LOMT

| | Non septic MET patients | Septic MET patients | P value |
|---|---|---|---|
| Age* | 66 (± 17.3) | 62.9 (± 16.6) | 0.017 |
| Sex (male) | 1081/2177 (49.7%) | 86/177 (48.6%) | 0.785 |
| Surgical | 942/2177 (43.3%) | 88/177 (49.7%) | 0.235 |
| Unplanned ICU admission | 307/2177 (14.1%) | 307/2177 (14.1%) | <0.001 |
| LOS** | 12 (16) | 19 (20) | <0.001 |
| Hospital mortality | 439/2177 (20.2%) | 47/177 (26.6%) | 0.043 |

* Normal distributed variable; ** Non normal distributed variable

**CONCLUSIONS.** Septic patients reviewed by the MET were younger, more likely to be admitted to ICU, had a longer hospital length of stay and higher likelihood of dying compared to non septic MET reviewed patients. Further strategies are needed to promptly recognize and escalate care of septic patients in our hospital.

# Organ donation: 0498–0502

## 0498

### A CONTINUOUS AND NATIONWIDE OPEN AUDIT OF THE DECEASED DONATION PROCESS IN SWEDISH ICU'S

T. Nolin[1], S. Walther[2], C. Mårdh[1], G. Karlström[3], on behalf of the Swedish Intensive Care Registry (SIR)

[1]Centralsjukhuset, Anestesikliniken, Kristianstad, Sweden, [2]Thorax-Kärlkliniken, Linköping, Sweden, [3]Centralsjukhuset Karlstad, AnOpIVA, Karlstad, Sweden

**INTRODUCTION.** Organ procurement from deceased intensive care patients is an important responsibility of the intensive care team. Donor specialized doctors, DDoc and donor specialized nurses, DNurse are commissioned in Sweden to promote organ and tissue donation at their hospitals with the aim to minimize loss of suitable organ donors. The Swedish Intensive Care Registry (SIR) and the Swedish Council for Organ and Tissue Donation have designed a structured protocol for follow up of deceased intensive care patients.

**OBJECTIVES.** The aim of this study was to examine results from the first complete year of this nationwide, systematic audit and to identify shortcomings in the organ donation process.

**METHODS.** A predetermined dataset (including presence of new, severe brain injury; mechanical ventilation during the last 24 h before death; ICD10 diagnosis, contact with transplant coordinator, contraindications to organ donation, the will of the deceased, presumed consent, decision to donate and actual donation) was collected for every ICU death to aid analysis and groupings of patients. The data were sent electronically to SIR, validated and displayed on the SIR open website within 6 h from completed validation (http://avlidna.icuregswe.org).

**RESULTS.** There were 3,383 deaths in 80 ICU's during 2009. These were grouped as follows:

GROUPINGS OF DECEASED IN ICU

| Group | New, severe brain injury | Mechanical ventilation | Brain death | Deaths no. (%) | Reviewed by Ddoc/Dnurse (%) |
|---|---|---|---|---|---|
| I | No | No | No | 705 (21) | 86 |
| II | No | Yes | No | 1,689 (50) | 88 |
| III | Yes | No | No | 88 (3) | 92 |
| IV | Yes | Yes | No | 653 (19) | 90 |
| V | Yes | Yes | Yes | 248 (7) | 91 |
| All groups | | | | 3,383 (100) | 88 |

A further analysis of the 248 deaths in group V showed contraindications to organ donation in 40 cases (20 decided by ICU-physician, 20 decided after having consulted transplant coordinator). Of the 208 cases identified as medically suitable for organ donation (potential deceased organ donor), the patient's will was known in 88 cases (59 were positive and 29 negative) and unknown in 120 cases (75 were presumed positive and 42 were vetoed by family). Of the 134 remaining deaths, actual organ donation was performed in 129. Two were lost due to hemodynamic problems, 1 due to newly detected contraindication, 1 due to missing recipient and 1 due to organizational problems.

**CONCLUSIONS.** Seven percent of all deceased ICU patients were diagnosed with brain death. Actual donors of confirmed brain deaths were 52% and of "potential deceased organ donors" 62%. We believe that an open and continuous audit of selected steps in the deceased donation process [1] highlights areas for improvement that eventually may lead to less loss of organs for transplantation.

**REFERENCE(S).** 1. Guide of recommendations for Quality Assurance Programmes in the Deceased Donation Process. Dopki project. (http://www.dopki.eu).

## 0499

### MYTHS AND FACTS: WHAT SHOULD WE KNOW ABOUT NEUROCRITICAL PATIENT EVOLUTION AND ORGAN DONATION? A MULTICENTRIC STUDY IN CATALONIA, SPAIN

T. Pont[1], N. Masnou[1], J. Gener[2], M. Bodí[3], M. Bodi[4], P. Salamero[1]

[1]University Hospital Vall d'Hebron, Transplant Coordination Management, Barcelona, Spain, [2]University Hospital Germans Trias, Intensive Care Unit, Badalona, Spain, [3]University Hospital Arnau de Vilanaova, Intensive Care Service, Lleida, Spain, [4]University Hospital Joan XXIII, Intensive Care Service, Tarragona, Spain

**INTRODUCTION.** In hitherto published data there are no registers telling us how many neurocritical patients die in brain death. The follow up protocol of these patients is used by the transplant coordinator to avoid losses of potential organ donors in Catalonia.

**AIM.** To analyse evolution of neurocritical patients in intensive care units in four university hospitals with donation programs in Catalonia.

**METHODS.** These hospitals completed the following questionnaire:

1. Administrative data: no. of admissions, no. of neurocritical patients, survival, mortality and occupation rates.
2. Neurocritical pathologies: no. of brain traumas, no. of strokes (hemorrhagic and ischaemic), no. of brain tumors, no. of anoxic encephalopathy.
3. Evolution by pathology (alive or type of death: heart arrest and brain death), length of stay and number of donors. The study period was 2002–2008.

**RESULTS.** We analysed 2,472 neurocritical patients (GCS < 8) out of 64.971 admitted in ICU.) Of those analysed 30% (755/2,472) died in brain death and 55% (416/755) of them became organ donors. 40% (984/2,472) were released with good outcomes and 6% (151/2,472) had poor results (G0S III–IV). The average length of stay for brain dead patients was 3.7 days (range 1–11) compared to 13.9 days (range 1–45) deaths in cardiac arrest. By pathologies, brain death occured as follows: 1. brain trauma 18% (175/876). 2. subarachnoidal haemorrhage 34% (104/298) 3. Intracerebral haemorrhage 50%(312/618) 4. ischaemic stroke 30% (66/225), 5. Brain tumor 25% (25/88) 6. Anoxic encephalopathy 40% (85/208).

**CONCLUSIONS.**

1. 30% of neurocritical patients admitted in ICU died in brain death.
2. Brain death occured in the first 3 days.
3. A standardised protocol of prudential observation time, including evaluation, prognosis and family information, would surely lead to improved good results, family satisfaction and organ donation.

## 0500

### MULTICENTER STUDY ON THE EVOLUTION OF CRITICAL NEUROLOGICAL DISEASES IN ICUS FROM CATALONIA: GENERAL RESULTS AND REPERCUSSION OF PRACTICES IN ORGAN AND TISSUE DONATION

M.A. Bodí[1], T. Pont[2], J. Mestre[3], J. Gener[4], E. Oliver[5], M. Badía[6], S. Quintana[7], E. Muñoz[8], X. Esquirol[9], P. López[10], R. Deulofeu[11], Neurocritical Diseases Evolution Catalan Study Investigators

[1]Universitary Hospital in Tarragona Joan XXIII, Tarragona, Spain, [2]Universitary Hospital Vall Hebron, Barcelona, Spain, [3]Hospital de Sabadell, Sabadell, Spain, [4]Universitary Hospital Germans Trias i Pujol, Badalona, Spain, [5]Universitary Hospital Bellvitge, Barcelona, Spain, [6]Universitary Hospital Arnau de Vilanova, Lleida, Spain, [7]Hospital Mutua Terrassa, Terrassa, Spain, [8]Hospital Santa Tecla, Tarragona, Spain, [9]Hospital General de Granollers, Granollers, Spain, [10]OCATT (Catalan Transplant Organization), Barcelona, Spain, [11]OCATT, Barcelona, Spain

**INTRODUCTION.** In Spain organ donation rates seem to have reached a limit which is difficult to exceed. Nevertheless, organ demand heavily exceeds supply. Despite all efforts, we still observe losses of donors due to lack of detection in the Intensive Care Units (ICU). This is partly due to a lack of familiarity with the process, but also to the establishment of a limitation of therapeutic effort (LTE), derived from the application of the concept of futility, without taking into account the possibility of organ donation.

**OBJECTIVES.** (1) To analyse in general the evolution of patients with Critical Neurological Diseases (CND), defined by a Glasgow Coma Score < 8, admitted to participating hospitals, and in particular to detect possible losses of organ donors. (2) To determine whether all families of potential organ and/or tissue donors had been informed or not about the possibility of donation. (3) To know the number of cases of CND to which a LTE (withdrawing and withholding treatment or non-admittance to an ICU) is applied. (4) To analyse the effects of LTE on organ donation.

**METHODS.** Prospective, multicentre and observational study of all critical neurological patients with GCS < 8. Study patients were followed until death (detailing the type of death, CA or BD), release from hospital or 30 days of in-hospital stay. A file was kept for each patient on a dedicated secure web database. Statistical analysis was descriptive.

**RESULTS.** 10 hospitals participated, with 286 patients included (range 1–72 cases per centre) during the last trimester of 2009. Mortality rate was 48.6, and 42% of deaths were brain deaths (BD). 59% of BD patients were organ donors. In 35 cases (83.3%) the families of BD patients received information about organ donation. The remaining 10 families (16.3%) were not informed due to some existing medical contraindication. LTE was applied in 24% of cases, and 3 patients survived afterwards. The average age of survivors is similar to that of BD patients (55 years) and significantly lower than that for deaths due to cardiac arrest (CA) (77 years). In the group of deaths due to CA, 17% of patients were tissue donors, and 5% of them came from the LTE group.

**CONCLUSIONS.** Mortality rates in CND are high, and 40% of our patients evolved to brain death. More than a half of them became organ donors. LTE was applied to 25% of the CND patients. Tissue donation rates were very low (17%) in both groups (BD and cardiac arrest).

**REFERENCE(S).** 1. Azoulay E et al. for the Conflicus Study Investigators and for the Ethics Section of the European Society of Intensive Care Medicine. Prevalence and Factors of Intensive Care Unit Conflicts: the conflicts study. Am J Respir Crit Care Med 2009;180:853–60.
2. Saviozzi A et al. The epidemiology of brain death in tuscany: is there need for novel indicators? Transpl Proc 2009;41:1090–1.

## 0501

### TRENDS AND DEMOGRAPHICS OF 154 BRAIN DEAD PATIENTS BETWEEN 1995 AND 2009

E.J.O. Kompanje[1], Y.J. de Groot[1], J. Bakker[1]

[1]Erasmus Medical Center, Intensive Care Medicine, Rotterdam, Netherlands

**AIMS.** Brain dead patients are an important source of organs for transplantation. We conducted a retrospective study to search for changes in trends and demographics of brain dead patients over the past 15 years that could have been a result of changes in incidence and mortality in patients with a subarachnoid haemorrhage (SAH), an intracerebral haemorrhage (ICH) or a traumatic brain injury (TBI).

**METHODS.** A retrospective observational cohort study of all patients who became brain death and donated one or more organ(s) between 1995 and 2009. All patients were admitted to a tertiary university hospital intensive care unit.

**RESULTS.** 154 patients became brain dead of which 57.1% was caused by a SAH, 22.0% by a TBI, 12.3% by an ICH and 8.6% by other causes. The median length of stay was 1 day for all three groups. TBI patients were predominantly male (88.2%) and younger of age (mean age: 37.5 years). This is in sharp contrast with the SAH patients who were predominantly female (65.9%) and older of age (mean age: 51.5 years). Fifty-six percent of the patients who died of a SAH did so after a rebleed. The primary origin of the aneurysm was the Arteria communicans anterior (26.5%) closely followed by Arteria cerebri media (18.1%). The ICH patients were even divided between males and females and had a mean age of 56.6 years. The mean reason of a TBI was a road traffic accident (55.8%) followed by fall-related TBI (35.3%). After introduction of the National Donor Register in 1998 the number of registered donors who donated an organ was 37 versus 54 donating patients who were not registered in the period between 1995 and 2009.

**CONCLUSIONS.** Almost 60% of the brain dead patients who donated one or more organs were not registered in the National Donor Register. In this group relatives gave permission for organ donation. This study confirms demographic distribution of previous studies of brain dead patients. The main source of brain dead organ donors remains a middle-aged female with a fatal SAH. Due to a decline in road traffic accidents and a sharp decrease of SAH mortality of 50% in the past two decades, resulting from a European wide smoking ban and better surgical and endovascular treatment options after a SAH, we anticipate a decline of brain dead patients in coming decades.

## 0502

### AN EVALUATION OF POTENTIALLY MODIFIABLE FACTORS IMPACTING ON THE CONVERSION RATES OF POTENTIAL ORGAN DONORS (HEART BEATING AND NON-HEART BEATING) AT UNIVERSITY HOSPITAL BIRMINGHAM OVER 24 MONTHS

A. Billington[1], C. Miller[1], E. Holyday[1], W. Tunnicliffe[1]

[1]University Hospital Birmingham, Birmingham, UK

**INTRODUCTION.** Organ transplantation transforms thousands of lives each year, yet three people die each day in the UK whilst awaiting transplant.[1] The UK Organ Donation Taskforce analysed systems in the UK and in other countries to ascertain what changes should be made to improve donation rates, their recommendations were detailed in the report 'Organs for Transplants' [2]. Despite many changes subsequently being made nationally, regionally and locally, there continues to be missed opportunities at University Hospital Birmingham, where potential donors fail to become actual organ donors.

**OBJECTIVES.** To determine which potentially modifiable factors exist within the cohort of potential organ donors that do not become actual donors at University Hospital Birmingham (UHB) from 2008 to 2010 and to generate solutions to these issues.

**METHODS.** All deaths occurring in the ITUs at UHB are audited by in house Specialist Nurses for Organ Donation. This audit of potential donors is used to generate key performance data for each of the main steps in becoming an organ donor:

- Referral rates
- Brain stem death testing (BSDT) rates
- Percentage of families approached
- Consent rate including the rate of collaborate consent (Clinician and Specialist Nurse together)
- The number of organs retrieved and the number successfully transplanted

This allows benchmarking to other NHS trusts and the UK national average. By further examining this audit data a cohort of potential donors where opportunities were missed can be identified. The case notes for these patients will be reviewed by 2 ITU Consultants and 2 Specialist Nurses so that the factors to account for these missed opportunities can be categorised and evaluated.

**RESULTS.** There were 207 potential donors meeting UHB trigger referral criteria in this 24 month period.

Heart beating organ donation

Referral rate increased from 90 to 100%. The rate of BSDT increased from 72 to 76% however, families are still being approached for consent prior to BSDT. Uncontrolled cardiac arrests occurred in 15% prior to BSDT. Consent rate remained at 61% despite an increase in collaborative request rates.

Non-heart beating organ donation

Referral rate has decreased from 86 to 71% despite continuing education and a clinical trigger for referral. Consent rate has decreased to 62% despite an increase in the collaborative request rate from 14 to 46%. A large drop in the conversion rate to 13%, accounted for by an increase in uncontrolled arrests or prolonged ischaemic times.

**CONCLUSION.** Further detailed analysis is continuing before detailed conclusions can be drawn, however, the importance of timing approach to the family for consent, the role of physiological management of the potential donor and the length of the process appear to be the key issues which will need to be addressed.

**REFERENCES.** 1. NHSBT. http://nhsbtweb/organ_donation_and_transplantation/.
2. DoH (2008) Organs for transplants: a report from the organ donation taskforce.

## 0504

### PROGNOSTIC VALUE OF CONTINUOUS EEG MONITORING DURING THERAPEUTIC HYPOTHERMIA IN PATIENTS WITH COMA AFTER CARDIAC ARREST

L.A. Urbano[1], A.O. Rossetti[2], F. Delodder[1], M. Oddo[1]

[1]Lausanne University Hospital (CHUV), Department of Intensive Care Medicine, Lausanne, Switzerland, [2]Lausanne University Hospital (CHUV), Department of Clinical Neurosciences, Lausanne, Switzerland

**INTRODUCTION.** Continuous EEG (cEEG) is increasingly used to monitor brain function in neuro-ICU patients. However its value in patients with coma after cardiac arrest (CA), particularly in the setting of therapeutic hypothermia (TH), is only beginning to be elucidated.

**OBJECTIVES.** To examine the prognostic value of cEEG performed during TH.

**METHODS.** From April 2009 to January 2010, we prospectively studied 21 consecutive comatose CA patients treated with TH (33°C, 24 h) who were monitored with cEEG, initiated during the maintenance phase of TH and maintained up to 48 h. EEG background reactivity to painful stimulation was tested[1]. We analyzed the association between early cEEG findings and outcome, assessed at 3 months with the Glasgow–Pittsburgh Cerebral Performance Categories (CPC).

**RESULTS.** Continuous EEG was started after a median of 12.8 h following CA. Non-reactive cEEG background (6/9 [67%] among non-survivors vs. 0/12 survivors, $p < 0.002$), prolonged discontinuous "burst-suppression" activity (6/9 [67%] vs. 0/12, $p < 0.002$) and non-convulsive EEG seizures with absent background reactivity (4/9 [44%] vs. 0/12, $p = 0.02$) were strongly associated with mortality. All patients with non-convulsive EEG seizures showed no EEG improvement after TH and died. Non-reactive cEEG background during TH had a positive predictive value of 100% (95% CI: 52–100%) and a false positive rate of 0% (95% CI: 0–26%) for mortality. All survivors had a reactive cEEG background, and the majority of them (10/12 [83%]) had good neurological recovery at 3 months (CPC 1 or 2).

**CONCLUSIONS.** Presence of a reactive background on cEEG during TH is associated with good neurological recovery after CA. These data support further clinical studies to examine the value of cEEG monitoring in patients with coma after CA treated with TH.

**REFERENCE(S).** 1. Rossetti AO, Oddo M, Logroscino G, Kaplan PW. Prognostication after cardiac arrest and hypothermia: a prospective study. Ann Neurol. 2010;67(3):301–7.

# Assessing consciousness disorders: 0503–0507

## 0503

### EARLY DETECTION, OUTCOME AND FACTORS ASSOCIATED TO CRITICAL ILLNESS MYOPATHY

X. Sarmiento[1], H. Pérez-Moltó[1], J. Coll-Cantí[2], S. Vitoria[1], M.T. Misis[1], R. Alvarez[2], J. Klamburg[3], I. Ojanguren[3]

[1]Hospital Germans Trias i Pujol, Medicina Intensiva, Badalona, Spain, [2]Hospital Germans Trias i Pujol, Neurologia, Badalona, Spain, [3]Hospital Germans Trias i Pujol, Badalona, Spain

**INTRODUCTION.** critical illness myopathy (CIM) is a common finding in severely ill patients, although its early diagnosis and outcome are not exactly established.

**OBJECTIVES.** To detect the presence of CIM in severe critically ill patients in early stages following their outcome.

**METHODS.** A prospective study performed among 50 critical patients admitted to ICU. When EMG alterations were detected a muscle biopsy was performed. Several items were recorded, including septic shock, length of stay (LOS), ventilation time, triggering force and eventual outcome.

**RESULTS.** The first detectable sign of CIM was fibrillation and was present in 68%, being in 30% detected in the first week and 70% during the second week. Patients with CIM had typical pathologic changes of CIM, whereas three patients without CIM where also biopsied (controls) and pathological CIM sings were not found. Among 38 patients with shock 25 had myopathy. The use of aminoglycosides and muscular relaxants was significantly higher among patients with CIM. There were no significant differences between patients with and without myopathy regarding age, body mass index, use of corticotherapy, SOFA and APACHEII scores or mortality scores and mortality. Nevertheless, LOS and mechanical ventilation times were longer among patients with myopathy. Triggering force was not significantly different between patients with or without myopathy. All patients recovered full muscle strength in 90 days, (median 22 days).

**CONCLUSIONS.** Fibrillation in the EMG is the best method for early and easy detection of CIM. This is directly related to typical pathological changes of CIM. Its onset is within the first 2 weeks of illness. The presence of CIM is associated to a prolonged mechanical ventilation time, and to longer LOS. Nevertheless, CIM was not related to the triggering force or to mortality.

**GRANT ACKNOWLEDGMENT.** Study supported by grant: PI-61510 Fundació-Marató-TV3.

## 0505

### TRANSCRANIAL DOPPLER SONOGRAPHY FOR THE DIAGNOSIS OF BRAIN DEATH: ANALYSIS OF THE INTER-EXAMINER RELIABILITY OF DETECTING CEREBRAL CIRCULATORY ARREST

J.M. Domínguez-Roldán[1], J.J. Egea-Guerrero[1], C. García-Alfaro[1], P. Jimenez-Gonzalez[1], F. Hernandez-Hazañas[1], F. Murillo-Cabezas[1]

[1]H.H.U.U.Virgen del Rocío, Neurocritical Care Unit, Seville, Spain

**OBJECTIVE.** The main objective of this research was to analyze the inter-examiner reliability of detecting cerebral circulatory arrest by transcranial Doppler sonography (TCD) in the diagnosis on brain death.

**HYPOTHESIS.** There is a good interobserver agreement in the diagnosis of cerebral circulatory arrest by means of TCD for brain death diagnosis.

**POPULATING.** The population of this research studied 126 neurologic patients. Group A: 63 patients in brain death (Whole brain death criteria fulfilled); Group B: 63 alive neurocritical patients (head trauma and/or subarachnoid hemorrhage).

**METHOD.** To estimate the agreement of the TCD recording performed by two independent ICU doctors during sonographic exam for brain death diagnostic purpose the TCD register was analyzed. The following patterns were considered compatible with the diagnosis of brain death: Systolic spikes, reverberating flow, separation diastole-systole; TCD patterns non compatible with brain death: Any TCD register with end-diastolic positive flow or lack of insonation. For this research the register of both middle cerebral arteries and basilar artery was considered. Statistical analysis: measure inter-observer variability by Kappa test of Cohen.

TABLE 1

| | | Observer 2 Brain death | Observer 2 Non brain death |
|---|---|---|---|
| Observer 1 | Brain death | 62 | 3 |
| Observer 1 | Non brain death | 0 | 61 |

Proportion agreement 0.97; prevalence index 0; bias index: 0.023; kappa: 0.99524. In the three cases of disagreement, the observer 2 was not able to insonate one of the arteries required for fulfilling the brain death criteria.

**CONCLUSIONS.** According to our results, the inter-observer agreement of TCD for brain death diagnosis, according Landis RJ and Koch GG criteria, is almost perfect. The hypothesis of good inter-observer agreement of TCD for brain death diagnosis is evidenced.

## 0506

### COMPARISON OF CAM-ICU AND ICDSC FOR THE DETECTION OF DELIRIUM IN CRITICALLY ILL PATIENTS

L.D.S. Constantino[1], C.D. Tomasi[1], C.L. Grandi[1], J. Salluh[2], M. Soares[2], V.R. Giombelli[1], S.C. Alves[1], R.C. Macedo[1], D. Biff[1], C. Ritter[1], F. Dal Pizzol[1]

[1]Universidade do Extremo Sul Catarinense, Criciúma, Brazil, [2]Hospital do Câncer-I, Instituto Nacional do Câncer, Unidade de Terapia Intensiva, Rio de Janeiro, Brazil

**INTRODUCTION.** *Delirium* an acute transient cognitive dysfunction, a highly frequent and serious problem in intensive care units (ICU) associated with increased mortality, prolonged mechanical ventilation, and prolonged hospital length of stay (LOS) [1–2]. *Delirium* is often underdiagnosed [3] probably because clinical aspects, such as oversedation may limit verbal communication precluding the performance of an adequate cognitive assessment in ICU patients [4].

**OBJECTIVES.** To compare and assess the agreement between the diagnosis of delirium obtained by the Confusion Assessment Method of ICU (CAM-ICU) and Intensive Care Delirium Screening Checklist (ICDSC) in patients admitted to the ICU and their association with outcomes.

**METHODS.** Adult patients admitted to the ICU for more than 24 h between May and November 2008 were included. Patients with a RASS −4 to −5 for ≥ 3 days were excluded. Clinical data was recorded daily until ICU discharge. Patients admitted to ICU were evaluated for diagnosis of delirium using the CAM-ICU and the ICDSC, twice a day during their ICU stay. Delirium evaluation was performed by a single investigator (CDT) during the study period, and patients were followed until ICU discharge or for a maximum of 28 days.

**RESULTS.** During the study period, 383 patients were admitted to the ICU and 162 (42%) were evaluated; delirium was identified in 26.5% of patients by CAM-ICU and in 34.6% by ICDSC. There was agreement in delirium diagnosis between the two methods in 42 (26%) patients, and in excluding delirium in 108 (67%) patients. The ICDSC was positive in 11 (7%) patients in whom CAM-ICU was negative. Delirium, diagnosed either by ICDSC or CAM-ICU assessments, was associated with both significantly increased hospital LOS and mortality. Patients with positive ICDSC presenting with negative CAM-ICU had similar outcomes as compared to those without delirium.

**CONCLUSIONS.** Patients with delirium diagnosed only by the ICDSC did not present higher risk for poor outcomes. This finding suggests that the CAM-ICU should be preferentially used in the diagnosis of delirium in ICU patients.

**REFERENCE(S).** 1. Ely EW, Gautam S, Margolin R, Francis J, May L, Speroff T, Truman B, Dittus R, Bernard R, Inouye SK. The impact of delirium in the intensive care unit on hospital length of stay. Intensive Care Med. 2001;27:1892–900.
2. Wacker P, Nunes PV, Cabrita H, Forlenza OV. Post-operative delirium is associated with poor cognitive outcome and dementia. Dement Geriatr Cogn Disord. 2006;21:221–7.
3. Fong TG, Tulebaev SR, Inouye SK. Delirium in elderly adults: diagnosis, prevention and treatment. Nat Rev Neurol. 2009;5:210–20.
4. Pisani M, Inouye SK, McNicoll L, Redlich CA. Screening for pre-existing cognitive impairment in older intensive care unit patients: use of proxy assessments. J Am Geriatr Soc. 2003;51:689–93.

**GRANT ACKNOWLEDGMENT.** CNPq, CAPES, FAPESC, UNESC, Instituto Nacional do Câncer.

## 0507

### PREVALENCE OF ICU-ACQUIRED NEUROMYOPATHY IN 66 FRENCH ICUS: A ONE DAY STUDY

G. Chanques[1], L. Zoric[2], A. Bonnal[2], M. Leone[3], J.M. Constantin[4], B. Allaouchiche[5], S. Jaber[1], J.Y. Lefrant[2], AzuRea Study Group

[1]CHU Montpellier, SAR B, Montpellier, France, [2]CHU NÎMES, Pole ARDU, Nimes, France, [3]Assistance Publique des Hôpitaux de Marseille, Marseille, France, [4]CHU Clermond Ferrant, Clermont Ferrand, France, [5]Hopital Edouard Heriot, Lyon, France

**INTRODUCTION.** ICU-acquired neuromyopathy (ICU-ANM) is a frequent complication in ICU patients and it prolongs mechanical ventilation and ICU legth of stay [1, 2].

**OBJECTIVES.** The end points of our study were to evaluate the prevalence and the risk factors of ICU-ANM during a 1 day survey in 66 ICUs of the South of France

**METHODS.** Each unit was audited at 1 day from January to April 2009 after the approval of the Ethics Committee. The patients present in the Unit were included in the study if they did not receive any sedative drugs and if their level of cooperation permitted the evaluation of the neuromuscular function (GCS 15). Patients with known neurological or muscular disease were excluded. ICU-ANM were explored by the Medical Research Council (MRC) clinical score. A MRC score < 48 signed the presence of ICU-ANM. The main risk factors of ICU-ANM were explored.

**RESULTS.** One hundred eighty-five of the 625 present patients were included. An ICU-ANM was observed in 46 patients (25%) (median 30 [14–40]). After univariate and multivariate analysis with logistic regression, the risk factors of ICU-ANM were corticosteroid therapy (Odds ratio 2.9 [1.3–6.1]), sedative drugs during the preceding stay in the ICU (OR 6.9 [2.3–20.3]). Characteristics of the patients at admission in the ICU (demography, SAPS II, diagnosis at admission) were not risk factors for ICU-ANM. The existence of a sedation algorithm or of a protocol of glycemic control was not protective factors.

**CONCLUSIONS.** The prevalence of ICU-ANM is high, involving one quarter of the studied patients. The incidence of ICU-ANM is probably higher, as we did not evaluate sedated patients and that some patients with MRC score > 48 could have been in the phase of recuperation of an ICU-ANM. The risk factors of ICU-ANM we found in our study were the administration of corticosteroids or of sedative drugs.

**REFERENCE(S).**

1. JAMA 2002;288:2859–957. 2. Crit Care Med 2005;33:349–54.

# Poster Sessions
# Respiratory mechanics and lung volume measurements: 0508–0521

## 0508

### A SIMPLE APPROACH FOR ESTIMATING INSPIRATORY ENDOTRACHEAL TUBE RESISTANCE: $K_2$ ROHRER'S CONSTANT MEASUREMENT VIA THE RAPID AIRWAY OCCLUSION METHOD

A. Flevari[1], I. Siempos[1], M. Theodorakopoulou[1], F. Frantzeskaki[1], S. Asoti[1], D. Koukios[1], C. Papageorgiou[1], G. Dimopoulos[1], A. Armaganidis[1]

[1]2nd Department of Critical Care Medicine, Attikon University Hospital, Athens, Greece

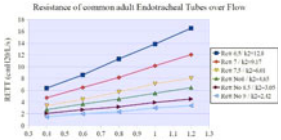
**INTRODUCTION.** Respiratory mechanics are monitored at the bedside and provide useful information about disease evolution and efficacy of therapeutic interventions. Ventilatory settings are adjusted in order to ameliorate patient—ventilator synchrony. In this interaction, the role of the Endotracheal Tube (ETT) Resistance ($R_{ETT}$) is often overlooked, since traditionally pressure is measured from the Y-piece of the ventilatory circuit. The issue of $R_{ETT}$ has been evaluated in the past years through several methods, among which the rapid end-inspiratory occlusion method was not included.

**OBJECTIVES.**

1. To measure inspiratory Resistance of different sized adult ETTs (Portex) via the above method, under variable in vitro conditions (artificial lung).
2. To calculate Rohrer's coefficient of nonlinear resistance, $k_2$, from the graph of inspiratory Resistance over Flow for each tube, so as to understand its behaviour, since previous studies have resulted in diverse results.

**METHODS.** Peak and plateau pressures were recorded at both proximal and distal sites of the ETT after applying inspiratory occlusion (for 3 s) under constant flow. Resistance was calculated from (Peak pressure—Plateau pressure)/inspiratory flow, at both sites. Distal pressure was obtained via an intraluminal catheter with 1.2 mm inner and 1.7 mm outer diameter. $R_{ETT}$ value resulted from the difference Rproximal—Rdistal. Line graph of $R_{ETT}$ over inspiratory Flow was plotted and Rohrer's constants were calculated by first fitting Flow to Resistance by the method of least squares. Two additional Resistances and five different compliances were tested.

**RESULTS.** For ETTs with inner diameter 9.0, 8.5, 8.0, 7.5, 7.0 and 6.5 mm, $k_2$ was 2.42, 3.05, 4.65, 6.01, 9.17 and 12.80 $cmH_2O/L/s$, respectively. $R_{ETT}$ value was independent of both externally applied resistance and Test Lung compliance.




Resistance of adult endotracheal tubes over flow.

**CONCLUSIONS.** The greater the ETT's inner diameter, the smaller the $k_2$ constant and the less dependent is $R_{ETT}$ on flow. Applying this technique in intubated patients may help the clinicians estimate the performing ETT size and perhaps improve Work of Breathing.

**REFERENCES.** 1. Claude G, Jean-Christophe R. Measurement of respiratory system resistance during mechanical ventilation. Int Care Med 2007; 33(6):1046–9. 2. Patrick W, John M, Gordon B. In vitro versus in vivo comparison of endotracheal tube airflow resistance. Am Rev Respir Dis 1989;140(1):10–6.

## 0509

### ACCURACY OF ESOPHAGEAL AND GASTRIC PRESSURE MEASUREMENTS WITH A POLYFUNCTIONAL NASO-GASTRIC TUBE

D. Chiumello[1], V. Berto[2], C. Mietto[1], E. Gallazzi[2], A. Marino[2], R. Russo[1], D. Tubiolo[1], L. Gattinoni[1]

[1]Fondazione IRCCS Ca' Granda, Ospedale Maggiore Policlinico, Anaesthesia and Intensive Care, Milan, Italy, [2]Università degli Studi di Milano, Milan, Italy

**INTRODUCTION.** Transpulmonary pressure ($P_L$), namely the difference between airway pressure (Paw) and pleural pressure ($P_{pl}$), plays a great role in the common ventilatory management because it allows to minimize pulmonary overdistension [1]. In clinical practice $P_{pl}$ is estimated by measuring the esophageal pressure (Pes). This is done by using an esophageal balloon catheter positioned in the inferior third of the esophagus. Intra-abdominal pressure (IAP) can be estimated with various techniques, such as bladder or gastric pressure (Pga). When intra-abdominal pressure becomes greater than 10-15 mmHg, it is defined as intra-abdominal hypertension (IAH) [2]. IAH can negatively influence several organic functions. In fact it can be the cause of a reduction in cardiac output, a worsening in gas exchange and a decrease in splancnic perfusion. At the present time, there is not a naso-gastric tube which allows to measure simultaneously the esophageal and gastric pressure and feed the patient.

**OBJECTIVES.** The aim of our study was to evaluate the accuracy of esophageal and gastric pressure measurements obtained with a polyfunctional naso-gastric tube (Sidam, Italy) compared to a standard naso-gastric tube (Viasys, USA).

**METHODS.** In critically ill patients which required enteral feeding, flows, Paw, Pes and Pga were measured using both the polyfunctional and the standard naso-gastric tubes in the same clinical condition. From the tracks analysis Respiratory System Elastance ($E_{RS}$ = deltaPaw/TV), Chest Wall Elastance ($E_W$ = deltaPes/TV) and Lung Elastance ($E_L = E_{RS} - E_W$) were obtained.

**RESULTS.** 14 sedated, intubated, mechanically ventilated patients with Acute Respiratory Failure (7 males) were enrolled. The mean clinical characteristics at the enrollment were: age 69.4 ± 15.2 years, BMI 25.2 ± 3.5 $kg/m^2$, $PaO_2/FiO_2$ 373.7 ± 129.0, PEEP 4.9 ± 2.3 $cmH_2O$.

We found a significant correlation between Pes and Pga values obtained with both devices ($r^2 = 0.882$, $p < 0.0001$ and $r^2 = 0.866$, $p < 0.0001$). The Bland–Altman analysis showed a bias of 0.007 with a CI 95% (+0.505; −0.491) and a bias of -0.168 with a CI 95% (+0.841; −1.117).

Furthermore $E_W$ and $E_L$ obtained from the polyfunctional naso-gastric tube resulted significantly correlated with those obtained using a standard tube ($r^2 = 0.945$, $p < 0.0001$ and $r^2 = 0.992$, $p < 0.0001$, respectively).

**CONCLUSIONS.** The polyfunctional naso-gastric tube shows a good accuracy in esophageal and gastric pressure measurements, and for this reason it should be considered a valid alternative tool to measure Pes and Pga in patients that also require enteral feeding.

**REFERENCE(S).** 1. Talmor D et al. New Engl J Med 2008.
2. Malbrain ML et al. Intensive Care Med 2004.

## 0510

### EFFECTS OF PLEURAL EFFUSION ON RESPIRATORY MECHANICS IN ALI/ARDS PATIENTS

D. Chiumello[1], V. Berto[2], C. Mietto[1], E. Gallazzi[2], A. Marino[2], M. Lazzerini[1], P. Biondetti[1], L. Gattinoni[1]

[1]Fondazione IRCCS Ca' Granda, Ospedale Maggiore Policlinico, Anaesthesia and Intensive Care, Milan, Italy, [2]Università degli Studi di Milano, Milan, Italy

**INTRODUCTION.** Pleural space is normally a virtual space that contains a small amount of lubricating fluid (10–20 mL) [1]. Pleura can be affected by various pulmonary or extrapulmonary diseases that lead to an excess in liquid formation or in a reduction in drainage and promote the development of pleural effusion, which can also affect the respiratory system. The computed tomography scan is the gold standard to quantify the amount of pleural effusion and lung collapse. Critically patients have commonly an alterated pulmonary (interstitial-alveolar) permeability, that increases pulmonary edema and decreases lung compliance and volume, causing a restrictive ventilatory defect [2].

**OBJECTIVES.** The aim of the study was to determine if pleural effusion in critically ill patients can significatively affect gas-exchange, respiratory mechanics and response to PEEP.

**METHODS.** 24 sedated, intubated, mechanically ventilated critically ill patients with a recent diagnosis of ALI/ARDS who underwent a CT-scan at 5 $cmH_2O$ of PEEP for clinical reasons were enrolled. A Tidal Volume (TV) of 8 mL/kg at two different PEEP levels (5 and 15 $cmH_2O$) was applied; flow, airway pressure (Paw) and esophageal pressure (Pes) were recorded for 10 min. Lung and pleural effusion were outlined separately with a dedicated software; lung total weight and pleural effusion volume were computed with a dedicated software. Patients were divided into two groups according to the median of the pleural effusion volume, higher or lower than the median value of 338.5 mL. Respiratory System Elastance ($E_{RS}$ = deltaPaw/TV), Chest Wall Elastance ($E_{CW}$ = deltaPes/TV) and Lung Elastance ($E_L$ = (deltaPaw − deltaPes)/TV) obtained from each group at different level of PEEP were compared, with a paired two-sample *t* test.

**RESULTS.** 24 patients (19 males) were enrolled. The mean clinical characteristics at the admission in intensive care were: age 58.9 ± 18.5 years, BMI 25.0 ± 2.5 $kg/m^2$, $PaO_2/FiO_2$ 198.1 ± 59.5 and PEEP 9.5 ± 1.9 $cmH_2O$. In Table 1 are summarized the data.

**CONCLUSIONS.** We don't observe any significant difference between $E_{RS}$, $E_{CW}$ and $E_L$ into two groups. The pleural effusion does not seem to impair the respiratory mechanics in patients with ALI/ARDS.

**TABLE 1** ANALYSIS RESULTS

| Elastance | PEEP | Lower volume group | Higher volume group | t | Degrees of freedom | p |
|---|---|---|---|---|---|---|
| $E_{RS}$ ($cmH_2O$/L) | 5 | 23.7 ± 6.0 | 22.8 ± 4.6 | 0.426 | 22 | 0.674 |
| | 15 | 24.4 ± 5.5 | 23.4 ± 6.1 | 0.403 | 22 | 0.691 |
| $E_{CW}$ ($cmH_2O$/L) | 5 | 5.2 ± 1.7 | 8.4 ± 5.0 | −2.099 | 22 | 0.048 |
| | 15 | 6.3 ± 2.7 | 7.9 ± 3.8 | −1.242 | 22 | 0.227 |
| $E_L$ ($cmH_2O$/L) | 5 | 18.5 ± 6.1 | 14.4 ± 4.8 | 1.857 | 22 | 0.077 |
| | 15 | 18.1 ± 4.2 | 15.5 ± 4.3 | 1.512 | 22 | 0.145 |

**REFERENCE(S).**1. Mitrouska I et al. Can Respir J. 2004.
2. Calandrino FS et al. Am Rev Respir Dis. 1988.

## 0511

### PERICARDIAL PRESSURE CORRELATES WITH DYNAMICAL INDICES IN MECHANICALLY VENTILATED PATIENTS

B. Lansdorp[1,2], J. Lemson[1], C. Hofhuizen[1], H.V. Swieten[3], J.V.D. Hoeven[1], P. Pickkers[1]

[1]Radboud University Nijmegen Medical Centre, Department of Intensive Care Medicine, Nijmegen, Netherlands, [2]University of Twente, Department of Technical Medicine, Enschede, Netherlands, [3]Radboud University Nijmegen Medical Centre, Department of Cardiothoracic Surgery, Nijmegen, Netherlands

**INTRODUCTION.** Fluid administration is a daily intervention on the intensive care unit. However fluid administration increases cardiac output only when the heart is on the steep part of the Frank Starling curve. Although dynamic indices are accurate predictors of volume responsiveness (VR), they are only applicable in patients during controlled mechanical ventilation with volumes > 8 ml/kg.

**OBJECTIVES.** To provide insight in the way the ventilatory pressures are being distributed within the thorax and to analyze their correlation with arterial pressure variations.

**METHODS.** We include patients scheduled for coronary artery bypass grafting. During surgery, small non-compliant balloon-catheters are positioned in the pleural- and pericardial-cavity for pressure measurements. Pressure monitoring includes intra-arterial pressure (IAP), central venous pressure (CVP), airway pressure (Paw), pericardial pressure (Ppc) and pleural pressure (Ppl). Recording was performed during controlled ventilation (PRVC) at tidal volumes (Tv) of 4, 6, 8 and 10 mL/kg. From the IAP-signal and ECG the following dynamic indices were calculated, pulse pressure variation (PPV), systolic pressure variation (SPV) and pre-ejection period variation (ΔPEP) were derived, stroke volume variation (SVV) was calculated from pulse contour analysis.

**RESULTS.** Until now, six patients were included, figure 1??? shows a data sample from patient #4. As a result of increasing Tv from 4 to 10 mL/kg mean ΔPaw (peak pressure—PEEP) varied from 11.7 to 19.0, ΔPpl from 3.6 to 9.0 and ΔPpc from 1.2 to 3.7$cmH_2O$. Dynamic indices changed from 2.8 to 8.5, 1.4 to 6.6, 3.7 to 7.1 and 1.2 to 5.5% for PPV, SPV, SVV and ΔPEP, respectively. Correlations were significant ($p < 0.001$) for both Ppl and Ppc with SPV and ΔPEP, although coefficients for Ppc were slightly better, see Fig. 2.

**CONCLUSIONS.** The change in pericardial pressure during controlled ventilation correlates best with the dynamical indices, in particular SPV and ΔPEP.

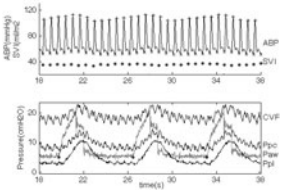



Fig. 1 Distribution of pressure in the thorax

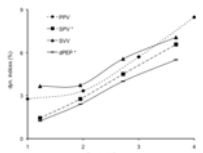


Fig. 2 Correlation between Ppl and Dyn. indices

## 0512

### RESPIRATORY MECHANICS IN ELDERLY ARDS PATIENTS

M. Katsiari[1], C. Dimitrakopoulou[2], M. Kyriakopoulou[2], A. Maguina[1], C. Sotiropoulou[2], N.G. Koulouris[3], A. Koutsoukou[2]

[1]Konstantopoulion General Hospital, Intensive Care Unit, Athens, Greece, [2]Evangelismos General Hospital, Department of Critical Care, Athens, Greece, [3]Sotiria Hospital for Chest Diseases, University of Athens, 1st Department of Respiratory Medicine, Athens, Greece

**INTRODUCTION.** Age-related declines in pulmonary function have been described in humans, with consequent alterations in respiratory system mechanical properties and gas exchange.

**OBJECTIVES.** To evaluate possible age-related changes in respiratory system mechanics of ARDS patients and consequent differences in selection of ventilatory settings.

**METHODS.** Prospective clinical study in two ICUs of Athens during a 2-year period. Fifty-eight consecutive patients meeting criteria of early ARDS were enrolled in this study and were stratified in two groups based on age (of the patients) with 65 year to delineate younger (Group A, n = 40) from older (Group B, n = 18) patients. Data compiled for each patient included anthropometric characteristics, ARDS origin, severity scores, ventilator settings, arterial blood gases, respiratory system mechanics, ICU length of stay (LOS) and outcome.

**RESULTS.** Severity of underlying illness measured by APACHE II score (corrected for age) did not differ among the two study populations (16.5 ± 5.7 vs. 17.8 ± 6.6, p = 0.536, in Group A and B, respectively). Also, severity of lung insult, as judged by LIS (2.74 ± 1.31 vs. 2.55 ± 0.68, p = 0.56) and multiorgan dysfunction, as measured by SOFA score (9 ± 3 vs. 10 ± 4, p = 0.4) were similar in the two groups. Although younger patients revealed a higher incidence of pulmonary ARDS, no significant difference among the study groups was identified (62.5 vs. 50%, p = 0.37). Concerning the ventilatory settings, no differences were identified, apart from inspiratory to total breathing cycle duration ratio (Ti/Ttot) which was higher in Group A (0.34 ± 0.065 vs. 0.30 ± 0.067, p = 0.03). Total PEEP was comparable among the two cohorts (9 ± 3 vs. 8 ± 3, p = 0.37). Elderly patients presented with lower $PaO_2$ (87.5 ± 27 vs. 75.4 ± 11.9 mmHg, p = 0.022), but this statistical difference disappears after calculating the $PaO_2/FiO_2$ ratio (134.16 ± 47.46 vs. 127 ± 40.2 mmHg, p = 0.58). Ventilation, as judged with $PaCO_2$, was similar in the two ARDS groups (42.55 ± 6.97 vs. 41.68 ± 8.74 mmHg, p = 0.95). Respiratory system mechanics were also comparable (static elastance of respiratory system $E_{st,rs}$: 39.4 ± 15.7 vs. 38.7 ± 15.7 $cmH_2O$/ml, p = 0.87, resistance of respiratory system $R_{max,rs}$: 8.23 ± 3.7 vs. 7.44 ± 3.1, p = 0.55). ICU LOS (10 ± 9 vs. 14 ± 8 days, p = 0.27) and mortality (35 vs. 61.1%, p = 0.063) did not differ significantly.

**CONCLUSIONS.** Elderly ARDS patients present with a predilection for extrapulmonary ARDS. No differences in ventilator settings were identified, apart from the longer expiratory time used in these patients. Elderly ARDS patients did not present with worse arterial blood gases or respiratory mechanics in comparison with younger ones. No impact on ICU LOS and mortality has been clearly documented in our study.

## 0513

### ECHO EVALUATION OF CHANGES IN BREATHING PATTERN INDUCED BY INSTRUMENTATION: NASAL VERSUS ORAL BREATHING

E. Soilemezi[1], M. Talias[2], E. Soteriades[3], P. Chatzaras[1], M. Tsagourias[1], D. Matamis[1]

[1]Papageorgiou General Hospital, Intensive Care Unit, Thessaloniki, Greece, [2]Open University of Cyprus, Healthcare Management Program, Nicosia, Cyprus, [3]Cyprus Institute of Biomedical Sciences, Department of Occupational and Enviromental Medicine, Nicosia, Cyprus

**INTRODUCTION.** Alterations in the breathing pattern secondary to the use of instruments, mouth piece (MP) and nose clip (NC), has already been reported with different levels of disagreement, concerning the degree of alteration and the methods employed. Furthermore, the underlying mechanisms of breathing pattern changes comparing nasal to mandatory oral breathing are poorly understood.

**OBJECTIVES.** The aim of our study was to explore the diaphragmatic contraction with the M-mode ECHO in both nasal and oral breathing.

**METHODS.** 40 healthy volunteers (20 male and 20 female) were studied in the semi-recumbent position with M-mode ECHO, after a 10 min period of quiet breathing and 10 min of adaptation, while breathing with a NC and a MP through a pneumotachograph. The diaphragmatic excursion (displacement), the speed of the diaphragmatic contraction (slope), the inspiratory time ($T_i$) and the expiratory time($T_e$) were studied with the M-mode ECHO in both situations. In the second situation (breathing with a NC through the MP of the pneumotachograph), we correlated the tidal volume ($V_t$) with the diaphragmatic displacement measured with ECHO.

**RESULTS.** Diaphragmatic displacement significantly increased when the individuals shifted from nasal to oral breathing (from 1.7 to 2.3 cm, $p < 0.001$), leading to higher tidal volume per breath, while the speed of the diaphragmatic contraction remained constant (from 1.26 to 1.22 cm/s). In parallel, respiratory rate decreased due to the increase in the total respiratory time ($T_{tot}$) from 4.4 to 5.23 s ($p < 0.001$). The increase in the $T_{tot}$ was due to an increase in the $T_i$ from 1.9 to 2.17 s, but mainly to the increase of $T_e$ from 2.5 to 3.0 s ($p < 0.001$). There was a statistical significant increase of 312 ml of $V_t$/cm of diaphragmatic displacement in males and 232 ml/cm in females, with no statistical difference between them (p = 0.44).

**CONCLUSIONS.** Instrumentation, nasal versus oral breathing, induces significant changes in the respiratory pattern even in non-obstructive breathing. The mechanism of these changes is poorly understood. However, they may have important implications on the experimental settings in patients breathing orally through an orotracheal tube.

**REFERENCE(S).**

Perez W, Tobin MJ.Separation of factors responsible for change in breathing pattern induced by instrumentation. J Appl Physiol. 1985;59:1515–20.

## 0514

### ULTRASOUND ASSESSMENT OF DIAPHRAGMATIC KINETICS IN HEALTHY VOLUNTEERS BREATHING WITH INCREASED RESISTIVE AND ELASTIC RESPIRATORY LOADS

E. Soilemezi[1], M. Talias[2], E. Soteriades[3], V. Makrakis[1], M. Tsagourias[1], D. Matamis[1]

[1]Papageorgiou General Hospital, Intensive Care Unit, Thessaloniki, Greece, [2]Open University of Cyprus, Healthcare Management Program, Nicosia, Cyprus, [3]Cyprus Institute of Biomedical Sciences, Department of Occupational and Enviromental Medicine, Nicosia, Cyprus

**INTRODUCTION.** The ultrasound assessment of diaphragmatic motion patterns during different respiratory conditions remain poorly documented.

**OBJECTIVES.** The aim of our study was to evaluate with echo the diaphragmatic motion under conditions of increased respiratory resistive and elastic loads in healthy volunteers.

**METHODS.** The kinetics of the diaphragm [diaphragmatic displacement ($D_d$, cm) and the speed (cm/s) of the diaphragmatic contraction] were studied using M-mode sonography of the right diaphragm. The breathing pattern of the respiratory system [$T_i$, $T_e$, $T_{tot}$, $V_t$, $V_E$, RR, $V_d/V_t$, RQ and Resting Energy Expenditure (REE)] were measured using an indirect calorimetry device in 40 (20 male and 20 female) healthy volunteers in semi recumbent position. The experiment was conducted first while the individuals were breathing quietly (phase I), then while breathing under a resistive load of 40 $cmH_2O$/lit/s (phase II) and finally while breathing under a 4 kg weight on their chest and a 3 kg weight on their abdomen, in order to reduce the chest wall compliance (phase III).

**RESULTS.** Using a multivariable-adjusted fixed effect linear regression model (adjusted for age, gender, BMI and respiratory rate) we found a statistically significant tidal volume increase by 422, 552 and 535 ml per each centimeter of diaphragmatic displacement in phases I, II, and III, respectively ($p < 0.01$). Male gender was associated with a 270 ml higher tidal volume compared to females. Resistive and elastic loads significantly decreased the $D_d$ from 2.3 to 2.15 and 2.19 cm, respectively ($p < 0.05$). The speed of $D_d$ remained constant with elastic loads, but decreased with resistive loads from 1.2 to 0.7 cm/s ($p < 0.05$). Minute ventilation ($V_E$) remained constant (10 l/min) during the three phases. However, with resistive loads RR decreased due to an increase in $T_{tot}$ from 5 to 6.2 s, while $V_t$ significantly increased. On the contrary, with the elastic loads used, no significant change in the respiratory pattern was observed. REE increased, compared to baseline, only with resistive loads, from 1524 kcal/day to 1772 kcal/day ($p < 0.001$).

**CONCLUSIONS.** Resistive loads represent a significant burden to the respiratory system compared to the elastic loads. To minimise this burden, the respiratory system decreases the speed of the diaphragmatic contraction and the RR, maintaining constant the $V_E$ through an increase in $V_t$.

## 0515

### CALCULATION OF FUNCTIONAL RESIDUAL CAPACITY BY ELECTRICAL IMPEDANCE TOMOGRAPHY

H. Heinze[1], J. Karsten[1], W. Eichler[2], B. Sedemund-Adib[1], M. Heringlake[1], T. Meier[1]

[1]Department of Anaesthesiology, University of Lübeck, Lübeck, Germany, [2]Department of Anaesthesiology and Intensive Care, Klinikum Neustadt, Neustadt, Germany

**INTRODUCTION.** If changes of functional residual capacity (FRC) could be estimated by end-expiratory lung impedance (EELI) provided by electrical impedance tomography (EIT) is under debate [1, 2].

**OBJECTIVES.** We studied the accuracy of FRC as measured with EIT ($FRC_{EIT}$) compared with direct measurements of FRC with the oxygen washout technique ($FRCO_2$) in ventilated postoperative cardiac surgery patients.

**METHODS.** Following approval of the local ethics committee, we studied 54 postoperative ventilated cardiac surgery patients after alveolar derecruitment, i.e. open endotracheal suctioning, and alveolar recruitment (RM). Patients were ventilated with biphasic positive airway pressure, positive end-expiratory pressure of 10 $cmH_2O$, and a tidal volume of 6–8 ml/kg. All patients received a standard suctioning procedure with disconnection of the ventilator (20 s, 14 F catheter, 200 mmHg negative pressure). The patients were randomized into two groups, receiving either a RM (PEEP 15 mbar, PIP 35-40 mbar for 30 s, group RM) or no RM, in which ventilation was resumed without a RM (group NRM). Measurements were conducted at the following time points: Baseline (T1), after suctioning (T2), after RM or NRM (T3), and 15 and 30 min after T3 (T4 and T5). We measured $FRCO_2$ using the oxygen washout technique (LUFU System, Dräger Medical AG, Lübeck, Germany) [3]. By means of EIT (EIT Evaluation kit, Dräger Medical AG, Lübeck, Germany) we measured global impedance tidal variation (TV) and end-expiratory lung impedance (EELI). $FRC_{EIT}$ was calculated in two ways: 1. at each time point using TV and simultaneous measured tidal volume ($V_T$): $FRC_{EIT\_Vt} = EELI \times V_T/TV$; and 2. using absolute FRC values at T1: $FRC_{EIT\_T1} = EELI_{Tx} \times FRCO_2(T1)/EELI(T1)$. $FRC_{EIT\_Vt}$ and $FRC_{EIT\_T1}$ were compared with $FRCO_2$ using Bland–Altman analysis.

**RESULTS.** FRC values calculated by $V_T$ and TV ($FRC_{EIT\_Vt}$) underestimate $FRCO_2$ by 1.8 L with limits of agreement of 1.6 to 2.4 L. When comparing FRC values calculated with $FRCO_2$ at T1 ($FRC_{EIT\_T1}$) with $FRCO_2$ bias was −0.1 to 0.7 L with limits of agreement ranging from 1.4 to 2.8 L. There were no differences between the two groups.

**CONCLUSIONS.** During routine bedside manoeuvre as endotracheal suctioning or alveolar recruitment FRC cannot be estimated by EIT measurement with reasonable accuracy.

**REFERENCE(S).** 1 Intensive Care Med. 2003;29:37–43.
2. Intensive Care Med. 2009;35:1362–7.
3. Anesth Analg. 2007;104:598–604.

## 0516

### LUNG REGIONAL STRESS/STRAIN RELATION IN MECHANICALLY VENTILATED PATIENTS

G. Perchiazzi[1], A. Stabile Ianora[2], S. Derosa[1], N. D'Onghia[1], M. Pellegrini[1], L. Pitagora[1], D. Polieri[1], G. Hedenstierna[3], R. Giuliani[1]

[1]University of Bari, Emergency and Organ Transplantation, Bari, Italy, [2]University of Bari, Radiology, Bari, Italy, [3]Uppsala University, Medical Sciences, Clinical Physiology, Uppsala, Sweden

**INTRODUCTION.** Transpulmonary pressure (Ptp) or stress, deforms lung parenchyma from its resting position, which is the Functional Residual Capacity (FRC). Ratio of lung volume change to FRC is named strain.

**OBJECTIVES.** Aim of the study was to evaluate the Stress versus Strain (S/S) relation of five lung Regions of Interests (ROI) in supine, mechanically ventilated patients by using computed tomography (CT).

**METHODS.** During sedation, ten intubated and ventilated patients without pulmonary pathologies, were transported to CT unit. We collected the tracings of flow, volume and pressure at airways opening together with esophageal pressure. During volume controlled mechanical ventilation we executed 8 end-inspiratory hold maneuvers (IHM) at different inflation volumes (from 4 to 11 ml/kg in steps of 1 ml/kg). Simultaneously with each IHM and at FRC, we performed CT scans at a level between heart and diaphragm. Each scan was divided 4 regions of interest (ROI) into nondependent, intermediate, dependent and sub-cardiac. By the gas content of the ROIs and of the entire slice, we calculated regional and global strains. Stress was estimated by Ptp. Exponential regression of the single S/S curves was performed, tested for statistical significance and compared by Fisher test.

**RESULTS.** Global and regional S/S curves are exponential and described by statistically different equations. At the same stress, dependent ROIs show a fourfold higher strain than nondependent regions.

**CONCLUSIONS.** Lung is inherently inhomogeneous. While titrating mechanical ventilation, it is necessary to be cautious in using parameters derived from global lung strain because it can be very different from the strain of single ROIs.

**GRANT ACKNOWLEDGMENT.** The Swedish Medical Research Council (5315); the Italian Ministry of University and Scientific Research.

## 0517

### EFFECTS OF FLUIDS QUANTITY ON RESPIRATORY MECHANICS

L. Farabegoli[1], E. Marangoni[2], V. Alvisi[2], M. Verri[2], S. Zardi[2], M.V. Colamussi[2], R. Alvisi[1], C.A. Volta[1]

[1]Università degli Studi di Ferrara, Ferrara, Italy, [2]Azienda Ospedaliera-Universitaria S. Anna Ferrara, Emergenza, Ferrara, Italy

**INTRODUCTION.** Anaesthesia induction determines a reduction of functional residual capacity (FRC) [1]. Furthermore, the surgical insult is associated with an increased extravascular lung water mainly because of the pro-inflammatory response induced by surgery itself and the administration of intra-operative fluids. The decrease of FRC associated with increased extra vascular water could be responsible of oedema of the small to medium airways, and hence of an increases of inspiratory and expiratory resistances up to the development of expiratory flow limitation (EFL) [2].

**OBJECTIVES.** The aim of this prospective randomized trial was to determine whether different quantitative strategies of fluids administration could have different effects on perioperative respiratory function, particularly on the development of EFL.

**METHODS.** Including criteria: adult patients undergoing elective major abdominal surgery. Exclusion criterion: the presence of EFL before surgery, evaluated through the NEP test both in seated and supine position [2]. On the day of surgery, patients were randomized in two groups on the basis of the volume replacement strategy: Group A: 12 ml/kg/h and Group B: 18 ml/kg/h. They were ventilated in volume controlled mode. An inspiratory pause of 20% allowed the calculation of the quasi-static compliance of respiratory system (Cqst, rs) whilst the determination of the peak inspiratory pressure and the pressure at the point of 0 flow ($V'$) allowed the calculation of the resistance of the respiratory system (Rmin, rs).The presence of EFL during general anaesthesia was assessed with PEEP test which consisted of the rapid subtraction of 3 $cmH_2O$ of PEEPe immediately before expiration (i.e. passing at the beginning of exhalation from a value of PEEP of 3 $cmH_2O$ to ZEEP). In patients with EFL, no difference of expiratory flow was detected between the breath at ZEEP and PEEPe, while in patients without EFL, a difference in expiratory flow ($\Delta V'$) was found. This difference of V' was quantified and calculated at mid-expiration.

**RESULTS.** We enrolled 22 patients, 11 in Group A and 11 in Group B. Cqst, rs ($47 \pm 3.3$ vs. $36 \pm 1.6$ l/$cmH_2$0), Rmin, rs, ($8 \pm 2.6$ vs. $10 \pm 4.8$ $cmH_2$0/l/s) the $PaO_2/FiO_2$ ratio (372 vs. 338) and $\Delta V'$ (0.09 vs. 0.07 l/s) were statistically worse in the group B. Moreover the presence of EFL was detected only in four patients of the group B.

**CONCLUSIONS.** The main result of our study is that differences in terms of quantity volume replacement strategy seem to influence both changes in of the respiratory system compliance and reduction in expiratory flows up to the development of expiratory flow limitation.

**REFERENCE(S).** 1. Wahba RWM. Perioperative functional residual capacity. Can J Anaesth 1991;83(3):384–400.
2. EltayaraL, Becklake MR, Volta CA, Milic Emili J. Relationship between chronic dyspnea and expiratory flow limitation in COPD patients. AJRCCM 1996;154:1726–34.

## 0518

### OPTIMUM PEEP GUIDED BY EIT IN THE DEPENDENT PART IS HIGHER WHEREAS IS LOWER IN THE NON-DEPENDENT PART COMPARED TO OPTIMUM PEEP GUIDED BY TRANSPULMONARY PRESSURE IN A PORCINE ACUTE LUNG INJURY MODEL

D. Gommers[1], I.G. Bikker[1], J. Bakker[1]

[1]Erasmus Medical Center, Intensive Care, Rotterdam, Netherlands

**INTRODUCTION.** Setting the optimal level of positive end expiratory pressure (PEEP) in the intensive care unit (ICU) is still a matter of debate. Talmor et al. (N Engl J Med 2008, 359:2095) used the transpulmonary pressure, calculated from the oesophageal balloon to set the PEEP in a recent randomized controlled study. This strategy aims at preventing alveolar collapse by counterbalancing the gravitational force of the lung by an equal or higher PEEP. The purpose of this study was to use electrical impedance tomography and evaluate the relation between ventilation distribution and transpulmonary pressure during a PEEP trial in porcine acute lung injury.

**METHODS.** Eight Yorkshire/Landrace pigs (28–31 kg) were studied during an incremental and decremental PEEP trial before and after the induction of acute lung injury (ALI) with oleic acid injected in the right atrium. Global lung parameters, regional compliance, and oesophageal pressure were recorded at the end of each PEEP step. Regional compliance was calculated by dividing the tidal impedance variation (EIT evaluation kit 2, Dräger, Lübeck, Germany) by the applied driving pressure.

**RESULTS.** During an expiration hold, transpulmonary pressures were negative at 0 $cmH_2O$ PEEP and became positive during the stepwise increase of PEEP at 5 $cmH_2O$ before, and 10 $cmH_2O$ PEEP after the induction of ALI. Optimum regional compliance was different between the ventral (non-dependent) and dorsal (dependent) regions of interest. In the healthy lung, optimum PEEP was 10 in the dorsal and 5 in the ventral lungs, whereas after ALI optimum PEEP was 15 in the dorsal ROI and 5 in the ventral ROI.

**CONCLUSION.** Optimum PEEP guided by EIT is different for dependent and non-dependent lung regions in experimental ALI.

## 0519

### ELECTRICAL IMPEDANCE TOMOGRAPHY AT TWO THORACIC LEVELS PROVIDES DETAILED INFORMATION ABOUT LOSS OF VENTILATION DURING A DECREMENTAL PEEP TRIAL IN MECHANICALLY VENTILATED PATIENTS

D. Gommers[1], I.G. Bikker[1], J. Bakker[1]

[1]Erasmus Medical Center, Intensive Care, Rotterdam, Netherlands

**INTRODUCTION.** As it becomes clear that mechanical ventilation can exaggerate lung injury, individual titration of ventilator settings is of special interest. Electrical impedance tomography (EIT) has been proposed as a bedside, regional monitoring tool to guide the ventilator. In the present study we evaluate the use EIT on ventilation distribution at a caudal and cranial lung level during a PEEP trial in mechanically ventilated patients.

**METHODS.** EIT (EIT evaluation kit 2, Dräger, Lübeck, Germany) was measured at cranial (just under the armpits, at the 3rd or 4th intercostal space) and caudal lung levels (just below the nipples at the 6th or 7th intercostal space) in 12 patients after cardio-thoracic surgery. Patients were fully sedated and mechanically ventilated and a PEEP trial was performed at 4 PEEP levels (15, 10, 5 and 0 $cmH_2O$).

**RESULTS.** The center of gravity index decreased after lowering the PEEP level at both the caudal and cranial lung levels. Whereas the tidal volume impedance variation divided by tidal volume increased at the cranial lung level and decreased at the caudal lung level during the decremental PEEP trial.

**CONCLUSION.** Ventilation distribution shifts from dorsal to ventral direction, and from caudal to cranial during a decremental PEEP trial in mechanically ventilated patients due to lung collapse.

## 0520

### TITRATION OF POSITIVE END-EXPIRATORY PRESSURE BASED ON A VOLUME-INDEPENDENT ELASTANCE

B.C. Bergamini[1], V.R. Cagido[2], N.S. Carvalho[1], A.C. Jardim-Neto[1], G. Casulari[1], F.C. Jandre[1], A. Giannella-Neto[1], W.A. Zin[2], A.R. Carvalho[2]

[1]Federal University of Rio de Janeiro, Biomedical Engineering Program/COPPE, Rio de Janeiro, Brazil, [2]Federal University of Rio de Janeiro, Carlos Chagas Filho Institute of Biophysics, Rio de Janeiro, Brazil

**INTRODUCTION.** Theoretically, the positive end-expiratory pressure (PEEP) that minimizes the elastance of the respiratory system (Ers) is equivalent to the mathematical inflection point (MIP) of the pressure–volume (PV) curve. However, Ers is highly dependent on the tidal volume ($V_T$) adjusted during PEEP titration.

**OBJECTIVES.** We aimed to propose a method to set the PEEP close to the MIP during PEEP titration using a volume-independent elastance ($E_1$) component.

**METHODS.** Initially, numerical simulations of PEEP titrations were performed using eight PV curves of patients with Acute Lung Injury (ALI). For each simulation, two models were used for the identification of the respiratory system mechanical properties: (1) the linear single compartment model (LSCM, $Paw = Rrs \cdot F + Ers \cdot V + PEEP$, where Rrs is the resistance of the respiratory system) and (2) the volume-dependent single compartment model (VDSCM, $Paw = Rrs \cdot F + [E_1 + E_2V] \cdot V + PEEP$, where $E_2$ is the volume-dependent elastance). From each model, the PEEP of minimal Ers ($PEEP_{minErs}$) and of minimal $E_1$ ($PEEP_{minE1}$) were identified and compared to each respective MIP. Disturbances in estimated $E_1$ and Ers caused by changes in $V_T$ and by endotracheal tube (ETT) mechanical properties were evaluated. Additionally, PV curves and identical PEEP titrations were performed (with a $V_T$ of 6 and 12 ml/kg) in 16 male Wistar rats (250–320 g) with ALI induced by *Escherichia coli* lipopolysaccharide injected intraperitoneally ($LPS_{ip}$, n = 8) and instilled intratracheally ($LPS_{it}$, n = 8). Data are presented as median and range values and variables were compared with the Kruskal–Wallis one-way ANOVA. Multiple comparisons were adjusted by the Bonferroni method considering a $P < 0.05$.

**RESULTS.** In both simulated and experimental PEEP titration results were comparable even with different pulmonary primary insults. The $PEEP_{minErs}$ was always significantly lower than the MIP (3 $cmH_2O$ [2–6] vs. 7 $cmH_2O$ [6–9], respectively; $P = 0.0004$). The $PEEP_{minE1}$ was always similar to the MIP (7 $cmH_2O$ [5–8] vs. 7 $cmH_2O$ [6–9] at low $V_T$ and 7 $cmH_2O$ [7–8] vs. 7 $cmH_2O$ [6–8] at high $V_T$), and was always significantly higher than the $PEEP_{minErs}$ (8 $cmH_2O$ [7–8] vs. 3 $cmH_2O$ [1–4]). The addition of ETT mechanical properties in both simulated and experimental PEEP titration had no effects on the estimation of the $PEEP_{minE1}$.

**CONCLUSIONS.** The volume-independent elastance seems to be a robust parameter to determine the PEEP close to the MIP independently of the adjusted $V_T$ and may be a practical, more feasible approach for PEEP titration.

**GRANT ACKNOWLEDGMENT.** FAPERJ, CNPq, MCT, CAPES.

## 0521

### COMPARISON OF TWO STRATEGIES TO SET POSITIVE END-EXPIRATORY PRESSURE DURING A DECREMENTAL TRIAL

B.C. Bergamini[1], D. Medeiros[2], F. Bozza[2], A. Giannella-Neto[1], A.R. Carvalho[3]

[1]Federal University of Rio de Janeiro, Biomedical Engineering Program, Rio de Janeiro, Brazil, [2]Oswaldo Cruz Foundation, Evandro Chagas Clinical Research Institute, Rio de Janeiro, Brazil, [3]Federal University of Rio de Janeiro, Carlos Chagas Filho Institute of Biophysics, Rio de Janeiro, Brazil

**INTRODUCTION.** The use of a low tidal volume ($V_T$) seems to influence mortality in patients with acute lung Injury/acute respiratory distress syndrome patients (ALI/ARDS). However, the optimal positive end-expiratory pressure is still uncertain.

**OBJECTIVES.** This study aims to compare two criteria for positive end-expiratory pressure (PEEP) adjustment in patients with ALI/ARDS in a decremental PEEP trial.

**METHODS.** The Institutional Review Board of the participating institution approved the study protocol. Six patients fulfilled ALI/ARDS criteria (2 with ALI and 4 with ARDS) and were included in the protocol. A recruitment maneuver (RM) was performed in Pressure Controlled Ventilation mode (PCV), driving pressure of 15 $cmH_2O$; inspiratory time of 3 s; respiratory rate (RR) of 10 bpm; $FIO_2$ of 1.0 and PEEP sequentially set at 25 (30 s), 30 (30 s) and 35 $cmH_2O$ (120 s time duration). Thereafter, in Volume Controlled mode with $V_T$ ranging 4-6 ml/kg, RR was adjusted to keep pH above 7.2, and PEEP was reduced from 25 to 9 $cmH_2O$, in steps of 2 $cmH_2O$ with 3 min per step. At the end of each step, arterial blood was collected for gas analysis. The airway pressure (Paw) and flow (F) were continuously acquired and recorded (sampling frequency of 200 Hz). The volume (V) was calculated by the numerical integration of flow. Two models were used for the identification of the respiratory system mechanical properties: (1) the linear single-compartment model ($Paw = Rrs \cdot F + Ers \cdot V + PEEP$, where Rrs is the resistance of the respiratory system) and (2) the volume-dependent single compartment model ($Paw = Rrs \cdot F + [E_1 + E_2V] \cdot V + PEEP$, where $E_1$ and $E_2$ are the volume- independent and dependent elastance, respectively). From each model, the PEEP of minimal Ers (PEEPminErs) and of minimal $E_1$ (PEEPminE1) were identified and compared to the PEEP of maximal arterial partial pressure of oxygen ($PEEPmaxPaO_2$). Additionally, the $\%E_2$ ($\%E_2 = 100\ [E_2V_T/(E_1 + E_2V_T)]$) was calculated in order to evaluate the presence of cyclical recruitment/derecruitment ($\%E_2 < 0$) as well as overdistension ($\%E_2 > 10\%$) induced by PEEP. Data are presented as median and range values and variables were compared with the Kruskal–Wallis one-way ANOVA. Multiple comparisons were adjusted by the Bonferroni method considering a $P < 0.05$.

**RESULTS.** In five of the six patients, the PEEPminErs was lower than the $PEEPmaxPO_2$ and the $PEEPminE_1$ (17 $cmH_2O$ [9–17] vs. 21 $cmH_2O$ [13–23] and 17 [13–23], respectively, however, no significant differences were observed (P = 0.095). Evidences of tidal overdistension ($\%E_2 > 20\%$) were observed in four of the six patients even at PEEP levels at the PEEPminErs. In two patients, evidences of tidal recruitment/derecruitment ($\%E_2 < 0$) were observed at all levels of PEEP.

**CONCLUSIONS.** The $PEEPmaxPaO_2$ tended to be higher than the PEEPminErs and the $PEEPminE_1$. Evidences of cyclical alveolar overdistension seemed to be present even at the level of the PEEP of minimal elastance.

**GRANT ACKNOWLEDGMENT.** FAPERJ, CNPq, CAPES.

# Glycaemic control 2: 0522–0535

## 0522

### BLOOD GLUCOSE VARIABILITY IN THE FIRST FORTY-EIGHT HOURS: DOES IT ALTER OUTCOME?

T. Clark[1], S. Griffiths[1], J. Paddle[2]

[1]Treliske Hospital, Royal Cornwall Hospital Trust, Department of Anaesthesia, Truro, UK, [2]Treliske Hospital, Royal Cornwall Hospital Trust, Department of Intensive Care, Truro, UK

**INTRODUCTION.** Evidence suggests that blood glucose (BG) variability, rather than absolute values, may be a predictor of intensive care unit (ICU) and in-hospital mortality [1, 2].

**OBJECTIVES.** To investigate whether BG variability within the first 48 h of admission (when patients may be at their most unstable) acts as a predictor of outcome in the ICU of a large district general hospital.

**METHODS.** We conducted a retrospective observational study in our ICU at the Royal Cornwall Hospital. We collected the first 10 BG values (correlating to the first 48 h) for all adult patients admitted between September 2008 and March 2009. The modified Bath protocol [3] was used for glycaemic control. We calculated the median BG value and the inter-quartile (IQ) range (as a measure of variability) for each patient. Spearman's correlation co-efficient was calculated to compare IQ range to secondary outcomes. The patient group was then split into 'high variability' and 'low variability' cohorts, and the ICU mortality of each cohort compared.

**RESULTS.** We identified 130 patients. 63% of patients were male, and the median age was 64. The Spearman's correlation coefficients when comparing IQ range with a secondary outcome were as follows: APACHE II 0.176, APACHE II risk of death 0.152, Length of stay (h) −0.113, Maximum number of organs supported 0.014, Respiratory support days −0.104, Cardiovascular support days −0.019, Renal support days 0.163 and Neurological support days 0.122. ICU mortality for this cohort was 18.5% (n = 24/130). There was no statistical difference in ICU mortality between the 'high variability' (IQ $\geq$ 2.56) and 'low variability' (IQ $\leq$ 0.7125) groups (18.2%, n = 6/33 for each, Fisher's exact $p$ test = 1.0). There was also no statistical difference between the mortalities of the 'high variability' group and the entire group (Fisher's exact $p = 1.0$).

**CONCLUSIONS.** In this retrospective observational study, we were unable to demonstrate that BG variability within the first 48 h of admission is predictive of outcome. There was a weak positive correlation between BG variability and APACHE II scores, APACHE II risk of death and both renal and neurological support days. There was no effect upon mortality. This may be explained by insufficient sample size and the use of robust non-parametric analysis, both of which may have under-powered this study. These findings are in contrast to recent evidence [1, 2].

**REFERENCE(S).** 1. Egi M, Bellomo R, Reade MC. Is reducing variability of blood glucose the real but hidden target of intensive therapy? Crit Care 2009;13(2):302.
2. Hermanides J et al. Glucose variability is associated with intensive care unit mortality. Crit Care Med 2010;38(3):838–42.
3. Laver S et al. Implementing intensive insulin therapy: development and audit of the bath insulin protocol. Anaesth Intensive Care. 2004;32:311–6.

## 0523

### AN AUDIT OF INTENSIVE AND CONVENTIONAL GLYCAEMIC CONTROL ON THE INTENSIVE CARE UNIT; ASSESSING THE EFFECTIVENESS AND SAFETY OF TWO PROTOCOLS

T.L. Duff[1], K. Bailey[1], S. Chandrasekaran[1]

[1]Stepping Hill Hospital, Anaesthetics and Intensive Care, Stockport, UK

**INTRODUCTION.** Following the Van den Berghe study in 2001 [1] there was a move to tight glucose control in critically ill patients with anticipation of a reduction in mortality. Many centres were unable to replicate the results leading to the international, multi-centre randomized control trial, NICE-SUGAR, comparing intensive versus conventional glucose control in critically ill patients [2]. This showed a statistically significant increase in mortality in patients managed with intensive glucose control. A meta-anlysis has shown an increased risk of hypoglycaemia with intensive insulin control and no overall mortality benefit [3]. Consequently many have returned to more conventional glucose control. Evidence supports standardisation of intravenous insulin therapy to improve efficiency and safety of blood glucose control in critically ill patients [4].

**OBJECTIVES.** To establish wether the re-introduction of conventional glucose control is safer and how well we adhere to protocols in our ICU.

**METHODS.** We performed two audits of blood glucose control during intensive insulin therapy [target glucose (TG) 4.4–6.5 mmol/l] and again after the introduction of a conventional glucose control regimen (TG 6–10 mmol/l). We compared the incidence of hypoglycaemic episodes, the number of episodes blood sugar was outside the target range and the number of protocol violations that occurred.

**RESULTS.** The percentage of blood glucose readings within the TG range for both intensive and conventional glucose control were 25.7 and 75.9%, respectively. There was a reduction in hypoglycaemic episodes (< 4.4 mmol/l) with conventional glucose control from 5.4 to 1.7% and no incidences of severe hypoglycaemia with the conventional regimen. There was a reduction in the incidence of hyperglycaemia, (> 10 mmol/l) from 16.6 to 9.2%. Both audits show that despite standard protocols there were a high number of violations/errors 60.2 and 54.5%.

**CONCLUSIONS.** The audit supports the evidence that a more liberal approach to glycaemic control on the ICU reduces the incidence of severe and mild hypoglycaemia and as a consequence may confer a mortality benefit. However protocol compliance was very poor and the high incidence of hyperglycaemia and its detrimental effects can not be overlooked in the critical care environment. The education of healthcare staff is a vitally important issue.

**REFERENCE(S).** 1. Van den Berghe G et al. Intensive insulin therapy in critically ill patients. N Engl J Med 2001;345:1359–67.
2. NICE-SUGAR Study Investigators. Intensive versus conventional glucose control in critically ill patients. N Engl J Med 2009;360:1283–97.
3. Donald EG et al. Intensive insulin therapy and mortality among critically ill patients: a meta-analysis including NICE-SUGAR study data. CMAJ 2009;180:821–7.
4. Kanji S. Standardization of intravenous insulin therapy improves efficiency and safety of blood glucose control in critically ill patients. ICM 2004;30:804–10.

## 0524

### ACCURACY ASSESSMENT OF REAL-TIME CONTINUOUS GLUCOSE MONITORS IN CRITICALLY ILL PATIENTS: PRELIMINARY RESULTS

C. Lorencio[1], Y.T. Leal[2], A. Bonet[1], J. Vehí[2], J. Bondia[3], A. Taché[1], J.M. Sirvent[1]

[1]Hospital Universitario Dr Josep Trueta de Girona, Intensive Care Medicine, Girona, Spain, [2]Institute of Informatics and Applications, University of Girona, Girona, Spain, [3]Instituto Universitario de Automática e Informática Industrial, Universidad Politécnica de Valencia, Valencia, Spain

**INTRODUCTION.** Hyperglycaemia is a common phenomenon in critically ill patients. Many studies have demonstrated improved prognosis in patients with better glycemic control. Continuous monitoring of glucose levels may improve glycemic control of these patients. There are no previous studies that assess the accuracy of continuous glucose monitors (CGMs) data in real-time (RT) in medical and surgical critically ill patients.

**OBJECTIVES.** To assess the accuracy of CGMs data in medical and surgical critically ill patients.

**METHODS.** Thirty-three patients were included (21 surgical/12 medical), mean age 66 ± 10 years (21 male), 18 of them were previously known diabetics (mean Hb1Ac 7.3 ± 4%), mean Body Mass Index 32 ± 7, mean APACHE II 18.5 ± 5.2, mean SOFA 8.4 ± 3.3. Patients were monitored for 72 h using the Guardian RT® (RT-CGM) (Medtronic). For these patients, arterial whole blood glucose samples were obtained and glucose concentration (BG) measured using HemoCue 201DM®, following the standard glycemic control protocol established by the Intensive Care Unit (4–24 BG determinations per patient/day were obtained, depending on the patient's glycemic control). Insulin therapy was administered according to the same protocol, using the BG values. Results were evaluated using paired values (BG/RT-CGM). Assessment tools include mean and median absolute relative difference (RAD; RAD = [(BG – RT-CGM)/BG]*100) and ISO criteria [1], defined as CGM values within ± 15 mg/dL for BG values < 75 mg/dL, and CGM values within ± 20% for BG values > 75 mg/dL.

**RESULTS.** A total of 729 paired BG/RT-CGM data points were analyzed. Results Table shows the overall assessment and the results for the two types of ICU patients, medical and surgical, studied.

RESULTS TABLE

| Patients ICU | Total reference readings | Mean RAD (SD) (%) | Median RAD (IQR) (%) | ISO Criteria (%) |
|---|---|---|---|---|
| Overall | 729 | 15.9 (13.8) | 12.8 (16.6) | 71.2 |
| Medical | 311 | 16.0 (12.8) | 13.4 (15.7) | 70.7 |
| Surgical | 418 | 15.9 (14.5) | 12.0 (17.0) | 71.5 |

**CONCLUSIONS.** They have not been observed significant differences in accuracy of CGM between medical and surgical patients. The mean and median RAD obtained in our study were similar to values reported in others studies [2]; these results suggest that RT-CGMs can be of clinical use in the ICU, however a larger number of paired data must be assessed.

**REFERENCE(S).** 1. Wentholt IM et al. How to asses and compare the accuracy of continuous glucose monitors? Diabetes Technol Ther. 2008;10:57–68.
2. Mastrototaro J et al. The accuracy and efficacy of real-time continuous glucose monitoring sensor in patients with type 1 diabetes. Diabetes Technol Ther. 2008;10:385–90.

**GRANT ACKNOWLEDGMENT.** This work is supported by the Spanish Ministry of Science and Innovation through grant DPI-2007-66728, the European Union through FEDER funds and the Autonomous Government of Catalonia through 2009 SGR 523.

## 0525

### HOW SWEET CAN WE GET? A CASE REPORT OF EXTREME HYPERGLYCEMIA

P. Remeta[1], I. Zykova[2], R. Pistorova[2], D. Morman[1]

[1]Regional Hospital Liberec, Department of Anesthesiology and Intensive Care Medicine, Liberec, Czech Republic, [2]Regional Hospital Liberec, Medical ICU, Liberec, Czech Republic

**INTRODUCTION.** Hyperosmolar hyperglycemic state (HHS) is one of the most serious acute complications of diabetes mellitus (DM). The prevalence of HHS is smaller than diabetic ketoacidosis (DKA), mostly it affects elderly people and it might be the first manifestation of undiagnosed DM. Unlike DKA (mortality rate < 5%), mortality rate in HHS is reported higher (5–20%), mostly due to comorbidities [2]. The treatment of HHS can cause cerebral oedema, slow correction of metabolic disturbance is crucial to avoid a possibly fatal complication. The highest so far reported plasma glucose level in a diabetic patient is 106 mmol/l (1,909 mg/dl) in a diabetic patient with HHS [3]. The absolutely highest reported plasma glucose level is 311.3 mmol/l (5,600 mg/dl), it was published in 1990—a case of a young man presenting after drinking 12 l of coca cola, six cans of pineapple juice, several liters of orange juice and sugared water in a hot weather [1].

**METHODS.** Case report. We report a 53 years old female brought to emergency department with an acute transient loss of consciousness and dysarthria. After detecting plasma glucose level of 146.6 mmol/l (2641 mg/dl), measured osmolarity of 406 mOsm/l and pH of 7.21 the patient was admitted to ICU. This HHS was the first manifestation of type II DM. Later detected personal history revealed a week lasting weakness and polypsia without polyuria before admission. Careful correction of glycemia was started. The following course was uneventful and uncomplicated, the patient was discharged home after 2 weeks. The compensation of diabetes was satisfactory by use of combination of peroral and intensified insulin regimen.

**CONCLUSIONS.** We report a case of glycemia of 146.6 mmol/l in a diabetic. Through the search of literature and MEDLINE we have found the highest glycemia of 106 mmol/l. Our case report after a search of literature and MEDLINE appears to be the highest glycemia so far reported in a diabetic.

**REFERENCE(S).** 1. Soni A, Rao SV, Bajaj R, Treser G. Extreme hyperglycemia and hyperosmolarity. Diabetes Care. 1990;13(2):181–2.
2. Kitabchi AE, Umpierrez GE, Miles JM, Fisher JN. Hyperglycemic crises in adult patients with diabetes. Diabetes Care. 2009;32:1335–43.
3. O'Malley G, Moran C, Draman MS, King T, Smith D, Thompson CJ, Agha A. Central pontine myelinolysis complicating treatment of the hyperglycaemic hyperosmolar state. Ann Clin Biochem. 2008;45(Pt 4):440–3.

## 0526

### INTENSIVE INSULIN THERAPY AND BLOOD GLUCOSE CONTROL: RESULTS OF A UK NATIONAL SURVEY OF INTENSIVE CARE UNITS

K. Sharpe[1], J. Paddle[1]

[1]Royal Cornwall Hospital, Truro, UK

**INTRODUCTION.** In 2001 Van den Berghe et al. published a landmark paper [1] showing a reduction in mortality and complications in critically-ill patients receiving an intensive insulin therapy (IIT) regimen to maintain tight glycaemic control. This led to widespread change in practice across many intensive care units (ICUs). The publication of the NICE-SUGAR trial in 2009 challenged the earlier research, suggesting IIT may increase mortality.

**OBJECTIVES.** We sought to assess the national response to new evidence by change in clinical practice in ICUs in the UK.

**METHODS.** We contacted all UK adult ICUs in the Directory of Critical Care (2007) by telephone between October 2007 and February 2008 [3], then conducted a follow-up survey between March and April 2010. The nurse in charge of the unit was surveyed using a predefined questionnaire. The questions assessed current practice with regards to IIT for Intensive Care patients. Unpaired t tests were used for statistical analysis.

**RESULTS.** Of 243 units that had a written policy for IIT in 2007/8, 232 (96%) still had a written policy in 2010. 106 (46%) units had updated their policy in response to new evidence, whilst 126 (54%) units stated that it had remained the same. Of 207 units that quoted both upper and lower target limits in 2010 (214 in 2007/8), the mean (median) lower limit for target blood sugar was 4.52 (4) mmol $l^{-1}$ in 2010, increased from 4.33 (4) in 2007/8 ($p = 0.016$). Upper limit increased from 7.00 (7) in 2007/8 to 7.91 (8) in 2010 ($p < 0.0001$). Target range increased from 2.66 (2.2) in 2007/8 to 3.38 (3) in 2010 ($p < 0.0001$).

UPPER LIMIT OF BLOOD GLUCOSE TARGET RANGE

| Upper limit (mmol $l^{-1}$) | Number (%) of ICUs in 2007/8 | Number (%) of ICUs in 2010 |
|---|---|---|
| ≤6.1 | 75 (31) | 34 (15) |
| 6.2–7.0 | 79 (33) | 50 (22) |
| 7.1–8.3 | 66 (27) | 74 (32) |
| >8.3 | 9 (3.7) | 66 (28) |
| No reported limit | 14 (5.7) | 8 (3.4) |

LOWER LIMIT OF BLOOD GLUCOSE TARGET RANGE

| Lower limit (mmol $l^{-1}$) | Number (%) of ICUs in 2007/8 | Number (%) of ICUs in 2010 |
|---|---|---|
| ≥4.4 | 96 (40) | 98 (42) |
| 4.0–4.3 | 106 (44) | 92 (40) |
| <4.0 | 13 (5.3) | 17 (7.3) |
| No reported limit | 28 (12) | 25 (11) |

**CONCLUSIONS.** The results of the UK National survey show a varied change in clinical practice in response to research. Over 50% of UK ICUs have not changed their policy since 2007 and 15% of units state their policy is still to maintain blood glucose levels below 6.1 mmol $l^{-1}$. Very few have abandoned a policy for IIT. However, overall there has been a significant relaxation of target ranges and higher target limits for blood glucose, suggesting that whilst there is continued confidence in the merits of IIT, practice is changing in response to recent research.

**REFERENCE(S).** 1. Van Den Berghe G, Wouters P et al. N Engl J Med. 2001;345:1417–8.
2. The NICE-SUGAR study investigators. N Engl J Med 2009;360:1283–97.
3. Paddle JJ, Prior K, Padkin A. Intensive Care Med. 2008;34:S222.

## 0527

### PERIOPERATIVE GLUCOSE CONTROL IN CARDIAC SURGICAL PATIENTS-DO WE HAVE AN ANSWER FOR THE OPTIMAL LEVEL?

J. Rahman[1], S. Stacey[2], M. Catolico[2], F.A. Mir[1]

[1]Royal London Hospital, London, UK, [2]London Chest Hospital, London, UK

**INTRODUCTION.** The prevalence of diabetes mellitus in patients requiring cardiac surgery is rapidly increasing. These patients have higher perioperative morbidity and mortality, significantly reduced long-term survival, and less freedom from recurrent episodes of angina. The postoperative care is complicated by the glucose control regimes maintaining optimal levels of blood glucose and avoiding the harmful effects of hypoglycaemia. Trials examining the effects of tighter glucose control have had conflicting results. Systematic reviews and meta-analyses have also led to differing conclusions and there is currently no clearly defined optimal blood glucose level peri operatively.

**OBJECTIVES.** Our survey aimed to assess whether the blood glucose level at which sliding scale insulin was started had any relation to increased episodes of hypoglycaemia in cardiac surgical patients.

**METHODS.** We conducted prospective survey on patients having cardiac surgery, operated during a period of 2 months. A total of 59 patients were operated on and included 58 on pump and 1 off pump surgeries. Out of these 11(18.64%) were known diabetics.

**RESULTS.** None of the patients who were put on the sliding scale with the blood glucose level greater than 8 mmol/l as per protocol in our hospital, developed hypoglycaemia.

**CONCLUSION.** The results of our survey suggested that the optimal blood glucose level for starting sliding scale insulin is between 8 and 10 mmol/l as opposed to the previously used level of 4-6 mmol/l in our unit.Our previous survey conducted a year ago, using 4–6 mmol/l as the optimal range for blood glucose level showed a higher incidence of hypoglycaemic episodes during the peri operative period.

**REFERENCES.** 1. Furnary AP, Gao G, Grunkemeier GL et al. Continuous insulin infusion reduces mortality in patients with diabetes undergoing coronary artery bypass grafting J Thorac Cardiovasc Surg, 2003;125:1007–21.
2. Van den Berghe G, Wouters P, Weekers F et al. Intensive insulin therapy in the critically ill patients. N Engl J Med. 2001;345:1359–67.
3. Butterworth J, Wagenknecht LE, Legault C et al. Attempted control of hyperglycemia during cardiopulmonary bypass fails to improve neurologic or neurobehavioral outcomes in patients.

## 0528

### CURRENT METHODS FOR BLOOD GLUCOSE MANAGEMENT ARE INSUFFICIENT

N.D.A. Scawn[1], T. Ridgway[1], E. Damm[1], V. Seppi[1]

[1]The Liverpool Heart and Chest Hospital, Liverpool, UK

**INTRODUCTION.** A Market Preference Evaluation (MPE) was performed on the Edwards Glucose Monitoring System with a GlucoClear sensor. The System provides automatic, real-time monitoring and trending of blood glucose (BG) values for critically ill adults. The MPE data provided insight into the relatively poor control of blood glucose in post-operative cardiac surgical patients, which was subsequently confirmed by a comprehensive prospective audit of glucose control. Having identified the need to improve glucose control, the hospital prioritized the implementation of a new glucose control policy. This was then trialed using real-time BG measurements to see if it improved the quality of glycemic control when compared to the current method of intermittent BG measuring.

**OBJECTIVES.** To demonstrate that real-time BG monitoring has the potential to improve both the quality and safety of glycaemic control.

**METHODS.** *Phase 1:* MPE, a non-blinded, single center study evaluating 17 adult patients undergoing cardiac surgery in which BG was continuously monitored in the OR, ICU and the general ward. Patients were monitored with the System for up to 72 h. Data was graphed to illustrate BG fluctuations. *Phase 2*: Audit, a prospective audit was completed for all patients undergoing elective cardiac surgery at the centre during the month of February. The audit recorded and analysed every BS measurement that was made for every patient in the 72 h immediately following the induction of anaesthesia. *Phase 3*: Implementation of Glucose Control: an Investigator Initiated, randomized, controlled, single center study will compare BS control using automated continuous BS monitoring compared with a control group using the hospital's current protocol of intermittent BS measurement at a variable frequency.

**RESULTS.** *Phase 1*: Data collected illustrated poor glucose control of cardiac patients. Patient glycemic variability increased as patients moved from the OR through ICU and to general ward. Significant episodes of hyper- and hypoglycemia were revealed during the automated real-time monitoring. *Phase 2*: The audit of 152 sequential elective cardiac patients showed that although only 24% were known diabetics, 94% received insulin at some stage in the 72 following surgery. 3728 BS measurements were made with a mean of 25 per patient. 89% of BS measurements were less than 10 mmol/l, however, 42% of patients had BS over 10 mmol/l at some time and 9% of patients spent more than 30% of time with BS above 10 mmol/l. *Phase 3*: Study is ongoing. Hypothesis is that continuous real-time BG measurements improve the quality of glycemic control when compared to the current practice.

**CONCLUSIONS.** Patients undergoing real-time BG measurements may have better glucose control and lower incidence of hypo/hyper-glycaemic episodes. Also, real-time BG measurements enable nurses to better adhere to an insulin protocol.

**GRANT ACKNOWLEDGEMENT**: Funded by Edwards Lifesciences.

## 0529

### NURSES 'ATTITUDES: A MAJOR BARRIER TO TIGHT GLUCOSE CONTROL PROTOCOL COMPLIANCE

Y.L. Nguyen[1], J. Duranteau[1], G. Cheisson[1]

[1]CHU de Bicêtre, Université Paris XI, Département d'Anesthésie-Réanimation, Le Kremlin Bicêtre, France

**INTRODUCTION.** The major reasons to implement a bundle of care, such as tight glucose control protocol, are to promote compliance with guidelines for best practice and to facilitate sustainability. All the patients admitted to our ICU benefit from a glucose control protocol prescription. However in a random sample of ICU patients, we observed that our protocol was not fully respected in terms of inclusion criteria or modifications of the speed of insulin drip.

**OBJECTIVES.** Before starting a multifaceted educational intervention as part of a quality improvement initiative in our ICU, we sought to identify barriers to nurses' compliance with our tight glucose control protocol. We hypothesized that nurses were not complying because majority of them did not benefit from the last educational intervention on glucose control.

**METHODS.** We performed a survey associated with semi-structured interviews of critical care nurses in a surgical ICU with 24 beds located in an academic hospital in Paris. We followed the knowledge-attitudes-behaviors model developed by Cabana et al. [1].

**RESULTS.** Sixty-five nurses (80%) answered our questionnaire. The majority of respondents were women (78%), younger than 35 years old (81%) and worked in the unit for less than 5 years (86%).Only 20% of nurses assisted to the last educational program on glucose control. All respondents were aware of the existence of the protocol and the majority familiar (71%) with it. Three quarter of the respondents agreed that there was a culture of tight glucose control in the unit and that the application of the protocol improved patient-centered outcomes. Two-thirds of respondents agreed with the efficacy of the protocol. 57% of nurses considered compliance with the protocol to be a priority. However, 80% of nurses acknowledged not complying with the protocol "often" or "very often". The more common answers were that "one size protocol does not fit all, particularly for diabetic patients" and the "fear of hypoglycemia". We did not identify any external barrier to the compliance of our protocol. The majority of respondents requested adaptation of the current tight glucose control protocol.

**CONCLUSIONS.** Despite our hypothesis about lack of knowledge driving non-compliance, we found that attitudes were the root cause of the low compliance by our nurses. Our educational intervention will therefore focus on the fear of causing hypoglycemia among our critical care nurses. We also plan to add to our protocol specific mentions for diabetic patients.

**REFERENCE(S).** 1. Cabana MD et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. JAMA. 1999;282(15):1458–65.

## 0530

### GLUCOSE LEVELS IN CRITICALLY ILL PATIENTS: POINT-OF-CARE (POC) TESTING VERSUS CENTRAL LABORATORY VALUES

S. Arce-Delgado[1], A. Bernat-Adell[1], F. Blanch-Eixarch[1], A. Ferrandiz-Selles[1], S. Guillamón-Navarro[1], L. Mateu-Campos[1], J. DeLeon-Belmar[1]

[1]ICU Dpt, University Associated General Hospital, ICU, Castellon, Spain

**BACKGROUND.** Critically ill patients' outcome could be better if their glucose levels remains in the normal range. A strict control of glucose levels in real time is needed for treating these patients in a proper way. POC technology allows to reduce the times for analysis, and permit readjusting of treatments in a more easily way.

**OBJECTIVES.** To compare accuracy of POC glucose levels with those processed by the conventional central laboratory.

**PATIENTS AND METHODS.** Prospective study of paired of samples obtained from 248 consecutively admitted to our ICU for determining glucose levels. Capillary blood samples were analyzed by bedside glucometers, and blood drawn from catheters was analyzed both in the central Lab and in the ICU through a blood gases analyzer ABL 850. Clinical and biological data that could interfere with measures were quoted. Results were analyzed by SPSS/PC 12.0 programs.

**RESULTS.** Obtained glycaemia levels were 144.4 for glucometers, 148.1 for central lab and 153.5 for blood analyzer. Concordances between methods were studied by Bland–Altman test, being all results in the range of 95% CI. In patients with peripheral oedema concordance between glucometers and central Lab results were good, but they were not when compared to blood gases analyzer. Haematocrit less than 25% or mean BP lower than 70 mm Hg did not influence the concordance between the considered methods.

**CONCLUSIONS.** Bedside glucometers seem to perform enough well for controlling glucose levels in critically ill patients. Found differences seem not to be related with the clinical condition of patients.

## 0531

### THE RISK OF HYPOGLYCEMIA IN CRITICALLY ILL PATIENTS IS HIGHER THAN WE THINK

A.D. Marinho[1], H. Castro[2], J.R. Monte[3], O. Afonso[4], E. Lafuente[5]

[1]Centro Hospitalar do Porto, Intensive Care Service, Porto, Portugal, [2]Centro Hospitalar do Porto, UCIP, Porto, Portugal, [3]Centro Hospitalar do Porto, SCIPC, Porto, Portugal, [4]Hospital Infante D. Pedro, Intensive Care Unit, Aveiro, Portugal, [5]Hospital Padre Américo, Intensive Care Unit, Vale de Sousa, Portugal

**INTRODUCTION.** Glycemic control is a common practice in critically ill patients, but there is insufficient information from randomized controlled trials to determine the optimal target range of blood glucose in the severely ill patient. What it is clear is that attempts to normalize blood glucose with IV insulin during critical illness results in higher rates of hypoglycemia.

**OBJECTIVES.** The aim of the present study was to assess the incidence of hypoglycemia in patients staying more than 10 days in different Intensive Care Units (UCIs).

**METHODS.** Multicenter, prospective, observational and cohort study, during a 4 month period (January–April 2010). All patients staying more than 10 days in 5 ICUs of 3 different hospitals were enrolled. At base line, demographic and clinical information was obtained, including information necessary to determine the severity of illness. The blood glucose level was collected every day.

**RESULTS.** 39 patients were enrolled. Mean age—57.07 ± 17.36 (55), mean SOFA score—8.02 ± 3.12 (8). Mortality rate of 20.51%. Blood glucose level had a mean daily value of 158.3 ± 41.2 (149.7) mg per deciliter. Mean daily insulin dose—24.57 ± 28.38 (15). Hypoglycemia (defined as a blood glucose level of 50 mg per deciliter) occurred in 7 patients (18%) but only in 0.6% of all blood glucose determinations.

**CONCLUSIONS.** The risk of hypoglycemia is higher than we think in patients staying longer time in ICU. As the incidence of hypoglycemia is very low when we take in account all measurements, most of the times the ICUs doctors do not realize the real incidence of this problem.

**REFERENCE(S).** 1. The NICE-SUGAR Study Investigators (2009) Intensive versus conventional glucose control in critically ill patients. NEJM 360:1283–1297.
2. Balasubramanyam A (2009) Intensive glycemic control in the intensive care unit: promises and pitfalls. J Clin Endocrinol Metab 94:416–417.

## 0532

### AN AUDIT OF GLUCOSE MANAGEMENT IN THE GENERAL ICU

M.G. Keane[1], S. Sawh[1], P. Patel[1]

[1]Hammersmith Hospital, London, UK

**INTRODUCTION.** Intensive glucose control was advocated to be an important part of critical care management until recently when it has been shown and to be associated with an increased frequency of hypoglycaemia [1] and mortality among adults in the ICU [2]. With this in mind we audited our own glucose control practice and examined why hypoglycaemic and hyperglycaemic episodes occurred.

**OBJECTIVES.**

1. Quantify the number of hyper/hypoglycaemic episodes.
2. Investigate if there was an association between blood glucose monitoring and changes to the rate of insulin infusion and episodes of hyper/hypoglycaemia.
3. Examine how hypoglycaemic episodes were managed.

**METHODS.** We conducted a retrospective audit of glucose management over a 2 week period in the General ICU. We recorded patient demographics, APACHE and SOFA scores, the individual glucose measurements, the number of hypoglycaemic and hyperglycaemic episodes per day, the number of changes to the rate of insulin infusion per day and the number of blood glucose checks per day. The target blood glucose for all patients was between 4.4 and 6.6 mmol/l. Additionally we analysed how hypoglycaemic episodes were managed. Hypoglycaemia was defined as a blood glucose measurement of less than 4.4 mmol/l and hyperglycaemia as a blood glucose measurement of greater than 6.6 mmol/l.

**RESULTS.** 16 patients were included, 75% were male with a mean age of 62.9 years. Their APACHE II scores ranged from 8 to 22. During the 2 week period 703 individual glucose measurements were taken, with 90 episodes of hypoglycaemia and 309 episodes of hyperglycaemia. When the data was analysed further, it was shown that on days when there was frequent blood glucose monitoring there were more hyperglycaemic ($R = 0.25$, $P < 0.05$) and hypoglycaemic ($R = 0.094$) episodes. On average 4.6 glucose measurements were taken before each episode of hypoglycaemia compared to 2.6 after, suggesting that frequent checks preceded hypoglycaemia rather than an episode of hypoglycaemia prompting regular monitoring. A similar trend was also seen with changes to the with insulin infusion rate; frequent changes were associated with a greater number of hyperglycaemic ($R = 0.29$, $P < 0.05$) and hypoglycaemic ($R = 0.089$) episodes per day. Episodes of hypoglycaemia were managed inconsistently with patients receiving a variety of correction fluids.

**CONCLUSIONS.** The audit found that intensively controlled blood glucose in ICU patient's resulted in a large number of hypoglycaemic incidents. In addition we observed that frequent blood glucose monitoring and adjustments to the rate of insulin infusions was associated with more frequent episodes of hypoglycaemia or hyperglycaemia. Following this audit we have advocated permissive hyperglycaemia in our unit and introduced new guidance for the management of hypoglycaemia.

**REFERENCE(S).** 1. Soylemez-Wiener R et al. JAMA. 2008;300(8):933–44.
2. NICE-SUGAR. NEJM. 2009;360(13):1283–97.

## 0533

### GLYCEMIC CONTROL IN FRENCH INTENSIVE CARE UNITS IN 2010: AN EVALUATION OF PRACTICE

C. Gakuba[1], J.-L. Hanouz[1]

[1]CHU Caen, Caen, France

**INTRODUCTION.** In 2009, the NICESUGAR study [1] did not confirm the beneficial effects of tight glycemic control in intensive care unit (ICU). The same year, french Expert's Formalized Recommendations (EFR) for blood glucose (BG) management have been published [2]. Several hypothesis have been proposed to explain the conflicting results of litterature: impact of the blood glucose (BG) variability, differences in glycemic target with the kind of diseases or type of ICU, differences according to the diabetic status or to the proportion of calories provided parenterally.

**OBJECTIVES.** To characterize the practice of glycemic control by french intensivists in the light of major recent publications.

**METHODS.** Phone survey during March 2010 with a standardized questionnaire of medical team members. Thirty-one surgical ICU (SICU), 28 medical ICU (MICU) and 11 polyvalent ICU (PICU)—which represent 70 ICU distributed on the 29 French university hospitals—were contacted. In addition 10 French non university hospitals ICU (NUICU) were questionned. All results are in percentage except BG in mmol/L.

**RESULTS.** All the contacted ICU accepted to participate. NICESUGAR study was known by the responder in 65/71/50 and 50% of SICU/MICU/PICU and NUICU. respectively. EFR were known by the responder in 48/50/58 and 50% of SICU/MICU/PICU and NUICU, respectively. ICU with intensivists who changed their practice since 2009 were 16/16/38 and 50% of SICU/MICU/PICU and NUICU, respectively. All of them declared to be more tolerant with the upper glycemic level. Among intensivists who did not change their practice recently, 10–20% said that their point of view prior to 2009 was confirmed by NICESUGAR results. The potential prognostic value of BG variability was known by 58/42/42 and 20% of the interlocutors in SICU/MICU/PICU and NUICU, respectively. The BG algorithms were all based on capillary glycemia with a period of measurement when stability is achieved of 3/4/3 and 3 h in SICU/MICU/PICU and NUICU, respectively. Only intravenous insulinotherapy was protocolized in 69/89/67 and 67%, respectively.

CHARACTERISTICS OF BG ALGORITHMS

| Characteristics of BG algorithms | SICU/MICU/PICU (n = 31/28/11) | NUICU (n = 10) |
|---|---|---|
| ICU with an algorithm | 84/62/82 | 90 |
| Established in 2009/2010 | 9/15/44 | 58 |
| 2001/2008 | 82/85/56 | 28 |
| Before 2001 | 9/0/0 | 14 |
| Computerized | 12/17/11 | 0 |
| Dynamic scale | 31/50/11 | 33 |
| Upper target of BG | 8.4/7.3/8.5 | 7.6 |
| Targets according to diseases | 4/11/0 | 22 |
| Prespecified calorie intake | 19/28/11 | 0 |

**CONCLUSIONS.** In most cases, glycemic control is performed with the help of an ICU algorithm. Despite the fact that none "universal" maximum BG level can be established, practices seem to converge to a upper target of BG around 8 mmol/L.

**REFERENCE(S).** 1. N Engl J Med 2009;360:1283
2. Ann Fr Anesth Reanim 2009;28:717.

## 0534

### GLYCEMIC CONTROL BY DYNAMIC PROTOCOL IN CRITICAL ILL PATIENTS

J. Villegas-del Ojo[1], M. Cid-Cumplido[1], E. Moreno-Millan[1], A.M. Garcia-Fernandez[1], J. Carbajal-Guerrero[1], F. Prieto Valderrey[1]

[1]Hospital Santa Barbara, Ciudad Real, Puertollano, Spain

**INTRODUCTION.** Glycemic control in critically ill patients is the weapon of battle of the articles of the past years. Despite the many protocols described in the literature, the control is still erratic, with a not insignificant numbers of hypoglycemia and in turn places a burden of care for nursing staff.

**OBJECTIVE.** To evaluate the effectiveness, easy and safety of insulin dynamic protocol designed in our ICU for critical patients, with euglycemia objective defined it as a blood glucose of 91–150 mg/dl.

**METHODS.** Initially sessions were conducted education and information for medical and nursing staff and conducted a previous survey. Prospective observational study. Patients admitted to the Intensive Care Unit polyvalent medical-surgical beds in the Hospital 8 Santa Barbara. Subjects were including as they entered the unit and after a row objectify that met the inclusion criteria (Gluc > 161 mg/dl on two determinations or > 200 mg/dl). Descriptive statistics were used for comprehensive analysis of the variables. Qualitative variables were expressed as a percentage and quantitative variables as mean ± SD, for this program was used SPSS.V13.0.

**RESULTS.** We included 30 patients of which 73.3% were male (22/8), overall mortality was 9.1%, 69.2% of patients hospitalized for medical reasons, 26.9% surgical and 3.8% traumatic. Of these 48.1% were diabetic (25% insulin, 20.8% OAD). 38.5% received corticosteroids and 25% developed kidney failure. With regard to nutrition received TPN 34.6 and 38.5% oral nutrition.

| | |
|---|---|
| Mean capillary blood glucose on admission | 213 ± 65.57 mg/dl |
| Normoglycemia (h) | 8.07 ± 7.2 |
| Mean blood glucose | 141.96 ± 23.77 mg/dl |
| Days of insulin | 4.02 ± 3.06 |
| Mean dose of insulin | 2.03 ± 1.22 U/H |
| Hypoglycemia < 60 mg/dl | 0.43% = 4 (52, 52, 50, 58 mg/dl) |

**CONCLUSIONS.** Given the objectified results we can say that this protocol is: simple, safe (hypoglycemia < 50 mg/dl 0% and 51–60 mg/dl and 0.43% effective (mean blood glucose 141.96 ± 23.77 mg/dl).

**REFERENCES.** 1. Greet Van der Berghe et al. Outcome benefit of intensive insuli therapy in the critically ill: Insulin dose versus glycemic control. CCM 2003;31:359–66.
2. Van den Berghe G, Wilmer A, Hermans G, Meersseman W, Wouters PJ, Milants I, Van Wijngaerden E, Bobbaers H, Bouillon R. Intensive insulin therapy in the medical ICU. N Engl J Med. 2006;354(5):449–61
3. Urdurti N. Das. Insulin: an endogenous cardioprotector. Curr Opin Critical Care 2003;9:375–83.
4. Troels Krarup Hansen et al. Intensive insulin therapy exerts antiinflammatory effects in critically ill patients and counteracts the adverse effect of low mannose-binding lectin levels. J Clin Endocrinol Metab. 88(3):1082–8.

## 0535

### GLUCOSE GRADIENTS IN DIFFERENT VASCULAR COMPARTMENTS AND DIFFERENT HYPOXIA MODELS: FORGOTTEN PLAYERS IN TISSUE HYPOXIA STATES?—PRELIMINARY EXPERIMENTAL DATA

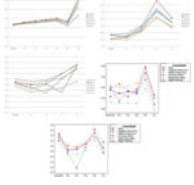
A.J. Pereira[1], P. Rehder[1], L.F.P. Figueiredo[1], E. Silva[1]

[1]São Paulo University/Instituto do Coração, São Paulo, Brazil

**INTRODUCTION.** Oxygen saturation gradients among different territories (as central to mixed venous circulations) are widely known and, recently, lactate gradients between central to mixed venous circulation were also described. Little is known about the pathophysiological meaning of these gradients, but their role may be a key understanding factor in how progression of organic dysfunctions develops in intensive care patients. Glucose, besides a central energetic source to live organisms, may not be a preferential ATP substrate to all tissues or organs as occurs with cardiomyocytes. Therefore, regional differences in glycemic concentrations may exist and their behavior may contribute to our understanding about cell death and organ disfunction in shock and hypoxia states.

**OBJECTIVES.** Detailed describe glucose gradient patterns in different vascular compartments and different models of tissue hypoxia.

**METHODS.** Observational experimental data, 37 large white pigs, male sex, 35 kg. Animals studied under general anesthesia, mechanically ventilated and fully monitorized. Fluoroscopy-guided coronary sinus, superior and inferior vena cavas, right atria/ventricle, PA and femoral artery catheterizations were performed. *Sepsis* = fecal peritonitis; *anemia* = progressive 5% reduction of hemotocrit from 30 to 7% (colloidal hydroxiethylstarch dilution); *hypoxia* = progressive 5% reduction in $FiO_2$ from 30 to 7% (air dilution with nitrogen gas); *tamponade* = progressive 20% reduction of initial CO each half hour. Complete blood gas analysis were performed hourly. Pigs were sacrificed with sedative overdose and 20 ml KCl 19.1% injection.



Glucose among different compartments and models

**RESULTS.** Higher differences among curves and along time were detected in anemia group. SVC consistently account for the lowest values in glucose concentrations (higher consumption by CNS?), except for anemia group (CS lower). In sepsis and hypoxia-hypoxic animals, glucose reaches peak values and acutely decreases in a different pattern (exhaustion?). Anemia, hypoxia and tamponade gradients among curves tend to enlarge along time, differently from control and sepsis.

**CONCLUSIONS.** Glucose patterns substantially vary along time, depending on tissue hypoxia model analyzed. Further tests in our sample and further investigations will be necessary to test the clinical significance of these findings and explain the pathophysiological reasons behind them.

**GRANT ACKNOWLEDGMENT.** FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo).

# Analgesia, sedation and cognitive dysfunction 2: 0536–0549

## 0536

### DOES MIDAZOLAM OVERSEDATE AND PROLONG EMERGENCE IN HAEMO-FILTERED ICU PATIENTS?

Z. Dhesi[1], N. Brincat[2], P. Breen[1], J.G. Davies[3], R. Shulman[1]

[1]University College London Hospital, Intensive Care Unit, London, UK, [2]University of Malta, Msida, Malta, [3]King's College London, Parmaceutical Science Division, London, UK

**INTRODUCTION.** Effective sedation is a fundamental component of ICU patient care. Excess sedation is associated with prolonged time to extubation, haemodynamic and neurological instability and longer ICU stays. Renal impairment leading to impaired excretion of drugs is a contributing factor.

**OBJECTIVES.** To compare both time to wake following discontinuation of midazolam, and sedation control, between haemofiltered (HF) and non haemofiltered (NHF) patients.

**METHODS.** In this retrospective observational study, 72 consecutive HF and NHF patients were studied over 18 months. Inclusion criteria included a minimum of 7 day stay on ICU and receiving continuous midazolam infusion. Exclusion criteria included patients who were intentionally oversedated or had impaired CNS function on admission. Sedation levels were calculated hourly using the UCLH Sedation Scale, and adjusted as per Unit protocol to achieve target sedation. A score between −1 and +1 represents optimal sedation, and −2 to −3 is 'oversedation', and +2 to +3 represents 'undersedation'.

**RESULTS.** There were 34 patients in the HF group and 38 in the NHF group. Baseline characteristics were similar for both. Approximately 40,000 h of sedation were analysed. At least one episode of 'oversedation' was recorded in 91.2% of the HF group and 89.5% of the NHF group. HF patients spent 16% of their ICU stay over-sedated, compared to 8% of the NHF patients ($p = 0.001$), see Table 1. Median time from midazolam discontinuation until sedation score of +1, was 20 h in the HF group, and 5 h in the NHF group ($p = 0.008$). There was no significant difference between the two groups for time from midazolam discontinuation to extubation. The HF group had more 'oversedation' episodes lasting 6–12 h ($p = 0.014$), 13–24 h ($p = 0.010$) and 25–48 h ($p = 0.002$).

**TABLE 1** SEDATION SCORE COMPARISON IN HF AND NHF GROUPS

| Sedation score | −3 | −2 | −1 | 0 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|
| HF | 6.6% | 9.8% | 10.7% | 13.8% | 35.5% | 4.7% | 1.8% |
| NHF | 1.6% | 5.3% | 8.9% | 12.9% | 40.6% | 7.4% | 3.9% |
| P value | 0.001 | 0.015 | 0.042 | Not Sig | Not Sig | Not Sig | Not Sig |

**CONCLUSIONS.** Haemofiltered patients spend twice as much time oversedated with midazolam than NHF patients, with longer times to wake after midazolam discontinuation (approximately 15 h). These results suggest there are three possible ways to improve practice—stop use of midazolam, switch to a non-accumulating agent, or more affectively minimise the doses of midazolam used.

## 0537

### REMIFENTANIL-BASED ANALGO-SEDATION AND THE STRESS RESPONSE IN THE PATIENTS SUBMITTED TO ELECTIVE AND ON-PUMP CARDIAC SURGERY: A PROSPECTIVE AND RANDOMIZED STUDY

S. Caroleo[1], O. Bruno[1], D. Vuoto[1], F. Infelise[1], A. Rubino[2], A. Renzulli[2], B. Amantea[1]

[1]University of Catanzaro, Anesthesia and Reanimation, Catanzaro, Italy, [2]University of Catanzaro, Cardiac Surgery, Catanzaro, Italy

**INTRODUCTION.** Pain, inflammatory and sympathetic response associated with anesthetic emergence have been identified as important factors mediating the increased incidence of cardiac ischemia postoperatively [1].

**OBJECTIVES.** To analyze the differences in terms of hemodynamic and stress response and cardioprotective effect after the implementation of two different analgo-sedation protocols aimed at mantaining a RASS score between −3 and −2.

**METHODS.** *Design* analysis of a prospective and randomized collected database. *Setting* Intensive Care Unit (ICU) in an University Hospital. *Patients* A total of 50 patients aged 30–80 (31 M and 29 F; ASA II–III) with an EUROSCORE between 6 and 10, submitted to elective on-pump cardiac surgery from July 2009 to February 2010. *Randomization* on ICU admission the patients were randomly assigned to Group 1 (Remifentanil 0.02–0.15 $\gamma$/kg/min + Midazolam rescue intravenous bolus of 1–2 mg if needed) or Group 2 (Propofol 0.5–4 mg/kg/h + Fentanyl rescue as an intravenous bolus of 50–100 $\gamma$ if needed). Glucose control and weaning were carried out with the same protocols in the two groups. *Data collection:* Preoperative and each hour (during the first 10 h in ICU) assessment of Bispectral Index (BIS) and of Glucose and Lactate blood levels; hemodynamic parameters, preoperative and postoperative assessment of TNF$\alpha$ and IL6, C-Reactive Protein (CRP), Troponin I (TnI) and B-type Natriuretic Peptide (BNP) blood levels. Weaning parameters were assessed 30 min after the start of weaning protocol. Moreover data about Admission SOFA score, weaning duration and ICU length of stay (LOS) were collected. *Statistics:* Within-between groups analysis, one-way ANOVA and unpaired t test were used when appropriate.

**RESULTS.** The preoperative and operative variables were comparable between the two groups ($p$ = NS for all measurements). BIS values were lower in group 1 ($p = 0.001$). Glucose and Lactate blood levels were lower in Group 1 ($p = 0.002$ and $p = 0.005$, respectively). Heart rate and mean arterial pressure were lower in Group 1 ($p = 0.008$ and $p = 0.004$, respectively). Cardiac index, indexed systemic vascular resistances, stroke volume index, cardiac cycle efficiency and dp/dt were higher in group 1 ($p = 0.002$, $p = 0.008$, $p = 0.02$, $p = 0.001$, $p = 0.008$ and $p = 0.004$, respectively). TNF$\alpha$, IL6 and CRP blood levels were lower in Group 1 ($p = 0.006$, $p = 0.01$ and $p = 0.005$, respectively). TnI and BNP blood levels were lower in group 1 ($p = 0.008$ and $p = 0.004$, respectively). Rapid Shallow Breathing Index (RSBI), and RR (Respiratory Rate) x PS (Pressure Support) were lower in Group 1 ($p < 0.001$). Admission SOFA score were lower in Group 1 ($p < 0.005$). Weaning duration were lower in group 1 ($p = 0.02$). No difference in ICU LOS.

**CONCLUSIONS.** The analgo-sedation protocol remifentanil-based was associated with a better postoperative protective profile in this specific clinical context.

**GRANT ACKNOWLEDGMENT.** Chiara Longo.

**REFERENCE(S).** 1. Warltier DC et al. Anesthesiology. 2000;92:253–9.

## 0538

### THE EFFECT OF A SEDATION WAKE-UP TRIAL ON THE OCCURRENCE OF DELIRIUM IN CRITICALLY ILL TRAUMA PATIENTS

M.I. Figueroa-Ramos[1,2], C.M. Arroyo-Novoa[1,2], K.A. Puntillo[2]

[1]University of Puerto Rico, Medical Sciences Campus, School of Nursing, San Juan, Puerto Rico, [2]University of California San Francisco, School of Nursing, San Francisco, USA

**INTRODUCTION.** Delirium is associated with negative outcomes in intensive care unit (ICU) patients [1, 2]. The administration of benzodiazepines could lead to delirium [3]. The implementation of a sedation wake-up trial (SWT) showed a significant reduction in the administration of sedatives, shorter duration of mechanical ventilation, and shorter length ICU stay [4, 5]. The SWT in addition to a daily spontaneous breathing trial (SBT) also demonstrated a significant reduction in those outcomes [6].

**OBJECTIVES.** To examine the effect of the SWT on the occurrence of delirium and to examine the benefits of SWT plus SBT in trauma ICU (TICU) patient outcomes.

**METHODS.** A prospective interventional trial was used. Patients with baseline neurological or psychiatric diseases, head trauma, and history of alcoholism or drug dependence were excluded. Patients in the intervention group (IG) received the paired intervention (SWT plus SBT), whereas the control group (CG) received continuous sedative infusion based on the standard clinical practice of the TICU.

**RESULTS.** Twenty patients per group participated. Delirium occurred in 80% of the CG versus 30% of the IG. Being in the CG (OR 0.06; 95% CI 0.01–0.36) and being older (OR 1.06, 95% CI 1.00–1.12) predicted delirium. The CG showed more hypoactive delirium while the IG showed more mixed delirium ($\chi^2 = 15.9, p = 0.001$). For every one unit increase in measurement time (8 h) for 3 days, the odds of being delirious decreased by 51% (OR 0.49, 95% CI 0.24–0.96). Patients in the IG spent shorter time in coma (RH 2.25; 95% CI 1.08–4.65), on mechanical ventilator (RH 3.09; 95% CI: 1.45–6.60), and in the TICU (RH 4.20; 95% CI 1.82–9.69).

**CONCLUSIONS.** This study extends the contribution of the combined intervention of SWT and SBT to improve clinical outcomes in trauma patients.

**REFERENCES.** 1. Ely EW, Gautam S, Margolin R et al. The impact of delirium in the intensive care unit on hospital length of stay. Intensive Care Med. 2001;27:1892–900.
2. Ouimet S, Kavanagh BP, Gottfried SB, Skrobik Y. Incidence, risk factors and consequences of ICU delirium. Intensive Care Med. 2007;33:66–73.
3. Pandharipande P, Cotton BA, Shintani A et al. Prevalence and risk factors for development of delirium in surgical and trauma intensive care unit patients. J Trauma. 2008;65:34–41.
4. Carson SS, Kress JP, Rodgers JE et al. A randomized trial of intermittent lorazepam versus propofol with daily interruption in mechanically ventilated patients. Crit Care Med. 2006;34:1326–32.
5. Kress JP, Pohlman AS, O'Connor MF, Hall JB. Daily interruption of sedative infusions in critically ill patients undergoing mechanical ventilation. N Engl J Med. 2000;342:1471–7.
6. Girard TD, Kress JP, Fuchs BD et al. Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial. Lancet. 2008;371:126–34.

## 0539

### IS THERE A PLACE FOR SUXAMETHONIUM IN THE CRITICAL CARE UNIT

J. Muller[1], P. Jeanrenaud[1]

[1]St Helens and Knowsley NHS Trust, Critical Care, Liverpool, UK

**INTRODUCTION.** Suxamethonium [1], historically, has been the preferred drug for providing rapid onset neuromuscular blockade in patients requiring intubation on critical care. There are numerous problems associated with Suxamethonium. Hyperkalaemia resulting in cardiac arrest is of great concern in critical care patients. Other complications include anaphylaxis, malignant hyperthermia, prolonged paralysis, bradycardia, raised intracranial pressure, raised intraocular pressure and myalgia. Critical care patients are much more vulnerable to an unpredictable hyperkalaemic response and it is not confined to patients with burns, neuromuscular disorders, renal failure and/or severe muscle trauma but septic patients as well. Rocuronium is an alternative agent that may be more suited to the critical care population.

**OBJECTIVES.** To assess attitude within Mersey region (UK) towards the use of suxamethonium within critical care given that alternative agents are available.In particular rocuronium which has its own reversal agent—sugammadex.

**METHODS.** We conducted a paper based survey of the 84 critical care consultants working in Mersey region. A response rate of 44% was achieved.

**RESULTS.** When performing emergency intubations in ICU 21 respondents (71%) used Suxamethonium in a varying degree. Of these 14 respondents (40%) used Suxamethonium more than 50% during emergency intubation, while 10 (29%) did not use Suxamethonium at all. Rocuronium was used by 26 (75%) of intensivists. Of these 17 (49%) used Rocuronium more than 50% during RSI whilst 8 (23%) did not use Rocuronium at all. Suxamethonium was viewed as having a place in ICU by 29 (82%) of respondents. Witnessed complications to suxamethonium included cardiac arrest 13(37%), hyperkalaemia 14(40%), bradycardia 23 (66%), anaphylaxis 10 (28%), malignant hyperpyrexia 2 (6%) and prolonged paralysis 16 (46%). 24 (69%) believed rocuronium to be preferable to suxamethonium. 13 (37%) administered rocuronium in the dose recommended for RSI (1.2 mg/kg).The availability of Sugammadex would persuade 16 (45%) to use rocuronium in the future.19 (73%) have not experienced any problems with Rocuronium.

**CONCLUSIONS.** A large number of intensivists are using suxamethonium more frequently than rocuronium despite indicating that rocuronium is more preferable. Many use suxamethonium for its ability to provde quick, reliable intubating conditions (Fig. 2) yet many are not using rocuronium at the dose intended therefore questionning the ability to make a comparison. Rapid offset was considered desirable but many believed this not to be applicable (Fig. 2) to their patients on critical care. In conclusion suxamethonium appears to still have a place within critical care but perhaps rocuronium is an agent more suited to many of the patients requiring intubation within critical care.

**REFERENCE.** Succinylcholine: New Insights into Mechanisms of Action of an Old Drug Anesthesiology. 2006;104(4): 633–4.

## 0540

### KNOWLEDGE OF DELIRIUM IN CRITICAL CARE PERSONNEL: A NATIONAL SURVEY

S.D. Chaudhry[1], R.S. Rao[1], P. Patel[1]

[1]Midstaffordshire Hospitals, NHS Foundation Trust, Critical Care, Stafford, UK

**INTRODUCTION.** Delirium affects at least one in 10 hospitalized patients, and is a common part of many terminal illnesses. Published guidelines of Society of Critical Care Medicine strongly advocate monitoring presence of delirium in all patients; ironically health care professionals have a limited knowledge of causative factors, diagnostic tools and treatment strategies.

**OBJECTIVES.** The aim of this survey was to ascertain the level of acquaintance and opinions prevalent among physicians, nurses and paramedical personnel in UK. The survey encompassed modifiable and mitigating risk factors; consequences and recommended pharmacologic approaches providing resolution of delirium in critical care patients.

**METHODS.** Contacted Intensive Care Society UK in June 2009 Published Online Survey for 6 months (July2009–Dec 2009)). Responses collected through Intensive Care Society UK and personal E mails.Participants included clinicians, nurses and paramedical personnel. Total of 101 Responses obtained (More than 2 answers obtained from most respondents). Data analysed and results presented as percentage of correct answers.

**RESULTS.** Delirium was stated as organ dysfunction by 55.6% respondents; clinical manifestations were correctly elucidated by 85%, 66% people recognized its relevance as terminal illness; validation tools were known to 50%; less than 20% were cognizant with modifiable risk factors while treatment with Haloperidol was known to 100% participants.

**CONCLUSIONS.** The preponderance of delirium and its adverse impact on Critical care LOS, morbidity and mortality incur substantial financial outcome of national Health resources. Educational workshops, posters and flowcharts to facilitate understanding the presentation and management of delirium form compelling commitment for the present day intensivist.

**REFERENCE(S).** 1. Wesley Ely E et al.Delirium as a predictor of mortality in mechanically ventilated patients in the intensive care unit. JAMA. 2004;291:1753–62

2. Wesley Ely E, Siegel MD, Sharon K. InouyeDelirium in the intensive care unit: an under-recognized syndrome of organ dysfunction. J Am Geriatr Soc. 2003;51:591–8.

## 0541

### BIOMARKERS IN DELIRIOUS PATIENTS AT THE CRITICAL CARE UNIT

M. van den Boogaard[1], L. Schoonhoven[2], K. Quinn[3], C. Hoedemaekers[1], J.G. van der Hoeven[1], P. Pickkers[1]

[1]Radboud University Nijmegen Medical Centre, Intensive Care Medicine, Nijmegen, Netherlands, [2]Radboud University Nijmegen Medical Centre, IQ Healthcare, Nijmegen, Netherlands, [3]St. Michael's Hospital, Anesthesia and Critical Care, Toronto, Canada

**INTRODUCTION.** Delirium occurs frequently in critically ill patients, and especially in severely ill and in infectious patients. Although several causal pathways for delirium have been described, the role of biomarkers in ICU patients is unknown. We investigated potential differences in various serum biomarkers between delirious and non-delirious ICU patients with and without an infection.

**METHODS.** Delirium in adult ICU patients was diagnosed using the confusion assessment method-ICU (CAM-ICU). Delirious and non-delirious patients were matched for age, APACHE-II score, the presence of absence infection or SIRS criteria, and length of ICU stay at the moment of blood withdrawal. Neurology and trauma patients were excluded. Within 24 h after the development of delirium blood was drawn for determination of biomarkers.

**RESULTS.** 50 delirious ICU patients were matched with 50 non-delirious patients. Delirious patients with infection or SIRS had significantly higher levels of IL-8, IL-18, IL-1ra, MCP-1, and procalcitonine compared with the non-delirious patients with an infection (Table 1). Non-inflamed delirious patients had significantly higher levels of IL-6, IL-8, IL-1ra, IL-10 and procalcitonine compared with non-delirious, non-inflamed patients. When corrected for infection or positive SIRS, levels of IL-8 ($p = 0.04$), IL-10 ($p = 0.03$), MCP-1 ($p = 0.004$), cortisol ($p = 0.009$) and procalcitonine ($p = 0.04$) were significantly higher in the delirious group compared with the non-delirious patients.

**TABLE 1** BIOMARKERS IN DELIRIOUS AND NON-DELIROUS

| | Infection or positive SIRS patients (n = 46) | | |
|---|---|---|---|
| Biomarkers | Dilirium (n = 26) | No dilirium (n = 20) | p value |
| IL-6(pg/mL) | 73 [38–143] | 41 [21–90] | 0.09 |
| IL-8(pg/mL) | 31 [24–44] | 17 [9–28] | <0.001 |
| IL-18(pg/mL) | 136 [88–187] | 84 [65–132] | 0.003 |
| MIF (pg/mL) | 438 [294–796] | 257 [157–576] | 0.13 |
| IL-1ra(pg/mL) | 48 [27–74] | 32 [18–47] | 0.04 |
| IL-10(pg/mL) | 23 [13–47] | 13 [5–35] | 0.08 |
| MCP-1 (pg/mL) | 516 [295–822] | 251 [199–339] | 0.001 |
| HNP (µg/mL) | 0.06 [0.03–0.13] | 0.07 [0.03–0.09] | 0.60 |
| Procalcitonine (ng/mL) | 1.0 [0.23–2.0] | 0.28 [0.10–0.64] | 0.003 |
| Cortisol (µmol/L) | 0.59 [0.34–0.98] | 0.48 [0.18–0.61] | 0.06 |
| | Non-inflamed patients (n = 54) | | |
| | Dilirium (n = 24) | No dilirium (n = 30) | p value |
| IL-6 (pg/mL) | 50 [29–90] | 34 [22–64] | <0.05 |
| IL-8 (pg/mL) | 20 [12–32] | 14 [9–22] | 0.001 |
| IL-18 (pg/mL) | 82 [66–141] | 88 [72–120] | 0.54 |
| MIF (pg/mL) | 334 [214–561] | 249 [179–702] | 0.08 |
| IL-1ra(pg/mL) | 24 [17–51] | 16 [11–25] | 0.02 |
| IL-10(pg/mL) | 28 [12–44] | 22 [9–48] | 0.03 |
| MCP-1 (pg/mL) | 288 [192–398] | 233 [175–306] | 0.15 |
| HNP (µg/mL) | 0.06 [0.04–0.10] | 0.04 [0.03–0.10] | 0.51 |
| Procalcitonine (ng/mL) | 0.22 [0.11–0.55] | 0.12 [0.06–0.18] | 0.01 |
| Cortisol (µmol/L) | 0.46 [0.23–0.72] | 0.30 [0.06–0.68] | 0.06 |

**CONCLUSIONS.** In ICU patients, delirium is associated with increased concentrations of several cytokines, even after adjusting for the presence of infection. We conclude that IL-8, IL-10, MCP-1, cortisol and procalcitonine are associated with delirium in ICU patients, and could serve as possible biomarkers.

## 0542

### PREOPERATIVE REGIONAL CEREBRAL OXYGEN SATURATION IS A PREDICTOR OF POSTOPERATIVE DELIRIUM IN ON-PUMP CARDIAC SURGERY PATIENTS

J. Schoen[1], J. Meyerrose[1], M. Heringlake[1], M. Hueppe[1], K.-U. Berger[1]

[1]University of Luebeck, Luebeck, Germany

**INTRODUCTION.** Postoperative delirium is a frequent and hazardous complication of on-pump cardiac surgery [1, 2]. Near infrared spectroscopy is a non-invasive method for detection of imbalances in the cerebral oxygen supply/demand-ratio that possibly account for postoperative global cerebral deficits.

**OBJECTIVES.** The presented study determines the relation between preoperative regional cerebral oxygen saturation and the incidence of postoperative delirium measured with the "Confusion Assessment Method for the Intensive Care Unit (CAM-ICU)" in patients with on-pump cardiac surgery.

**METHODS.** After approval of the local ethical committee and written informed consent, N = 231 patients scheduled for elective or urgent cardiac surgery were studied preoperatively and on the first, second and third postoperative day with the CAM-ICU. A positive result on at least one of the measured postoperative time points was considered as "delirium". Demographic, surgery related, and physiological data as well as the preoperative Mini-mental-status-Examination (MMSE) were documented. The Baseline $ScO_2$ was registered before induction of anaesthesia without supplemental oxygen and $ScO_2$ was recorded throughout the surgical procedure (INVOS 5100 Cerebral Oxymeter, Tyco Healthcare).

**RESULTS.** Of N = 231 patients included in the analysis, n = 60 (26%) patients developed a postoperative delirium. Patients with delirium were older (mean 73.6 ± 6.1 years vs. mean 65.1 ± 13.2 years; p = 0.000), had lower score in MMSE (mean 25.3 ± 3.6 vs. 27.5 ± 2.3; p = 0.000), had a significantly lower baseline $ScO_2$ (mean 57.6 ± 7.7% vs. 63.0 ± 7.4%; p = 0.000), and a lower minimal intraoperative $ScO_2$ (48.8 ± 9.4% vs. 55.0 ± 8.6%; p = 0.0001). The logistic regression identified the baseline $ScO_2$ as an independent predictor of the development of postoperative delirium (p = 0.002, Odds Ratio 4.1, CI 1.7–9.9).

**CONCLUSIONS.** The presented study shows, that a low preoperative $ScO_2$ is associated with postoperative delirium after on-pump cardiac surgery. Further investigation should determine, whether the preoperative optimization of $ScO_2$ and prevention of intraoperative imbalances of cerebral oxygen supply/demand-ratio can reduce the incidence of postoperative delirium.

**REFERENCES.** 1 Deiner S, Silverstein JH. Postoperative delirium and cognitive dysfunction. Br J Anaesth 2009;103 Suppl 1:i41–6.

2. Ely EW, Shintani A, Truman B, Speroff T, Gordon SM, Harrell FE Jr., Inouye SK, Bernard GR, Dittus RS. Delirium as a predictor of mortality in mechanically ventilated patients in the intensive care unit. JAMA 2004; 291:1753–62.

## 0543

### DEEPER SEDATION DURING COMA AS MEASURED BY BISPECTRAL INDEX MONITORING IS ASSOCIATED WITH DELIRIUM UPON EMERGENCE FROM COMA

J.M. Andresen[1], M.S. King[2], M.A. Davidson[3], T.D. Girard[2], P.P. Pandharipande[4], E.W. Ely[2], P.L. Watson[2]

[1]Vanderbilt University School of Medicine, Nashville, USA, [2]Vandebilt University School of Medicine, Department of Medicine, Nashville, USA, [3]Vanderbilt University School of Medicine, Department of Biostatistics, Nashville, USA, [4]Vanderbilt University School of Medicine, Department of Anesthesiology, Nashville, USA

**INTRODUCTION.** Delirium occurs in approximately two-thirds of critically ill patients and is associated with increased mortality, lengthened hospital stay, and higher costs [1]. Sedative-induced coma, not uncommon in the intensive care unit (ICU), is a known risk factor for delirium, but the exact relationship between depth of sedation and delirium is unknown [2]. The bispectral index (BIS) can monitor depth of sedation in a more detailed and less labor-intensive way than clinical assessment, but its usefulness in intensive care is not established. We hypothesized that duration of deep sedation, as measured by time at BIS value < 40, would be associated with a greater risk of delirium upon emergence from coma.

**METHODS.** In this prospective cohort study, we monitored 126 mechanically ventilated ICU patients using the BIS-XP 4.0. BIS score and BIS burst suppression (percent time the electroencephalogram was isoelectric) were recorded once per minute. Sedation level was also assessed twice per day using the Richmond Agitation-Sedation Scale (RASS). We defined coma as RASS −3 or deeper and emergence from coma as 3 consecutive RASS scores of −2 or higher. We assessed non-comatose patients for delirium twice daily using the Confusion Assessment Method for the ICU (CAM-ICU) and diagnosed emergence delirium when the first non-coma assessment was CAM-ICU positive. Severity of illness (APACHE II) was calculated at enrollment.

**RESULTS.** Of the patients who were comatose at some time during monitoring, 74 emerged from coma; 45 (61%) of these had emergence delirium. Patients with emergence delirium spent significantly more time at BIS < 40 (p < 0.01). After adjusting for burst suppression and severity of illness, time spent at BIS value < 40 was an independent predictor of emergence delirium (p = 0.04). Patients at BIS < 40 for 141 h (75th percentile) experienced a nearly fourfold higher odds of emergence delirium than patients at BIS < 40 for 27 h (25th percentile).

**CONCLUSIONS.** Greater time spent at BIS < 40 increases the odds of emergence delirium. Decreasing the time a patient is deeply sedated may decrease the incidence of delirium and its associated costs and mortality.

**REFERENCES.** 1. Ely EW et al. JAMA 2004;291:1753–62

2. Pandharipande P et al. Anesthesiology 2006;104:21–6.

**GRANT ACKNOWLEDGMENT.** National Institutes of Health, VA GRECC and Investigator-initiated grant from Aspect Medical.

## 0544

### ELECTROACUPUNCTURE-ANAESTHESIA DURING OPEN HEART SURGERY CAN REDUCE THE DURATION OF POSTOPERATIVE MECHANICAL VENTILATION AND IS SUPERIOR TO OPIOD-ANAESTHESIA FOR PAIN CONTROL IN THE EARLY POSTOPERATIVE PERIOD

T. Bachleda[1], J. Firment[2], P. Tassani-Prell[1]

[1]German Heart Centre Munich at the Technical University Munich, Institute of Anaesthesiology, Munich, Germany, [2]Faculty of Medicine at the Pavol Jozef Safarik University, 1st Department of Anaesthesiology and Intensive Medicine, Kosice, Slovakia

**INTRODUCTION.** Before the era of modern opioids, electroacupuncture was used to provide analgesia for many types of surgery, including open heart surgery.

**OBJECTIVES.** To compare electroacupuncture-anaesthesia (EAA) and conventional opioid-analgesia (OA) with respect to the duration of postoperative mechanical ventilation (MV) and early postoperative pain scores following open heart surgery.

**METHODS.** Prospective blinded randomized controlled trial involving 34 patients undergoing primary elective coronary artery bypass graft (CABG) or valve surgery. Exclusion criteria were: BMI > 35, diabetes, age > 75 years, ejection fraction (EF) < 30%, ASA > III, reduced pulmonary function (FEV1 and FVC < 50%), combination operations (e.g. CABG + valve surgery), pre-operative alcohol or drug abuse, severe neurological or psychiatric disease, inability to give informed consent. In both groups anaesthesia was induced in a standard manner with etomidate, sufentanil, midazolam and rocuronium. In the EAA group 3 acupuncture points were routinely used bilaterally: Ssu-Tu (Tb-9; extensor side of forearm between ulna and radius), Shuei-Tu (St-10; medial border of sternocleidomastoid muscle) and the Heart (100) to Trachea (103) ear point. The acupuncture needles were stimulated with asymetrical biphasic impulses at a rate of 15–20 Hz generated by the Chinese Acupuncture Analgesia Set Type 71-3 until closure of the thorax. Anaesthesia was maintained with propofol and isoflurane under BIS monitoring. The OA group additionally received a continuous sufentanil infusion intra-operatively. Sedation with propofol was discontinued after 1 h on the ICU provided that the patient was hemodynamically stable. Following extubation numerical analog pain scale (NAS) scores > 3 were treated with i.v. piritramid. After discharge from the ICU, patients interviewed regarding their level of satisfaction with their anaesthesia and postoperative analgesia.

**RESULTS.** Three patients were removed from the EAA group due to postoperative sedation of greater than 24 h duration (due to hemodynamic instability, bleeding, and requirement for re-thoracotomy). The two groups were comparable concerning sex, age, NYHA, BMI, EF, ASA. Data are presented as mean ± SD. A non parametric test (Mann–Whitney) was used in the statistical analysis. A p value < 0.05 was considered statistically significant.

POSTOPERATIVE DATA

| Analgesia type | Electroacupuncture group (n = 16) | Opioid group (n = 18) | p |
|---|---|---|---|
| Duration MV (min) | 345 ± 241 | 511 ± 232 | **0.027** |
| Sufentanil consumption (μg) | 46 ± 13 | 354 ± 71 | **0.000** |
| 1. Dose Piritramid (h after surgery) | 8.8 ± 6.8 | 6.1 ± 5.5 | 0.235 |
| Piritramid amount/4 h (mg) | 0.9 ± 2.2 | 3.8 ± 5.2 | 0.135 |
| Piritramid amount/24 h (mg) | 6.3 ± 6.4 | 11.0 ± 10.0 | 0.224 |
| NAS (1–10) | 1.8 ± 1.1 | 4.5 ± 2.3 | **0.001** |

**CONCLUSIONS.** EAA significantly reduces the duration of postoperative MV and seems to be a reliable method for intraoperative pain therapy. Patients who received EAA were more satisfied with their early postoperative analgesia than patients in the OA group.

## 0545

### WITCH LEVEL OF SEDATION FOR PATIENTS IN 66 ICUS: A ONE-DAY STUDY

G. Chanques[1], L. Zoric[2], A. Bonnal[2], M. Leone[3], J.M. Constantin[4], B. Allaouchiche[5], J.Y. Lefrant[2], S. Jaber[6], AzuRea

[1]CHU Montpellier, Montpellier, France, [2]CHU NÎMES, Nimes, France, [3]Assistance Publique des Hôpitaux de Marseille, Marseille, France, [4]CHU Clermond Ferrant, Clermont Ferrand, France, [5]Hopital Edouard Heriot, Lyon, France, [6]CHU Montpellier, SAR B, Montpellier, France

**INTRODUCTION.** Over sedation increases the morbidity and mortality in ICU [1]. The use of an algorithm is recommended but not yet widely spread [2].

**OBJECTIVES.** The main end point of our study was to audit the real practices of sedation on a single day in 66 ICUs in the South East of France.

**METHODS.** This 1 day study was approved by the Institutional Review Board. Units were audited from January to April 2009. The patients present in the Unit were included if they were receiving sedative drugs (hypnotics or morphine derives without muscular blockade). For each patient, the Ramsay score, the existence of analgesia and consciousness assessment and the existence or not of a nurse applied algorithm were noted. The sedation was considered as adequate if the Ramsay score was between 2 and 4, or at 5 for patients with a $PaO_2/FiO_2$ < 200 mmHg or intracranial hypertension. The sedation was considered too deep for Ramsay scores at 6 or at 5 for patients without ARDS/ALI or intracranial hypertension and insufficient for Ramsay scores at 1.

**RESULTS.** Among 625 patients, 202 were sedated. The consciousness was evaluated in 117 patients (58%), essentially by the Ramsay score (82%). Pain was evaluated in 59 patients (29%), by the BPS (44%) or an EVA scale (44%). On the day of the study, 84 patients (42%) had an adequate sedation, 79 (39%) were over sedated, 3 patients were under sedated. A written algorithm was used in 14 units (21%). After multivariate analysis and logistic regression, the risk factors for over sedation were: an admission to study delay ≤ 8 days (OR 2.6 [1.2–5.4]), the absence of sedation algorithm in the Unit, the SOFA score at the study day (OR = 1.2 [1.2–1.3]). The regular evaluation of consciousness and analgesia were not protective.

**CONCLUSIONS.** Sedation assessment remains under used, leading to over sedation in 39% sedated patients. Over sedation is more frequently encountered in the most severe patients and in those who have arrived in ICU since less than 1 week, and even more so if no written nurse applied algorithm of sedation exists in the unit.

**REFERENCE(S).** 1. N Engl J Med 2000;342:1471–7.

2. Anesthesiology 2007;106:687–95.

## 0546

### ANAPHYLAXIS IN ANESTHESIA AND CRITICAL CARE IN POLAND

G.G. Michalska[1]

[1]Deparment of Anesthesiology and Intensive Care, Military Hospital, Poznan, Poland

**BACKGROUND.** Anaphylaxis during anesthesia or in the intensive care unit (ICU) may be an acute and dramatic adverse event. The author report results of a 5-year survey of anaphylactic reactions observed during anesthesia and in ICU in Poland.

**METHODS.** Between 2003 and 2008 years, in Anesthesiology Department in Szczecin (Poland), 52 patients who experienced immune-mediated (anaphylaxis) reactions were referred to the Allergology Department. Anaphylaxis was diagnosed on the basis of clinical history, skin tests, and/or specific immunoglobulin E (asIgE) assay and serum samples for mast cell tryptase (MCT).

**RESULTS.** 23 patients showed a complete match between suspected cause and investigation results. The most common causes of anaphylaxis were opioids (n = 6), hypnotics (n = 4), latex (n = 6), antibiotics (n = 3), neuromuscular blocking agents (NMBAs) (n = 3), plasma volume expanders and blood (n = 3). In the 20 cases one or more substances were suspected. In the 9 cases there was a partial match, the right substance being suspected, but investigations showed an additional allergen or several substances, including the right substance being suspected. There were two anesthetic-related deaths. The positive predictive value of MCT for the diagnosis of anaphylaxis was 25.6%. The diagnostic value of as IgE was confirmed. Three patients showed elevated MCT, while specific IgE against the drugs tested was not detected. Two patients tested positive to as IgE, but negative to MCT.

**CONCLUSIONS.** (1) Anaphylaxis during anesthesia or in ICU setting may be potentially severe and associated with adverse outcomes. (2) Ideally diagnosis of anaphylaxis should rest upon different confirmatory tests rather than on a single one.

## 0547

### ROUTINELY DELIRIUM MONITORING FINDS LESS PATIENTS WITH DELIRIUM THAN SUBJECTIVELY ESTIMATED

U. Guenther[1], N.U. Theuerkauf[1], J. Weykam[1], U. Andorfer[1], T. Muders[1], H. Wrigge[1], C. Putensen[1]

[1]University Hospital of Bonn, Anaesthesiology and Intensive Care Medicine, Bonn, Germany

**INTRODUCTION.** Delirium is frequent among patients in intensive care units (ICU) [1]. It is a serious condition, because it predicts prolonged length of stay in-hospital, and in ICU [2] increased treatment costs [3] and increased mortality up to 12 months after discharge. Though an increasing number of delirium assessment tools have been introduced, delirium monitoring is still often deemed too time consuming and dispensable, and mere clinical judgement with rather subjective criteria is considered sufficient. The incidence of delirium, however, has been reported to be severely underestimated [4].

**OBJECTIVES.** Aim of this study was to compare the subjectively estimated incidence of delirium to the assessment with the Confusion Assessment Method for Intensive Care Units (CAM-ICU) as the reference method.

**METHODS.** This observational study was carried out with approval from our institution's ethics committee. Every patient admitted to our 31-beds ICU during a 2-months period was rated (A) by his/her nurse as having or not having delirium by subjective delirium criteria, and (B) with the CAM-ICU as the reference method by two 4th year medical students unaware of the other raters' judgment. Patients on their day of admission were excluded, as well as those with severe neurological impairments (e.g., history of stroke, dementia) and non-German speakers. Patients' demographics, including TISS-28, SOFA, and SAPS II were calculated from patients' day charts, nurses' notes each day of assessment.

**RESULTS.** Out of 170 screened patients, one withdrew consent, 4 were excluded due to incomplete data, 5 constantly comatose patients died in ICU and were also excluded. Patients were not assessed if deeply sedated or in coma. 434 paired observations in 160 patients were completed. Delirium was diagnosed in 29% (n = 126) and excluded in 71% (n = 280) with the CAM-ICU. Without CAM-ICU, subjective assessment found delirium in 19.8% of observations (n = 86) during delirium, but also in 9.2% (n = 40) in patients without delirium. Delirium was not found in 6.5% (28 cases) though delirium was diagnosed with the CAM-ICU. Four patients who had delirium left the ICU without ever been recognized by subjective assessment.

**CONCLUSIONS.** Subjective assessment omits a considerable amount of patients with delirium, but overestimates the total number of patients with delirium. Routinely delirium monitoring will identify patients who require special treatment and exclude those who do not.

**REFERENCES.** 1. Bergeron N et al. (2002) Delirium […]. Crit Care 6:181–182.

2. Pisani MA et al. (2009) Days of delirium are associated with 1-year mortality […]. AJRCCM 180:1092–1097.
3. Milbrandt EB et al. (2004) Costs associated with delirium […]. CCM 32:955–962.
4. Spronk PE et al. (2009) Occurrence of delirium is severely underestimated […]. ICM 35:1276–1280.

**GRANT ACKNOWLEDGMENT.** Departmental funding.

## 0548

### INCREASED UNPLANNED EXTUBATIONS AFTER IMPLEMENTATION OF ANALGOSEDATION

G. Salet[1], M. Markese[1], F. Rozendaal[1], C. de Jager[1], M. Moviat[1]

[1]Jeroen Bosch Hospital, Department of Intensive Care, 's-Hertogenbosch, Netherlands

**INTRODUCTION.** Unplanned extubation (UE), defined as self- or accidental extubation, is an important complication in the intensive care unit (ICU) and considered as an internal indicator of quality of health care on ICU's in the Netherlands. UE is associated with increased ICU length of stay and mortality. Previously reported predisposing factors are lack of sedation and night shifts. We investigated the relation between the implementation of analgosedation and UE on our 14-bed mixed ICU.

**METHODS.** The incidence of UE in a 40-month period was retrospectively examined (January 2007–April 2010). In January 2009 our sedation protocol (midazolam and/or propofol combined with fentanyl) was changed.We started with analgosedation (remifentanil/propofol) in selected patients with impaired renal and hepatic function. Data regarding sedative use, level of sedation (RASS score) and time of the day of the UE were collected from our patient data management system (Metavision).

**RESULTS.** 2054 patients were included in the study, mean age was 63.3 ± 15.9 year, 56.3% of the patients were male. The APACHE-II score of the entire study cohort was 19.01 ± 7.8, 19.7% of the patients died during the stay in our hospital. 1,042 patients were mechanically ventilated during the study period.In the 2007 and 2008 the incidence of UE was 3.3 and 2.3%, respectively. In 2009 the incidence was 4.9% increasing to 10% in the first quarter of 2010. All UE's were self-extubations. More UE's occurred during night shift after implementation of analgosedation (Table 1). Reintubation rates ranged from 50 to 63% during the study period. There were no differences in sedation levels in the years studied. Mean duration of ventilation (days) decreased from 7.8 in 2007 to 4.2 in 2010.

**CONCLUSIONS.** Allthough the implementation of analgosedation seems to be associated with a shorter mean duration of ventilation this is complicated by an increased number of UE. Interestingly, a substantial part of the patients did not require re-intubation indicating the need to better distinguish these patients from the ones that needed re-intubation.

## 0549

### EFFECT OF REMIFENTANIL ON MITOCHONDRIAL OXYGEN CONSUMPTION OF CULTURED HUMAN HEPATOCYTES

S. Djafarzadeh[1], M. Vuda[1], J. Takala[1], S.M. Jakob[1]

[1]University Hospital Bern (Inselspital), Department of Intensive Care Medicine, Bern, Switzerland

**INTRODUCTION.** Mitochondrial dysfunction has been implicated in various diseases of critically ill patients. Since many of these patients receive analgesic drugs, effects of these compounds on mitochondrial functions are of interest. Remifentanil is a specific $\mu$-opioid receptor agonist and a potent short-acting synthetic analgesic drug.

**OBJECTIVES.** This study addressed the hypothesis that remifentanil might regulate oxygen consumption of cultured human hepatocytes and their isolated mitochondria.

**METHODS.** The human hepatoma cell line HepG2 were exposed to remifentanil at 50 or 500 ng/ml for 1 h or 50 ng/ml for 2, 4, 8 and 16 h, and cellular respiration rates were measured using a high-resolution oxygraph (Oxygraph-2 k, Oroboros Instruments, Innsbruck, Austria). Glutamate/malate, succinate or ascorbate/TMPD were used as substrates to test the function of complex I, II and IV, respectively. Isolated HepG2 cells' mitochondria (isolated by differential centrifugations) were incubated with remifentanil at 50 or 500 ng/ml for 1 h and respiration rates were also measured. Detection and analysis of inhibitory kBa (IkBα) phosphorylation of cell extract of remifentanil (50 and 500 ng/ml, for 30 min)-induced HepG2 were done with a FunctionELISA™ IkBα assay kit (Active Motif, Carlsbad, CA, USA). Remifentanil-treated HepG2 cells were fixed and embedded in Epon and ultrathin sections were analyzed with an EM12 transmission electron microscope (Philips, Eindhoven, Netherlands).

**RESULTS.** We observed early (within the first hour of incubation) remifentanil-induced (at 50 and 500 ng/ml) increases in maximal cellular respiration (Fig. 1a, b) (C: control, R: remifentanil). This effect was not present at 2, 4, 8 or 16 h of incubation. Preincubation with naloxone (1,000 ng/ml) for 1 h (Fig. 2a, b; black bars) prevented the remifentanil-induced increase in cellular respiration. Remifentanil did not interfere with isolated mitochondrial respiration of HepG2 cells. Remifentanil also induced phosphorylation of IkBa, denoting the stimulation of nuclear factor kB. There were no major alterations in cellular or mitochondrial ultrastructure. Mitochondrial respiration data are presented as mean ± SD. Statistical significance between samples using the paired sample t test is indicated.

**CONCLUSIONS.** The data suggest that remifentanil at 50 and 500 ng/ml interferes with cellular respiration of human hepatocytes.

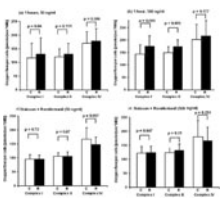


Fig. 1 HepG2 cells oxygen consumption

# Tracheostomy and airway management: 0550–0563

## 0550

### COMPLICATIONS OF TRACHEOSTOMY INSERTION IN CRITICALLY ILL PATIENTS: A PROSPECTIVE EVALUATION OF 200 PATIENTS

A.J. Glossop[1], T.C. Meekings[2], S.P. Hutchinson[3], S.J. Webber[1]

[1]Sheffield Teaching Hospitals NHS Foundation Trust, Department of Critical Care, Sheffield, UK, [2]Chesterfield and North Derbyshire Royal Hospital, Department of Critical Care, Chesterfield, UK, [3]Norfolk and Norwich University Hospital, Department of Anaesthesia and Critical Care, Norfolk, UK

**INTRODUCTION.** Quoted rates of complications following tracheostomy insertion vary greatly [1–4] with much of this data collected retrospectively. Due to large numbers of patients being lost to follow up there is little information available on complications occurring in patients with tracheostomies in situ or following their removal.

**OBJECTIVES.** To prospectively review all tracheostomies inserted into 200 consecutive critical care patients and record complications at the time of insertion, in patients whilst cannulated, and following decannulation.

**METHODS.** A questionnaire was completed at the time of insertion by the operator. All patients then received regular follow up visits whilst cannulated and post decannulation looking for complications directly related to tracheostomy insertion. Patients were followed up until hospital discharge, death or transfer to another institution.

**RESULTS.** Rates of major complications on insertion were: major bleeding 5%, tracheal wall injury 0.5%, pneumothorax 0.5%. There were no deaths attributable to tracheostomy insertion and 68.5% of patients had no insertion complications. Minor bleeding was seen in 12% and tracheal cartilage fracture in 6% of patients. Ninety-three percent of patients received at least one follow up visit. Complications in patients whilst cannulated were: prolonged bleeding 5%, pneumothorax 2%, surgical revision 3%, accidental decannulation 4% and tube blockage 6%. Of the blockages/displacements 40% resulted in a severe hypoxic event including 2 cardiac arrests. Sixty-two percent of patients received follow up post decannulation. One patient developed immediate respiratory problems and required recannulation. A high number of patients initially reported problems related to swallowing (liquids 12%, solids 5%) and phonation (hoarseness 4%, voice change 9%) however these symptoms settled in all patients other than one patient with a severe brain injury and one patient with a vocal cord palsy caused by lung cancer.

**CONCLUSIONS.** Rates of insertion complications were comparable to those previously described. Percutaneous tracheostomy can be safely performed in critical care patients. Our detailed follow up has highlighted an area of serious concern—blockage of tracheostomy resulting in hypoxia. All tracheostomies that blocked were single lumen tubes. No serious enduring problems were reported post decannulation in patients whilst still in hospital. However longer term follow up of patients following hospital discharge would be required to accurately assess frequency of late complications.

**REFERENCE(S).** 1. Fikkers BG et al. Anaesthesia. 2002; 57:1094–7.
2. Delaney et al. Critical Care. 2006;10(2):R55.
3. Silvester W et al. Crit Care Med. 2006;34(8):2145–52.
4. Diaz Regan G et al. Anaesthesia. 2008;63:1198–203.

**GRANT ACKNOWLEDGMENT.** n/a.

## 0551

### THE INDICATION FOR TRACHEOSTOMY IS THE MAIN DETERMINING FACTOR IN PREDICTING TIMING FOR TRACHEOSTOMY DECANNULATION

G. Hernandez[1], R. Ortiz[2], A. Pedrosa[2], R. Cuena[3], R. Fernandez[4], C. Vaquero[1], P. Gonzalez[1], S. Garcia[1]

[1]Hospital Infanta Sofia, Intensive Care, Madrid, Spain, [2]Hospital Virgen de la Salud, Intensive Care, Toledo, Spain, [3]Hospital Virgen de la Salud, Investigation Unit, Toledo, Spain, [4]Fundacio Althaia, Intensive Care, Manresa, Spain

**INTRODUCTION.** There is a lack of evidence-based protocols to decannulate tracheostomized patients because no variables have been clearly described to predict optimal timing for decannulation and outcome.

**OBJECTIVES.** Identificate decannulation-related variables by classifying tracheostomized patients into two groups based on the indication for tracheostomy, founded on variations in time to wean tracheostomized patients among subgroups of critically ill patients.

**METHODS.** This prospective observational cohort study took place in two medical-surgical ICUs. We excluded patients with do-not-resuscitate orders, tracheostomies for long-term airway control, neuromuscular disease, or neurological damage. We categorized patients into two groups according to the indication for tracheostomy: (1) prolonged weaning and/or mechanical ventilation; (2) low level of consciousness and airway management. A weaning and decannulation protocol was used. We recorded clinical and epidemiological variables of weaning from mechanical ventilation (MV): time to tracheostomy, time to decannulation, forced vital capacity (FVC), peak flow (PF), suctioning requirements and Glasgow Coma Score (GCS). Characteristics of respiratory secretions and swallowing function were categorized as semi-quantitative variables.

**RESULTS.** A total of 227 patients were tracheostomized in the ICUs, of which 151 were finally included in the study. Variables were analyzed in relation to the time period from weaning to decannulation. Time to decannulation was identified with multivariate analysis in Group 1 with: male gender [HR 1.74 (1.04–2.89), $p = 0.03$], age $> 60$ years [HR 0.58 (0.36–0.91), $p = 0.02$], suctioning frequency [HR 0.81 (0.67–0.97), $p = 0.02$], forced vital capacity [HR 0.48 (0.28–0.82), $p < 0.01$], peak flow [HR 0.25 (0.14–0.46), $p < 0.01$]; and in Group 2 with: GCS $< 13$ [HR 2.73 (1.51–4.91), $p < 0.01$], suctioning frequency [HR 0.7 (0.54–0.91), $p < 0.01$], and inadequate swallowing [HR 1.97 (1.11–3.52), $p = 0.02$].

**CONCLUSIONS.** The time to decannulation in tracheostomized patients varies significantly depending on the indication for tracheostomy.

**REFERENCE(S).** 1. Hernandez G, Fernandez R, Sanchez-Casado M, Cuena R, Lopez-Reina P, Zamora S, Luzon E. Tracheostomy tube in place at intensive care unit discharge is associated with increased ward mortality. Respir Care. 2009;54(12):1644–52.

2. Fernandez R, Bacelar N, Hernandez G, Tubau I, Baigorri F, Gili G, Artigas A. Ward mortality in patients discharged from the ICU with tracheostomy may depend on patient's vulnerability. Intensive Care Med. 2008;34 (10):1878–82.

## 0552

### SAFETY AND EFFICACY OF PERCUTANEOUS TRACHEOSTOMY TECHNIQUES IN CRITICALLY ILL PATIENTS: A COMPARATIVE META-ANALYSIS OF RANDOMIZED TRIALS

L. Cabrini[1], G. Monti[1], G. Landoni[1], D. Mamo[1], V.P. Plumari[1], F. Boroli[1], S. Colombo[1], A. Zangrillo[1]

[1]Ospedale San Raffaele, Vita-Salute University, Milan, Italy

**INTRODUCTION.** Percutaneous dilatational tracheostomy (PDT) is a common procedure in ICU: identification of the best technique is relevant for a large number of ICU patients.

**OBJECTIVES.** We performed a meta-analysis of randomized studies comparing PDT techniques in critically ill patients to investigate if one technique is superior to the others with regards to intraprocedural complications.

**METHODS.** The following inclusion criteria were employed for potentially relevant studies: (a) random allocation to treatment, (b) comparison of two different PDT techniques. The exclusion criteria were: (a) non-parallel design (i.e. cross-over) (b) duplicate publications, (c) absence of outcome data.

**RESULTS.** We identified only nine eligible randomized clinical trials [1–9]. All PDT were performed in an ICU settings. PDT were performed by intensivists and surgeons. The Griggs' technique, the Ciaglia's single and multiple-dilator resulted equivalent with regard to severe complications or the need for conversion to another percutaneous or surgical approach; the single-dilator showed a lower incidence of mild complications than the Griggs' PDT. The Trans-Laringeal Tracheostomy and PercuTwist had a higher rate of complications. No recommendation for specific subgroups (obese patients, trauma patients, neurosurgical patients and so on) can be made.

**CONCLUSIONS.** The safety profile of the Griggs', the Ciaglia's single and multiple-dilator PDT appeared largely equivalent, with single-dilator slightly superior.

**REFERENCES.** 1. Anon JM et al. Percutaneous tracheostomy: Ciaglia Blue Rhino versus Griggs' guide wire dilating forceps. A prospective randomized trial. Acta Anesthesiol Scand. 2004;48:451–6.
2. Ambesh SP et al. Percutaneous tracheostomy with single dilatation technique: a prospective randomized comparison of Ciaglia Blue Rhino versus Griggs' guidewire dilating forceps. Anesth Analg. 2002;95:1739–45.
3. Van Heurn LWE et al. Comparative clinical trial of progressive dilatational and forceps dilatational tracheostomy. Intensive Care Med. 2001;27:292–5.
4. Nates JL et al. Percutaneous tracheostomy in critically ill patients: a prospective randomized comparison of two techniques. Crit Care Med. 2000;28:3734–9.
5. Kaiser E et al. Prospective randomized comparison of progressive dilational versus forceps dilational percutaneous tracheostom. Anaesth Intensive Care. 2006;34:51–4.
6. Johnson JL et al. Crit Care Med 2001;29:1251–4.
7. Byhahn C et al. Percutaneous tracheostomy: Ciaglia Blue Rhino versus the basic Ciaglia technieque of percutaneous dilational tracheostomy. Anesth Analg 2000;91:882–6.
8. Cantais E et al. Percutaneous tracheostomy: prospecive comparison of the translaryngeal technieque versus the forceps-dilational technique in 100 critically ill adults. Crit Care Med 2002;30:815–9.
9. Byhahn C et al. Single-dilator percutaneous tracheostomy: a comparison of percuTwist and Ciaglia Blue Rhino techniques. Intensive Care Med 2002;28:1262–6.

## 0553

### CERVICAL ULTRASONOGRAPHY IN PERCUTANEAL TRACHEOSTOMY

J. Baldirà[1], K. Núñez[1], M. Rodríguez[1], L. Zapata[1], I. Moran[1], A. Torrego[2], E. Montserrat[3], X. León[4], L. Marruecos[1]

[1]Hospital de la Santa Creu i Sant Pau, Intensive Care Unit, Barcelona, Spain, [2]Hospital de la Santa Creu i Sant Pau, Pneumology, Barcelona, Spain, [3]Hospital de la Santa Creu i Sant Pau, Radiology, Barcelona, Spain, [4]Hospital de la Santa Creu i Sant Pau, Otolaryngology, Barcelona, Spain

**INTRODUCTION.** Percutaneal tracheostomy is a current method used for infraglotic cannulation (IC) in Intensive Care Units (ICU) which is not exempt of complications.

**OBJECTIVES.** The use of cervical ultrasonography can help deciding the most suitable IC technique.

**METHODS.** Prospective descriptive study undergone from 2006 to 2009 in a medicochirurgical ICU at a University Hospital. The protocol consisted on systematized physical exploration complemented with Cervical Doppler Ultrasound (CDU), collecting the following data: (a) cervical vessels in cervical midline (yes/no); (b) difficulty when identifying laryngeal structures [I: structure visualization (thyroid cartilage and/or cricoid); II: palpation of neck structures, III: palpation of thyroid or cricoid cartilages; IV: no cervical structures palpation; V: anatomic distortion]; (c) cricosternal distance (CD) (> 3 cm); (d) cervical midline occupation by CDU (thyroid-vessels; yes/no). Percutaneal tracheostomy (PT) was performed when the laryngo-thyroideal area did not show vessels on cervical midline, on a laryngeal difficulty grade less than III, CD > 3 cm. and free cervical midline in CDU. The IC were done under fibrobronchoschopic vigilance and performed by ICU medical staff. Surgical coniostomy (SC) was indicated as the first technique to be used in view of PT contraindication under I-III laryngeal difficulty. Surgical tracheostomy (ST) when IV–V laryngeal difficulty or impairment at performing (SC) or cervical radiotherapy. The impediment of a branchiochephalic trunk by means of physical exploration and/or (CDU) contraindicated PT and ST.

**RESULTS.** Of the 144 patients who were studied, 51 were female and 93 male, within an average age between 62.5 ± 14.9 years old; APACHE II 20.4 ± 9.0; average time of laryngeal intubation 19.5 ± 9.1 days and average stay at ICU from 35.9 ± 22.5 days. 144 IC were performed, out of which PT 79 (55%), SC 49 (34%) and ST 16 (11%). CDU changed the use of PT to SC or ST in 15 (11%) of patients out of the performed 49 SC (22%), as well as in 4 of the performed 16 ST (25%) which become the 23% of the total amount of SCs and STs. The early complications observed were angle encasement in 3 PT, several punctures (3–4) in 1 PT, lateral puncture in 1 PT, small bleeding and punctual desaturation in 1 PT, reintubation in 1 CT and in one case the bronchoscopic puncture. Only there was a serious one being bleeding during the performance of PT in a patient with a previous history of laryngeal malignancy that required conversion to ST. The incidende of early complications was 0.047% (total 0.1%).

**CONCLUSIONS.** To conclude, CDU can be a very useful instrument when deciding the most suitable IC technique in ICU patients as well as helping reduce the risk of possible complications.

## 0554

### ET-VIEW® FOR PERCUTANEOUS DILATIONAL TRACHEOSTOMY: AN ALTERNATIVE TO FIBEROPTIC BRONCHOSCOPIC GUIDANCE?

C.P. Guido[1], S. Pieri[1], A. Zeffiri[1], C. Pelagatti[1], A.R. De Gaudio[1]

[1]Azienda Ospedaliera Universitaria Careggi, Anesthesiology and Intensive Care, Florence, Italy

**INTRODUCTION.** Percutaneous Dilational Tracheostomy (PDT) is a common procedure for airway management in critically ill patients requiring long-term ventilatory support. Although infrequent, some of the early complications related to the procedure may lead to hypoxia, such as false passage, pneumothorax, guidewire dislodgement, difficult tube placement and tracheal laceration. Performing PDT under fiberoptic bronchoscopic guidance reduces the number of complications even though it may cause a decrease in oxygen tension due to the difficulty to properly ventilate the patient.

**OBJECTIVES.** We evaluated the possibility to ventilate the patient during tracheostomy execution using an endotracheal tube with a camera embedded tip for continuous visualization of patient airways on a dedicated monitor (ET-view, Unimedical Bio.Tech., Italy).

**METHODS.** Ten adult patients underwent PercuTwist PDT using ET-view instead of video fiberoptic bronchoscopy. Each PDT was performed under total intravenous anaesthesia, myoresolution and volume controlled ventilation. Heart rate, pulsoxymetric oxygen saturation and arterial blood pressure were monitored. ET-view was placed using an airway exchange catheter under continuous visualization. Mechanical ventilation (Tv 8–10 ml/kg, PEEP 5 $cmH_2O$, RR 12 bpm, $FiO_2$ 1.0) was maintained by using the ET-view tube throughout the whole duration of the procedure. Duration of each procedure was recorded.

**RESULTS.** All tracheostomies were successfully completed. Procedures lasted 8 ± 2 min. No patient had major adverse events. No episode of hypoventilation occurred and peripheral oxygen saturation was always maintained between 94 and 100%.

**CONCLUSIONS.** Compared to fiberoptic bronchoscopy, ET-view enables the operator to perform PDT under continuous endoschopic surveillance as well, but may be at lower risk of hypoventilation and hypoxia. The full management of airways is in fact ensured for the whole duration of procedure, since control of ventilation is guaranteed through the ET-view tube. ET-view may be a safe device to perform PDT, alternative to fiberoptic bronchoscope, particularly in those patients who cannot tolerate (e.g. neurosurgical patients) or are at greater risk of hypoxia (e.g. septic patients, one-lung patients).

## 0555

### NATIONAL SURVEY TO ASSESS THE CONTENT AND AVAILABILITY OF DIFFICULT AIRWAY CART IN CRITICAL CARE UNITS IN THE UNITED STATES

J. Porhomayon[1]

[1]University of Rochetser, Anesthesiology, Rochester, USA

**INTRODUCTION.** Limited data are available on the impact of difficult airway carts (DAC) in the management of airway in the intensive care unit. It is strongly recommended that a DAC be present.

**METHODS.** Following an internal review of Difficult Airway Cart at VA Medical Center an affiliate of the University of Buffalo a tertiary referral center for Cardiac, Thoracic and Otolaryngology surgery. We devised a set of proposals regarding what constitutes an ideal Difficult Airway Cart (Table 1). Survey was developed using dichotomous questions. It was first piloted among our own ICU physicians. In September 2009, 300 surveys were mailed to both surgical and medical intensive care unit directors with more than 5 years experience in academic institutions in the USA. ICU with less than 12 beds were excluded. This survey inquired the physicians regarding training in the use of emergency airway cart and the specific devices they had used for intubations. The number and percentage of availability of these equipments in ICU settings were determined separately in the responding surveys. The trends of presence or absence of these equipments and their possible effects in DAM situations were studied.

**RESULTS.** Only 70% of responses had a DAC in their unit. 82% of units surveyed checked the contents of the cart daily. 80% of directors were aware of its location. 80% of units had an attached list of contents and 51% had an attached algorithm for the management of a difficult airway. LMA was present in 80% followed by 35 and 30% of Combitube and Pre-assembled Needle Cricothyroidostomy set. Under the Non-Invasive airway devices video laryngoscope (VL) with 48% was ahead of Fibreoptic Bronchoscope (FOB) 38% and Lighted Stylet 15%. 80% of units had a $CO_2$ detection device immediately available.

**CONCLUSIONS.** It is strongly recommended that a DAC be present. What constitutes the ideal contents of a DAC is open to questions. We hope discussion will leadto consensus of what should or should not be included in the cart.

**REFERENCE(S).** 1. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology. 2003;98:1269–77.

2. Crosby ET, Cooper R M, Douglas MJ, Doyle DJ, Hung OR, Labrecque P, Muir H. The unanticipated difficult airway with recommendations for management. Can J Anaesth. 1998;45:757–76.
3. Bein B, Scholz J. Supraglottic airway devices. Best Pract Res Clin Anaesthesiol. 2005;19:581–93.
4. Savoldelli GL, Schiffer E, Abegg C, Baeriswyl V,Clergue F,Waeber J L,Comparison of the Glidescope, the McGrath, the Airtraq and the Macintosh laryngoscopes in simulated difficult airways*. Anaesthesia. 2008;63:1358–64.

## 0556

### CIAGLIA BLUE DOLPHIN: A NEW MODALITY OF PERCUTANEOUS TRACHEOTOMY

E. González Higueras[1], M.J. Bruscas[1], P.V. de Paz[1], L.F. Solana[1], J.C. Pérez[1], J.B. Araujo[1], M.A. Garijo[1], M.O. Castro[1], A. Corrales[1], F.F. Contreras[1], J.M. Añón[1]

[1]Hospital Virgen de la Luz, Intensive Care Medicine, Cuenca, Spain

**BACKGROUND.** Since Ciaglia et al. first described percutaneous dilatational tracheotomy (PDT) in 1985, percutaneous tracheotomy (PT) has gained widespread acceptance to control the airway in patients requiring prolonged ventilatory support. Since then, new techniques for PT have been described. Ciaglia Blue Dolphin (CBD) is the latest modification upon the technique of PT by dilatation in which the tracheotomy is performed by balloon dilatation.

**METHODS.** Prospective, observational study, carried out in a medical/surgical ICU. Nineteen critically ill adult patients were undergoing to CBD technique under endoscopic guidance. Description: once skin incision, tracheal puncture and predilatation have been performed, a balloon-cannula apparatus is passed over a guidewire until the tip of the balloon mounted at the distal end of the apparatus is seen in the trachea. Afterwards, the balloon is inflated with saline until 11 atm for 10–15 s, then deflated and the tracheotomy cannula is placed by advancing the entire apparatus into the trachea. The apparatus and guidewire is then removed, leaving only the cannula in place. The following variables were assessed: surgical time (from skin cut to the insertion of the tracheotomy tube), sex, age and surgical complications during and after the surgery (bleeding, desaturation, atelectasis, pneumothorax, pneumomediastinum, airway loss, impossibility of finishing the technique, surgical wound infection, laceration of the trachea, death as a result of the technique).

**RESULTS.** Nineteen procedures were performed in 19 mechanically ventilated patients. Thirteen of them were men. Age: 66.2 ± 14.1 years. APACHE II: 19.7 ± 4.3. Duration of the procedure: 3.5 min (r: 2–6). No complications were noted. Four patients (21%) died in ICU for their underlying pathology. Two patients stay currently in the ICU. Ten patients were discharged from the ICU with tracheotomy tube in place.

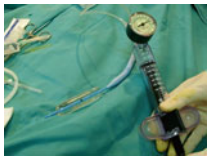


Figure 1

**CONCLUSION.** In spite of our small serie, (due to the recent introduction of this technique), we conclude that CBD is a safe and easy method of percutaneous tracheotomy.

## 0557

### DISLODGEMENT OF TRACHEOSTOMY TUBES IN AN ADULT ICU: A CASE SERIES

K. Dingli[1], M. Nel[1], G. Chilvers[1], C.M. Gómez[1]

[1]St. Marys Hospital, Adult Intensive Care Unit Imperial College, London, UK

**INTRODUCTION.** Tracheostomy to facilitate weaning from mechanical ventilation is a well established procedure commonly performed in critically ill patients. Of all the described post-procedural complications, Tracheostomy Tube Dislodgement (TTD) is a relatively common and potentially serious complication. Incidence of TTD following Surgical (ST) versus Percutaneous Dilatational Tracheostomies (PDT) varies across studies partly due to differences in the definitions used [1, 2].

**OBJECTIVES.** We investigated the incidence and type of TTD in patients receiving PDT versus ST.

**METHODS.** Data were collected prospectively from the 13-bedded unit with a mixed medical and surgical adult population over a 14-month period. All patients who underwent a tracheostomy were included. The decision on tracheostomy and technique was taken by the ITU consultant based on clinical assessment. PDT was performed using a dilatation technique [3]. ST was performed by a surgical colleague at the bedsite (standard tracheal window technique). Subgroup comparisons were carried out between the ST and the PDT group with emphasis on the incidence of TTD, defined as accidental decannulation by the patient or displacement with leak requiring repositioning. The Chi-square test was used to compare differences between groups. Values are presented as mean ± SD or median (IQR).

**RESULTS.** Tracheostomy was carried out in 127 pts (78 male, mean age 62 ± 15 years, mean BMI 26 ± 6 $kg/m^2$). Mean length of stay was 21 ± 13 days, mean day of procedure following admission was 7 ± 4 days and median APACHE IV score was 55 (IQR 25). ST was carried out in 97 pts (76%) and PDT in 30 pts. There were 33 post-procedural complications in total, significantly more in the ST group ($p < 0.001$). TTD was the most common post-procedural complication ($p < 0.001$). Other complications were bleeding ($n = 2$) and pneumomediastinum ($n = 1$).

TABLE 1 COMPLICATIONS IN THE ST AND PT GROUPS

| Complications | | PDT | ST | Total |
|---|---|---|---|---|
| Dislodgement | Accidental Decannulation | 4 | 14 | 18 |
| | Leak and replacement | 0 | 12 | 12 |
| Other | | 0 | 3 | 3 |
| Total | | 4 | 29 | 33 |

**STUDY LIMITATIONS:** This is a non-randomised prospective study. The lower incidence of complications in the PDT group is therefore likely attributable to selection bias.

**CONCLUSIONS.** These preliminary data support previous findings of more frequent complications in surgical tracheostomies. We have identified a high incidence of tracheostomy tube dislodgements in both types of tracheostomies which warrants further investigation.

**REFERENCES.** 1. Higgins KM, Punthakee X. Meta-analysis omparison of open versus percutaneous tracheostomy. Laryngoscope. 2007;117:447–54.

2. Friedman Y, Fildes J, Mizock B et al. Comparison of percutaneous and surgical tracheostomies. Chest 1996;110:480–5.
3. Ciaglia P, Firsching R, Syniec C. Elective percutaneous dilatational tracheostomy. Chest 1985;87:715–9.

## 0558

### PREDICTIVE INDICATORS OF DIFFICULT INTUBATION IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA SYNDROME

S. Rodríguez Villar[1], R. Hidalgo Carbajal[2], M. Sánchez Casado[1], D. Vielba Dueñas[2], J. Quiles Lapuerta[2], E. López Gabaldón[2], J. García del Palacio[2]

[1]Hospital Virgen de la Salud, Intensive Care Department, Toledo, Spain, [2]Hospital Virgen de la Salud, Chest Department, Toledo, Spain

**INTRODUCTION.** Patients with Obstructive Sleep Apnoea Syndrome (OSAS) face greater surgical risk. Anatomical and funcional abnormalities in the upper airways associated with this condition increase the risk of difficult intubation (DI) and problems with permeability of the upper airway, both during anaesthesia and post-surgery.In routine preoperative assessment, indices based on various anatomical features can be used to estimate the risk of difficult intubation. Of these morphometric indices, the most commonly used in clinical practice are: thyromental distance (TMD) and Mallampati score (MS). Since OSAS is, in itself, an indicator of DI, OSAS patients more frequently present with high DI indices.

**OBJECTIVES.** To determine the prevalence of different DI risk factors (DIRF), using the indices most widely used in clinical practice, in a series of patients diagnosed with OSAS and study whether a relationship exists between the severity of the OSAS [according to the apnea-hypopnea index (AHI)] and the prevalence of the DI risk factor (DIRF).

**METHODS.** Consecutive patients referred for consultation with breathing disorders during sleep, diagnosed with OSAS by home polygraph, were selected for the study. An AHI of $> 5$ was considered as diagnosis of OSAS. In these patients, a number of different clinical and morphometric indices were evaluated: neck diameter, body mass index (BMI), Mallampati score (MS), mouth aperture (MA), atlanto-occipital joint extension (AOJE), measurement of thyromental distance (TMD), mandibular protrusion (MP), horizontal mandible length (HML). Considered as a DI risk factor (DIRF): Mallampati $> 2$, MA $< 2$ cm, AO JE absent, MP absent, TMD $< 6$ cm, HML $< 9$ cm.

**RESULTS.** 77 patients were selected. 65 males (84.4%). Average age was 50.6 ± 11.67 years old.

RESULTS

| DIRF | N (%) | AHI DIRF | AHI without DIRF | dif |
|---|---|---|---|---|
| Mallampati 3-4 | 26 (33.8%) | 51.3 ± 27 | 41.4 ± 25.2 | ns |
| MA < 2 cm | 1 (1.3%) | 74 | 44.3 ± 26 | ns |
| MP absent | 10 (13%) | 46.7 ± 18.3 | 44.4 ± 27.1 | ns |
| AOJE absent | 2 (2.6%) | 57 ± 4.2 | 43 ± 25.7 | ns |
| TMD < 6 cm | 2 (2.6%) | 54 ± 28 | 44.5 ± 26.2 | ns |
| HML < 9 cm | 3 (3.9%) | 29 ± 6.2 | 45 ± 26.4 | ns |
| Total (all DIRFs) | 33 (42%) | 49.4 ± 25.2 | 33 ± 49.4 | ns |

RESULTS 2

| AHI | BMI | TMD | HML | Ø Neck |
|---|---|---|---|---|
| 44.7 ± 26 (8.8–122) | 31.6 ± 6.12 | 8.6 ± 1.3 cm (6–13) | 11 ± 1.05 cm (8–14) | 42 ± 3.6 cm (34–51) |

RESULTS 3

| | Mild SAHS (AHI 5–20) | Moderate (AHI 21–40) | Severe (AHI > 40) |
|---|---|---|---|
| Patients with DIRF n (%) | 2 (2.6%) | 14 (18%) | 17 (22%) |
| Without DIRF n (%) | 9 (11.7%) | 20 (26%) | 15 (19.5%) |

**CONCLUSIONS.** In the study population, there was a high proportion of patients presenting with DIRF (42%), mainly owing to the Mallampati scores. It can be seen that patients with DIRFs tended to present with a higher AHIs, however, this did not reach a level of statistical significance.Patients with severe OSAS also presented with more predictive indicators of difficult intubation than those with mild-moderate OSAS.

## 0559

### TRACHEAL SECRETION MANAGEMENT IN THE MECHANICALLY VENTILATED PATIENT: COMPARISON BETWEEN STANDARD ASSESSMENT AND AN ACOUSTIC SECRETION DETECTOR

A. Zanella[1], A. Lucchini[2], G. Bellani[1,2], G. Foti[2], A. Pesenti[1,2], R. Fumagalli[1,2]

[1]University of Milano-Bicocca, Department of Experimental Medicine, Monza, Italy, [2]San Gerardo Hospital, Department of Perioperative Medicine and Intensive Care, Monza, Italy

**INTRODUCTION.** Standard indicators for endotracheal suctioning are often based on clinical judgement which relies on the deterioration of the patient's condition and/or routine suctioning. TBA Care®, a secretion detector, analyses airway sounds and indicates the need for suctioning.

**OBJECTIVES.** In a prospective randomized trial we studied the efficacy of TBA Care® in detecting the presence of retained secretions compared to standard indicators.

**METHODS.** 72 general ICU patients were randomized at intubation into two groups differing only from suctioning indications. Control group indications: at least three times a day or clinically driven. Secretion detector group indications: device signal or clinically driven. For each suctioning procedure we recorded the indication and amount of secretions removed. Patients were followed until ICU discharge or extubation. Diagnosis of ventilator associated pneumonia (VAP) was confirmed through tracheal aspirate.

**RESULTS.** We recorded a total of 1,705 suctioning procedures in the control group and 1,354 in the secretion detector group. Patients in the secretion detector group were suctioned less frequently (3.9 ± 2.3 vs. 4.8 ± 1.2 suctioning procedures/day; $p = 0.002$) and with a lower rate of "unnecessary" suctionings, defined as suctioning with no collected secretions (3.5 vs. 12.1%; $p < 0.001$). In the secretion detector group 97.3% suctioning procedures were performed following indication of the device while in the control group clinical deterioration (65.2%) was the most frequent indicator. The incidence of VAP was similar in both groups.

**CONCLUSIONS.** TBA Care® seems a valid indicator for timely suctioning, anticipating clinical deterioration due to secretion retention and reducing unnecessary suctioning procedures.

## 0560

### NATIONAL SURVEY OF FENESTRATED AND NON-FENESTRATED TRACHEOSTOMY TUBE USE AND OCCURRENCE OF SURGICAL EMPHYSEMA IN UK ADULT INTENSIVE CARE UNITS

H.R.F. Powell[1], S. Hanna-Jumma[2], J.M. Philpott[1], D. Higgins[2]

[1]Southend University Hospital NHS Foundation Trust, ENT, Southend on Sea, UK, [2]Southend University Hospital NHS Foundation Trust, Critical Care, Southend on Sea, UK

**INTRODUCTION.** Surgical emphysema is a complication of tracheostomy that has been reported to occur in 20% (35/178) of United Kingdom (UK) intensive care units [1]. In several cases this has been associated with the early insertion of a fenestrated tracheostomy tube [2–4]. In the presence of positive pressure ventilation, air may leak from a fenestrated tube into the tissues even when a non-fenestrated inner cannula is inserted [5]. The UK Intensive Care Society guidelines for temporary tracheostomy 2008 recommend that fenestrated tracheostomy tubes should be used with caution in mechanically ventilated patients and only in patients who are weaning from ventilation [6]. The guidelines also state if a fenestrated tube is used, it is vital that the position and on-going patency of the fenestration(s) are checked regularly, but do not specifically recommend how this should be done.

**OBJECTIVES.** Primary—Prospective questionnaire study of adult intensive care units in the UK to establish the current practice with respect to use of fenestrated tracheostomy tubes and also to ascertain the incidence of surgical emphysema related to tracheostomy. Secondary—Establish current UK practice regarding the requesting of chest radiographs after tracheostomy and find out if units have changed their practice since publication of the TracMan study [7].

**METHODS.** A questionnaire was designed by the authors and distributed via email and web based technology (zapsurvey.com) to 110 general adult intensive care units in the UK. After 3 weeks, units that had not responded were contacted by telephone. Data was compiled and analysed using Microsoft excel.

**RESULTS.** 69 of the 110 units (63%) completed questionnaires (28 via internet survey and 41 by telephone). 63/69 units (91%) insert a non-fenestrated tube at the time of initial percutaneous tracheostomy and 6 (9%) use fenestrated tubes. 44/63 units electively changed the original tube to a fenestrated tube prior to discharge to the wards. Only 10 (14.5%) units check the position of the fenestration(s) in the tracheal lumen endoscopically when using a fenestrated tube. 43 units (62%) reported 1 or more cases of surgical emphysema related to tracheostomy. 61/69 (88.4%) units routinely request a chest radiograph after initial tracheostomy insertion compared with only 19 units (27.5%) that do so after a tube change.

**CONCLUSIONS.** In accordance with UK ICS guidelines [6] we would like to re-iterate that fenestrated tubes should not be inserted at the time of initial percutaneous tracheostomy. We would recommend that if a fenestrated tube is being used in a mechanically ventilated patient the position of the fenestration(s) in the tracheal lumen should be checked using flexible endoscopy. If however the patient is spontaneously ventilating the position of the fenestration(s) need only be checked if there is clinical suspicion of a problem.

**REFERENCE(S).**

Krishnan, Mostert, Fikkers, Orme, Fikkers. http://www.ics.ac.uk.

## 0561

### INCIDENCE OF SWALLOWING DISORDERS IN PATIENTS REQUIRING MORE THAN 7 DAYS OF INVASIVE MECHANICAL VENTILATION: PRELIMINARY RESULTS OF A PILOT STUDY

G. Beduneau[1], F. Soulis[2], P.G. Guitard[2], D. Carpentier[2], P. Bouchetemble[2], F. Tamion[2], C. Girault[2], A. Mercat[3], G. Bonmarchand[2], J.C.M. Richard[2]

[1]University Hospital, Rouen, France, [2]University Hospital, Bonn, Germany, [3]University Hospital, Angers, France

**INTRODUCTION.** Patients exposed to prolonged endotracheal intubation are at increased risks for significant swallowing disorders (SD) which may complicate the post-extubation period.

**OBJECTIVES.** Data in the literature about incidence and clinical impact of thus disorders are heterogeneous [1]. The primary aim of this pilot study was to evaluate incidence of SD occurring in patients with more than 7 days of invasive mechanical ventilation.

**METHODS.** A prospective pilot study realized in a 20 beds adults medical ICU of an University hospital. During 9 months (July 2009 and March 2010), we screened all patients with more than 7 successive days with intubation at the time of extubation. Only those without pre-existing comorbidities possibly associated with SD and able to cooperate were enrolled in the final analysis. A clinical standardized test specifically designed to detect SD was performed by a dedicated physiotherapist 24–48 h after extubation. This test combines clinical evaluation of cranial nerves and a swallowing test using water [2]. Preliminary data of patients without SD and with SD were compared using non parametric statistical test.

**RESULTS.** During the study period, 340 patients underwent intubation for at least 24 h. Among them, 48 patients (14%) have been intubated for more than 7 successive days, and 40 were enrolled : median age [mini–maxi] was 62 year [25–83], median duration of MV and ICU stay were, respectively, 11 days [8–47] and 17 days [8–56]. The SD detection test, performed in all patients within 48 h after extubation, was positive in 17 (43%) and negative in 23 (57%).

TABLE

| | Without SD (n = 23) | With SD (n = 17) | p |
|---|---|---|---|
| Age (mean ± SD) | 61 ± 14 | 54 ± 14 | 0.154 |
| MV duration (median, IQR) days | 9 (8–15) | 15 (11–25) | <0.01 |
| ICU LOS (median, IQR) days | 12 (11–20) | 19 (15–39) | <0.05 |
| LOS after extubation (median, IQR) days | 2 (2–4) | 7 (3–9) | <0.01 |

Only three patients with SD were evaluated by an oto-rhino-laryngologist because of clinical persistence of SD, several days after extubation. The fiberoptic endoscopic evaluation revealed incomplete glottal closing ability because of decreased mobility of one vocal cord in these three patients. Among the 40 patients, 3 required al least one reintubation. Two of them had swallowing disorders after the first extubation.

**CONCLUSIONS.** Based on these preliminary results, 43% of patients with prolonged mechanical ventilation exhibit SD. SD is associated with a prolonged MV duration and ICU stay. A prospective multicenter study is planned to identify in a larger cohort the risk factors and impact on clinical outcome of SD in patients intubated for more than 7 days.

**REFERENCE(S).**

1. The incidence of dysphagia following endotracheal intubation: a systematic review. Skoretz, Chest. 2010;137:665–73.

2. Postextubation fiberoptic endoscopic evaluation of swallowing after prolonged endotracheal intubation: a randomized, prospective trial. Barquist, CCM 2001;29:1710–3.

**GRANT ACKNOWLEDGMENT.** SRLF and ADIR.

## 0562

### HYPOGLOSSUS NERVE PARALYSIS: AN UNDERESTIMATED CAUSE OF SWALLOWING DISORDERS AFTER PROLONGED MECHANICAL VENTILATION

P.-G. Guitard[1], G. Beduneau[1], P. Bouchetemble[1], F. Soulis[1], N. Chastan[1], G. Bonmarchand[1], J.-C.M. Richard[1]

[1]University Hospital, Rouen, France

**INTRODUCTION.** Swallowing disorders (SD) are an usual and probably underestimate cause of extubation failure in ICU [1]. While laryngeal-pharyngeal oedema is often the only aetiology suspected, the failure of any organ used in the swallow process and specially the tongue could also be involved.

**OBJECTIVES.** To report a cohort of difficult to wean patients who develop a tongue paralysis during their stay in order to discuss causes and consequences of this unfamiliar SD aetiology.

**METHODS.** A retrospective study realized in a six beds weaning units (WU) of an university hospital. Between Nov 2003 and Nov 2008, all patients admitted in the WU for management of prolonged mechanical ventilation (MV) were systematically submitted to a clinical test of cranial nerves and to a deglutition test. All patients with a clinical diagnostic of unilateral or bilateral hypoglossus nerve paralysis were enrolled. SAPS 2, duration of MV, type of paralysis and association with others cranial nerves abnormalities were checked. We also looked for the causes of this paralysis and notified the intensity of the SD recovery 1 year after ICU discharged.

**RESULTS.** During the study period, 229 patients were admitted in the WU and hypoglossus paralysis was found in 10 of them (4%). Among the 10 patients, 5 were tracheotomised after at least 1 re-intubation and 2 were tracheotomised without any extubation attempt. Two patients required one re-intubation before a successful extubation. The last patient was successfully extubated after 10 days of MV. The median age of the population was 44 years (IQR: 36–59). The median SAPS2 score was 46 (43–76) and their median duration of mechanical ventilation was 31 days (25–72). All patients had a peripheric paralysis confirmed in electromyography. In five cases the tongue paralysis was associated with others cranial nerves block whose three with an homolateral recurrent laryngeal nerve paralysis (Tapia's syndrome). The aetiology of the paralysis was obvious in three cases: two Tapia's syndrome due to an homolateral jugular thrombosis after a central venous jugular catheter and one post infectious Guillain–Barre syndrome. In the sevenother cases, we found three ICU acquired neuromyopathy and two HSV seroconversion without any clinical sign of infection. For two patients, we were not able to find any abnormality that could be related to the isolated tongue paralysis. One year after discharged, seven patients had a complete recovery.

**CONCLUSIONS.** Hypoglossus nerve paralysis is a unusual cause of SD, easy to detect by a simple clinical exam. Because of the unexpected significant incidence reported in this study, we suggest that a systematic clinical evaluation of cranial nerves (specially hypoglossus) should be associated with the currently performed swallowing test for further SD studies.

**REFERENCE(S).** 1. The incidence of dysphagia following endotracheal intubation: a systematic review. Skoretz, Chest. 2010;137:665–73.

## 0563

### EXPERIENCE WITH THE BONFILS SEMI-RIGID STYLET ASSISTED PERCUTANEOUS DILATIONAL TRACHEOSTOMY

V. Khridin[1], N.A. Pedersen[1]

[1]Copenhagen University Hospital Glostrup, Anaesthesiology and Intensive Care, Copenhagen, Denmark

**INTRODUCTION.** Through the recent years a fiberscopic control has being increasingly used during percutaneous dilational tracheostomy (PDT) in order to observe the needle insertion and to stabilize the endotracheal tube under retraction. It is shown that a Bonfils semi-rigid stylet (BSS) (Karl Storz Endoscope) has several advantages compared to a flexible endoscope [1]. We report a frequency of usage of the fiberscopic control, particularly BSS, during PDT in our hospital's six-beds general and nine-beds neurosurgical intensive care units in 2009, as well as our experience with BSS.

**OBJECTIVES.** All tracheostomy procedures performed in 2009 were registered and described as surgical, PDT with flexible fiberscope and BSS.

**METHODS.** The curve of the tip of BSS was reduced from 45° to 30° in order to make a passage through the endotracheal tube easier. The BSS was connected to a Karl Storz Medi Pac™ video monitor. Usage of BSS during PDT was compared a flexible endoscope.

**RESULTS.** Forty-seven tracheostomies were performed in 2009. Fifteen (31.9%) of them were performed surgically and 32 (68.1%) as PDT. 10 procedures (31.2% of all PDT) were guided with BSS, 7 (21.9%) procedures with a flexible scope and 15 (21.9%) were performed without usage of any fiberscopic control. 10 cases have shown that a modified Bonfils semi-rigid stylet comparing to a flexible scope provides better stabilization of the larynx and the trachea, better stabilization of the tube when the tube is retracted above the vocal chords. Besides, only one hand is needed to keep both the tube and the stylet. There is no risk of fiber damage under needle insertion. Connected to a video monitor, the BSS makes it possible for a PDT performing doctor to visualize and adjust the needle insertion into the trachea as well as observe the entire procedure.

**CONCLUSIONS.** PDT guided by BSS provides several advantages compared to a flexible endoscope and can be recommended as a routine technique.

**REFERENCE.** 1. U. Buehner, J. Oram, S. Elliot, A. Mallick, A. Bodenham. Bonfils semirigid endoscope for guidance during Percutaneous tracheostomy. Anaesthesia. 2006;61:665–70.

# Improving outcome in COPD and ARDS: 0564–0577

## 0564

### HOSPITAL LEVEL AND OUTCOME OF MECHANICALLY VENTILATED PATIENTS WITH AND WITHOUT ARDS IN GERMANY

K. Raymondos[1], M. Quintel[2], T. Dirks[1], J. Ahrens[1], U. Molitoris[1], T. Dieck[1], K. Johanning[1], D. Henzler[3], R. Rossaint[4], C. Putensen[5], H. Wrigge[5], R. Wittich[6], M. Ragaller[7], T. Bein[8], M. Schneider[9], C. Rabe[10], J. Schlechtweg[11], M. Holler[12], F. Frutos-Vivar[13], A. Esteban[13], S. Rosseau[14], W. Koppert[1], H. Hecker[15], C. Spies[16], S. Weber-Carstens[16], for the Study Group on Mechanical Ventilation in Germany

[1]Medical School Hanover, Anaesthesiology and Intensive Care Medicine, Hannover, Germany, [2]Georg-August University of Göttingen, Anaesthesiology II—Operative Intensive Care Medicine, Göttingen, Germany, [3]Dalhousie University Halifax, Anaesthesiology and Critical Care, Halifax, Canada, [4]University Hospital Aachen, Anaesthesiology, Aachen, Germany, [5]University Hospital Bonn, Anaesthesiology and Operative Intensive Care Medicine, Bonn, Germany, [6]Carl-Thiem-Hospital, Anaesthesiology and Intensive Care Medicine, Cottbus, Germany, [7]University Hospital Carl Gustav Carus, Anaesthesiology and Intensive Care Medicine, Dresden, Germany, [8]University Hospital Regensburg, Anaesthesiology, Regensburg, Germany, [9]Dietrich-Bonhoeffer-Klinikum, Anaesthesiology, Neubrandenburg, Germany, [10]University Hospital Bonn, Internal Medicine, Bonn, Germany, [11]Klinikum Bad Salzungen gGmbH, Anaesthesiology, Bad Salzungen, Germany, [12]Städtisches Krankenhaus Martha-Maria Halle-Dölau gGmbH, Anaesthesiology, Halle, Germany, [13]University Hospital Getafe, Intensive Care Medicine, Madrid, Spain, [14]Charité, University Hospital Berlin, Internal Medicine, Dev. Infectiology and Pneumology, Berlin, Germany, [15]Medical School Hanover, Biometry, Hannover, Germany, [16]Charité, University Hospital Berlin, Anaesthesiology and Intensive Care Medicine, Berlin, Germany

**INTRODUCTION.** Outcome of nonsurgical, ventilated patients may depend on the volume of patients [1].

**OBJECTIVE.** To determine hospital mortality and associated risk factors of unselected, ventilated patients in reference to the treating institution.

**METHODS.** In a sub-study from the 2nd International Study on Mechanical Ventilation (ISMV) [2], ventilated patients who had been admitted to an intensive care unit (ICU) in May 2004 in Germany were included, if ventilated for more than 12 h invasively or at least 1 h non-invasively. Patients were compared for treatment in a non-university hospital (NUH) or university hospital (UH), and analysed separately for having developed ARDS (NUH: $n = 111$; UH: $n = 87$) or no ARDS (NUH: $n = 357$; UH: $n = 473$). Multivariable logistic regression was performed separately for the patient group with or without ARDS to define risk factors independently associated with increased hospital mortality. Both models included the same variables concerning the setting of care (e.g. hospital- and ICU-size, NUH, UH), baseline factors (e.g. age, SAPS II-Score, main reason for ventilation), ventilator settings and gas exchange values averaged over the first week of ventilation or after ARDS-onset and complications occurring over the course of ventilation (e.g. sepsis, shock, acidosis, organ failures).

**RESULTS.** 19.3% of all ventilated patients (2.6% of all ICU admissions) developed ARDS ($n = 198$). The crude hospital mortality for patients with ARDS was 49.5%; it was higher in NUH than in UH (57.5 vs. 39.3%, $p = 0.012$). In patients without ARDS there was a smaller, but still significant difference (NUH: 31% vs. UH: 21.4%, $p = 0.002$). Multivariable analysis revealed that in patients with ARDS treatment in a NUH was the most important risk factor for hospital mortality [odds ratio (95% confidence interval); 4.82 (1.75–13.26) $p = 0.002$], followed by organ failures, higher levels of inspired oxygen and plateau pressure. Therapy in a NUH was also a risk factor for ventilated patients without ARDS [1.81 (1.12–2.91) $p = 0.015$]. Tidal volumes per predicted bodyweight were similar in NUH and UH (mean [SD]; 9.0 [2.5] vs. 9.1 [2.1] ml/kg, n.s.). Of all other ventilatory parameters averaged over the first week after ARDS development, only the PEEP level differed, being lower in NUH (8.3 [4.0] vs. 10.1 [4.3] $cmH_2O$, $p = 0.003$). No other parameters were different between ARDS patients treated in NUH or UH, such as SAPS II (48.7 [20.4] vs. 45.2 [17.2], n.s.).

**CONCLUSION.** Although the mean SAPS II scores were higher in our entire patient group with ARDS, the hospital mortality was 8% lower than in the ALIVE study [3] and 13% lower compared to ARDS patients from the other countries of the second ISMV [2]. The hospital mortality of ARDS patients was remarkably higher in NUH than in UH and, treatment in a NUH was the most important risk factor for ARDS patients but less important for patients without ARDS.

**REFERENCES.** 1. Kahn NEJM 2006.
2. Esteban AJRCCM 2008.
3. Brun-Buisson ICM 2004.

## 0565

### PATIENTS WITH SEVERE COPD REQUIRING INVASIVE MECHANICAL VENTILATION: MORTALITY RATE AND A 2-YEAR FOLLOW-UP

C. van den Bosch[1], L. Pronk[2], M. Sleeswijk[1]

[1]Flevoziekenhuis, ICU, Almere, Netherlands, [2]Flevoziekenhuis, Respiratory Medicine, Almere, Netherlands

**INTRODUCTION.** The prognosis of patients with severe COPD (GOLD III-IV) is poor, after invasive mechanical ventilation (iMV), the hospital mortality appears to be around 50% [1]. In addition weaning can be difficult and patients may end up being ventilator-dependent [2]. Patients with severe COPD are often rejected for iMV because of a presumed difficult and prolonged weaning period and poor prognosis. However there is little evidence supporting this treatment strategy and ICU treatment has improved over the last decade.

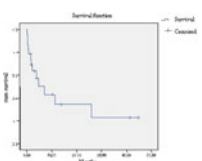
**OBJECTIVES.** An outcome study in patients with severe COPD (FEV-1 < 1L) requiring iMV because of acute respiratory failure.

**METHODS.** A retrospective single center study, on a mixed ICU. In total 22 patients with 25 admissions, were included in this study, between Jan 2006 and Feb 2010.

**RESULTS.** Primary diagnosis at admission was exacerbation COPD in 44%, exacerbation COPD plus cardiac failure in 20%, pneumonia and sepsis in 36%. A previous history of congestive heart failure was present in 37%, 23% used oxygen at home and 32% were housebound. The ICU mortality was 12% and hospital mortality 16%. Cumulative mortality after 30-days was 23%, after a 1/2 year 56% and after 1 and 2 years 73 and 78%, respectively. None of the discharged patients were mechanical ventilator depended. The median follow-up after ICU discharge was 113 days [range 10–1400].

PATIENTS CHARACTERISTICS

| | Patients n = 22 |
|---|---|
| Age [mean (SD)] | 67.6 (± 9.4) |
| Male/Female | 12/10 |
| FEV1 [mean (SD)] | 0.75 (± 0.19) |
| FEV1% [mean (SD)] | 30.6 (± 10) |
| APACHE II [mean] | 20.8 (± 6.1) |
| ICU stay [days; median [range]] | 6 [1–25] |
| Time intubated [days; median [range]] | 4 [1–22] |
| Time at pulmonary ward* [days; median [range]] | 8.5 [5–35] |



**CONCLUSIONS.** We found a hospital mortality of only 16% without substantial problems regarding weaning. In addition long-term prognosis still remains poor. Clinical research should also focus on the post ICU period in order to improve outcome in patients with severe COPD requiring iMV.

**REFERENCES.** 1. Anon JM et al. Mechanical ventilation of patients on long-term oxygen therapy with acute exacerbations of chronic obstructive pulmonary disease: prognosis and cost-utility analysis. ICM. 1999;25:452–7.
2. Menzies R et al. Determinants of weaning and survival among patients with COPD who require mechanical ventilation for acute respiratory failure. Chest. 1989;95:398–405.

## 0566

### BAROTRAUMA IN PATIENTS WITH ACUTE RESPIRATORY DISTRESS SYNDROME

M.-C. Pintado[1], R. de Pablo[1], M. Trascasa[1], E. Lopez-Ramos[1], B. Llorente[1], P. Villa[1], J.-A. Cambronero[1]

[1]Universitary Hospital 'Príncipe de Asturias', Intensive Care Unit, Alcalá de Henares, Spain

**INTRODUCTION.** Barotrauma is a feared complication of mechanical ventilation and is associated with increased morbidity and mortality[1]. Incidence of barotrauma in patients with Acute Respiratory Distress Syndrome (ARDS) has been shown to range between 0 [2] to 76% [3]. Many authors recognize that experimental pulmonary and extrapulmonary acute respiratory distress syndrome are not identical, with different response to ventilatory therapies [4].

**OBJECTIVES.** To analyse whether barotrauma varies between ARDS with pulmonary (ARDSp) and extrapulmonary origin (ARDSexp).

**METHODS.** We evaluate incidence, risk factors and outcomes of developing barotrauma in patients with ARDSp and ARDSexp, in a cohort of patients who met the ARDS criteria of the Consensus Conference [5] after 24 h in mechanical ventilation with low tidal volume (6–8 ml/kg body weight), and who were part of study comparing two methods of setting the level of positive end-expiratory pressure (PEEP): according to the ARDSNetwork standard-of-care recommendations [6] or to the best compliance according to the method proposed by Suter [7]. We measured demographic data daily ventilator settings, severity of disease, organ failure, daily Acute Lung Injury scale (LIS) [8] and outcome. Variables with normal distribution were described as mean ± SD, with non-normal distribution as medians and interquartile ranges.

**RESULTS.** We included 70 patients: 36 and 34 on each group of study. There were no differences on incidence of barotrauma between both groups (16.6 vs. 17.6%, $p = 0.99$). In the whole study population, 39 patients had ARDSp and 28 ARDSexp. There were more incidence of barotrauma in ARDSp (23 vs. 11%), but it not reached statistically significance ($p = 0.20$). In ARDSp there were no differences between severity of illnes or ARDS at baseline between patients who developed barotrauma or not; but in ARDSexp patients who developed barotrauma presented a more severe ARDS at baseline (LIS 3.25 ± 0.25 vs. 2.75 ± 0.53, $p = 0.02$) and reached a more severe grade of ARDS (maximun LIS 3.83 + 0.28 vs. 3.08 + 0.53, $p = 0.04$). On respect to ventilaroy parameters, we found a different behavior: a strong trend to a higher airways pressures in ARDSp patients who developed barotrauma, without a difference in oxygenation, versus a strong trend to a worse oxygenation in patients with ARDSexp who developed barotrauma. There were no differences in ICU or hospital mortality between ARDSp and ARDSexp, who developed or not barotrauma.

**CONCLUSIONS.** Risk factors for barotrauma in patients with ARDS with pulmonary and extrapulmonary origin are different. Although they do not influence the mortality of these patients.

**REFERENCE(S).** 1. Intensive Care Med. 2004;30:612–9.
2. Care Med. 1994;22:1568–78.
3. Am J Respir Crit Care Med. 1994;149:295–305.
4. Curr Opin Crit Care. 2005;11:10–7.
5. Am J Respir Crit Care Med. 1994;149:818–24.
6. N Engl J Med. 2000;342:1301–8.
7. N Engl J Med 1975;292:284–9.
8. Am Rev Respir Dis. 1988;138:720–3.

## 0567

### MULTIORGAN FAILURE AND POSSITIVE END-EXPIRATORY PRESSURE IN PATIENTS WITH ACUTE RESPIRATORY DISTRESS SYNDROME

M.-C. Pintado[1], R. de Pablo[1], E. Lopez-Ramos[1], M. Trascasa[1], R. Molina[1], C. Martínez[1], J.-A. Cambronero[1]

[1]Universitary Hospital 'Príncipe de Asturias', Intensive Care Unit, Alcalá de Henares, Spain

**INTRODUCTION.** There is known that mechanical ventilation may contribute to the development of systemic inflamatory response and subsequent multiple organ failure and death, in patients with Acute Respiratory Distress Syndrome (ARDS) [1]. Several studies have demonstrated that this effect could be mediated by the method chosen to set the possitive end-expiratory pressure (PEEP) in these patients [2–4].

**OBJECTIVES.** To compare the effect on multiorgan failure at 28 days of two strategies of setting PEEP in patients with ARDS ventilated with low tidal volumes.

**METHODS.** We included consecutive patients who met the ARDS criteria of the Consensus Conference [5], after 24 h on mechanical ventilation with low tidal volume (6–8 ml/kg body weight) and limitation of pressures on airway at 35 $cmH_2O$. They were randomizad into two groups: a group control, where PEEP was set according to the $FiO_2$ applied as in the ARDS-Network study [6], or a interventional group, where PEEP was set according to the method proposed for Suter [1], which consist in setting PEEP level according to static compliance. In both groups PEEP level was set daily [7]. We defined organ failure as a punctuation of 3 or 4 in the Sepsis-Related Organ Failure Assesment (SOFA) [8], and number of organ failure-free days to day 28 as the number of days alive and free of organ failure at day 28.

**RESULTS.** We included 70 patients, 36 in control group and 34 in interventional group; most of them were on multiorgan failure (77.8 vs. 97.1%, respectively, $p = 0.02$), being the most frequent second failure of organ the cardiovascular failure. At study inclusion, the mean SOFA were 8.86 ± 0.61 in the control group versus 9.36 ± 0.66, $p = 0.56$. Despite the fact that, at study inclusion, the interventional group had more incidence of multiorgan failure; at day 28, we found that in this group there were significantly more organ failure-free days [median of 20 days (0–26) vs. 6 days (0–23), $p = 0.02$], more cardiovascular failure-free days [median of 22 days (0–25) vs. 16 days (0–23), $p = 0.04$] and more respiratory failure-free days [median of 14 days (0–22) vs. 7 days (0–19), $p = 0.03$] compared to control group. When we analyzed the information depending on the origin of the ARDS, we found that this effect was mainly in the case of pulmonary ARDS.

**CONCLUSIONS.** In our study, a mechanical ventilation on patients with ARDS based on low tidal volume and a level of PEEP set according to the best complicance is associated with more organ disfunction free-days at day 28.

**REFERENCE(S).** 1. Slutsky, Am J Respir Crit Care Med. 1998;157:1721–5.
2. Ranieri, JAMA. 1999;282:54–61.
3. Villar, Crit Care Med. 2006;34:1311–8.
4. Amato, N Engl J Med. 1998;338:347–54.
5. Bernard, Am J Respir Crit Care Med. 1994;149:818–24.
6. N Engl J Med. 2000;342:1301–8.
7. Suter, Chest. 1978;73:158–62.
8. Vincent, Crit Care Med. 1998;26:1793–800.

## 0568

### PROGNOSTIC VALUE OF CAPILLARY LEAK INDEX, INTRA-ABDOMINAL AND ABDOMINAL PERFUSION PRESSURE, EXTRAVASCULAR LUNG WATER ON OUTCOME IN MECHANICALLY VENTILATED PATIENTS

C. Cordemans[1], P.-J. Palmers[1], A. Van Craenenbroeck[1], A. Van Hootegem[1], A. Van Ingelgem[1], N. Van Regenmortel[1], I. De Laet[1], K. Schoonheydt[1], H. Dits[1], M. Malbrain[1]

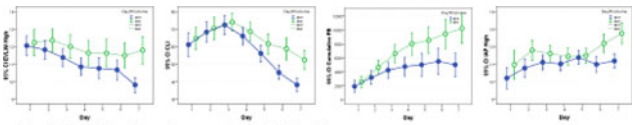
[1]ZNA Stuivenberg, Intensive Care Medicine, Antwerpen, Belgium

**INTRODUCTION.** Besides intra-abdominal (IAP) and abdominal perfusion pressure (APP), extravascular lung water (EVLWi) is also a prognostic tool in mechanically ventilated (MV) pts [1].

**OBJECTIVES.** Prospective analysis of the prognostic value of EVLWi in MV pts.

**METHODS.** Prospective single center epidemiologic study. Values mean ± SD. Data analyzed from 123 pts. M/F ratio 2/1; age 63.8 ± 15.8; BMI 25.5 ± 5.5; SAPS II 51.8 ± 17.1; SOFA 10.3 ± 4.4. Maximal IAP 14.3 ± 4.8, mean IAP 9.1 ± 2.9 mmHg. Baseline APP (= MAP-IAP) 53.6 ± 13.3. Intra-abdominal hypertension (IAH), defined as maximal or mean IAP ≥ 12 mmHg was present in 78(63%) and 25(20%) of cases, respectively. Capillary leak index (CLI) defined as CRP/albumin. EVLWi and pulmonary vascular permeability index (PVPI) calculated using PiCCOplus (Pulsion Medical Systems, Munich, Germany). Primary endpoint was outcome (at 28 days). Responders defined as pts in whom a maximal drop in EVLWi (DeltaMax) ≥ 5 ml/kg was observed during stay.

**RESULTS.** Baseline EVLWi was 9.6 ± 4.7 ml/kg, the highest during the first day was 10.6 ± 4.8, maximal and mean during first week was 12.8 ± 5.3 and 10 ± 4.1, respectively. Maximal EVLWi was reached on day 2.8 ± 1.9 and significantly higher in nonsurvivors ($n = 65$) than survivors ($n = 58$): 13.7 ± 5.9 versus 11.7 ± 4.3, respectively ($p = 0.04$), however the area under the ROC curve was only 0.6. The AUROC for DeltaMax was 0.74. In univariate analysis, minimal, mean and maximal EVLWi were predictors for mortality. During the first week of ICU stay the EVLWi, IAP, CLI, PVPI, daily and cumulative fluid balance remained higher in nonsurvivors (Fig. 1). Mortality was higher, the higher the maximal EVLWi. IAP was significantly higher in nonsurvivors from day 6 onwards, whereas APP was already significantly lower from day 1. Survivors had a trend to decrease EVLWi between first and last measurement with −1.3 ± 3.5 whereas EVLWi increased in nonsurvivors with 2.1 ± 5. Responders had a significant lower 28 day mortality 32 versus 58.2% ($p = 0.017$).



*[Fig 1. Evolution (survivors = closed circles)]*

**CONCLUSIONS.** IAH is common in MV patients. APP seems to be a better outcome predictor than IAP. Maximal, mean and the trend in EVLWi values correlated well with outcome. We hypothesize that there is a strong correlation between capillary leak (CLI and PVPI), positive fluid balance, increased IAP, increased EVLWi and organ failure with poor prognosis. Future studies should look at the effect of aiming for a negative fluid balance on these parameters.

**REFERENCE(S).** 1. Sakka SG et al. Chest. 2002;122:2080–6.

## 0569

### HEALTH RELATED QUALITY OF LIFE IN COPD PATIENTS FOLLOWED 24 MONTHS AFTER ICU CARE

J. Berkius[1], L. Engerström[2], L. Orwelius[3], F. Sjöberg[4], S.M. Walther[5,6]

[1]Anestesi och Operationskliniken, Västervik, Sweden, [2]Vrinnevisjukhuset, Anestesikliniken, Norrköping, Sweden, [3]Linköping University Hospital, Department of Intensive Care, Linköping, Sweden, [4]Linköping University, Linköping, Sweden, [5]Linköping University Hospital, Department of Cardiovascular Anaesthesia and Intensive Care, Linköping, Sweden, [6]Linköping University, Department of Medicine and Care, Division of Cardiovascular Medicine, Linköping, Sweden

**INTRODUCTION.** Survival after intensive care of COPD patients is poor with about 50% dying within 2 years (1–3).

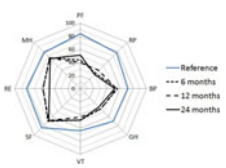
**OBJECTIVES.** The aim of this study was to examine perceived health related quality of life (HRQL) over 24 months in COPD patients that were treated in the ICU.

**METHODS.** Complete follow-up was achieved for 23 COPD patients (7 male, 16 female) at 6, 12 and 24 months after they were admitted to ICU with respiratory failure. Mean (SD) age was 68.4 years, Charlson comorbidity score was 3.4 (1.9) and APACHE II score was 19.0 (7.4) at the time of ICU admission. Eight patients (39%) received invasive mechanical ventilation. Length of stay in the ICU was median 51 (IQR 32–99) h. HRQL was assessed with EQ5-D and SF-36. HRQL was contrasted with a sex and age matched Swedish reference population.

**RESULTS.**

EQ5-D AND SF-36 COMPONENT SCORES

| | 6 months (n = 23) | 12 months (n = 23) | 24 months (n = 23) | Reference (n = 23) |
|---|---|---|---|---|
| EQ5-D, mean (SD) | 0.62 (0.31) | 0.58 (0.33) | 0.53 (0.36) | 0.78 (0.24) |
| EQVAS, mean (SD) | 52.2 (19.1) | 55.4 (17.9) | 50.9 (16.4) | 76.8 (14.8) |
| SF-36, Physical component score, mean(SD) | 33.2 (9.2) | 30.9 (8.9) | 33.0 (9.9) | 45.4 (13.9) |
| SF-36, Mental component score, mean (SD) | 45.9 (12.6) | 44.5 (12.7) | 43.4 (13.5) | 49.9 (11.3) |




SF-36 dimensions over time in COPD patients

**CONCLUSIONS.** HRQL in COPD patients was low and remained constant in the same patients followed for the whole time period, 24 months after ICU care.

**REFERENCE(S).** 1. Rivera-Fernandez et al. Crit Care Med. 2006;34:2317–24. 2. Berkius et al. Acta Anaesthesiol Scand. 2008;52:759–65. 3. Ai-Ping et al. Chest 2005;128:518–24.

## 0570

### INCIDENCE AND PROGNOSIS OF INTRA-ABDOMINAL HYPERTENSION (IAH) AND LOW ABDOMINAL PERFUSION PRESSURE (APP) IN MECHANICALLY VENTILATED PATIENTS DURING THE FIRST WEEK IN ICU

A. Reintam Blaser[1,2], J. Starkopf[1,3], M. Björck[4], M.L. Malbrain[5], Gastro-Intestinal Failure Trial Group

[1]University of Tartu, Tartu, Estonia, [2]Inselspital, Bern, Switzerland, [3]Tartu University Hospital, Tartu, Estonia, [4]Uppsala University Hospital, Uppsala, Sweden, [5]ZNA Stuivenberg, Antwerpen, Belgium

**OBJECTIVES.** To describe the incidence of intra-abdominal hypertension (IAH) and the dynamics of abdominal perfusion pressure (APP) and their related impact on outcome in mechanically ventilated (MV) critically ill patients.

**METHODS.** Prospective observational multicenter study during 2 weeks in November 2009. Consecutive patients admitted to the participating ICUs and requiring MV for at least 6 h were included. Maximal, minimal and mean intra-abdominal pressure (IAP), mean arterial pressure (MAP) and APP (defined as MAP-IAP) were recorded on day 1, 2, 4 and 7. Primary endpoint was 28-day mortality.

**RESULTS.** 358 patients from 39 ICUs were included, their mean APACHE II score on admission was 19.8 (8.0) and 28-day mortality 31%. Mean number of IAP measurements was 3.2 per day. IAH (mean IAP $\geq$ 12 mmHg) occurred in 163 patients (45.5%) at least once. In 97/163 (59.5%) IAH was present at least on 2 study days and in 17 patients (10.4%) in all 4 study days. IAH was associated with significantly longer duration of MV, ICU-stay and hospitalization (10.7 vs. 7.6; 13.6 vs. 10.1 and 23.1 vs. 19 days, respectively, $p < 0.01$) but not with higher 28-day mortality (31.9 vs. 30.3%, $p = 0.412$). The number of patients still in ICU on day 28 was similar in both groups (14.7 vs. 11.3%, $p = 0.279$). Abdominal compartment syndrome (ACS = mean IAP $\geq$ 20 mmHg with new onset of an organ failure) developed in 16 patients (4.5%), and was of primary origin in 9 (with a mortality of 37.5%) and secondary in 7 patients (mortality 42.9%). Surgical decompression was performed in one patient with primary ACS on day 1 (survived), in one patient with primary ACS on day 4 (died) and in one patient with secondary ACS on day 7 (died).

The patients with IAH had a mean APP of 64.3 versus 73.1 mmHg ($p < 0.001$) on day 1. The patients with an APP $\leq$ 55 mmHg at any time had significantly higher 28-day mortality than those with APP > 55 (40.8 vs. 24.9%, $p = 0.002$). Even though low APP was more common in patients presenting with IAH on day 1, in one-third of these patients the IAP was not elevated. From day 1 to 7 the mean APP increased by 1.9 (14.3) mmHg in patients with IAH compared to 6.9 (12.8) mmHg in patients without IAH. Non-survivors had lower APP on admission and during their stay and the lower the APP the higher the mortality (OR 1.018, 95% CI 1.003–1.034).

**CONCLUSIONS.** We report the interim results of the largest multicentre study on the epidemiology of IAP and APP. IAH occurs frequently in MV patients and is associated with longer MV, ICU and hospitalization periods, but not with higher mortality. On the other hand, APP below 55 mmHg is associated with significantly higher 28-day mortality, but is often related to a low MAP rather than a high IAP. The APP increases less over time in patients with IAH during their first week in ICU.

## 0571

### HEALTH RELATED QUALITY OF LIFE IN ARDS SURVIVORS: IMPORTANCE OF THE EARLY MEASUREMENT

O. Roca[1,2], J.R. Masclans[1], X. Muñoz[2,3], F. Torres[4], F. Morell[2,3], J. Rello[1,2]

[1]Vall d'Hebron University Hospital, Critical Care Department, Barcelona, Spain, [2]CibeRes (Ciber Enfermedades Respiratorias), Instituto de Salud Carlos III, Madrid, Spain, [3]Vall d'Hebron University Hospital, Respiratory Medicine Department, Barcelona, Spain, [4]IDIBAPS, Statistics and Methodology Support Unit, Barcelona, Spain

**INTRODUCTION.** ARDS survivors have decreased quality of life after hospital discharge. Nevertheless, there are no data about the long term predictive capacity of the early alterations observed in HRQL.

**OBJECTIVES.** To evaluate early HRQL and its correlation with long term HRQL abnormalities in ARDS survivors.

**METHODS.** Prospective multicentric study in 3 ICUs (1998–2003). Health related quality of life (HRQL) was assessed with the Nottingham Health Profile (Spanish version) at the 1st and the 6th month after ARDS. Data are expressed as median (interquartile range). Spearman correlation and Mann–Whitney U tests were performed (SPSS v18.0 Inc. Chicago, IL, USA).

**RESULTS.** 15 patients (27% M), age 49 (28–55) years old. When ARDS was diagnosed they presented: LIS 2.60 (2.33–3.00); baseline $PaO_2/F_IO_2$ 100 (76–125) mmHg. Days with mechanical ventilation were 29 (14–31) and the length of stay in the ICU was 36 (22–43) days. ARDS survivors presented worse HRQL. The score obtained in all dimensions of HRQL tend to improve from the 1st to the 6th month, however statistical significance was only reached in dimension of Pain and Mobility as well as in the global HRQL. Interestingly, a significant positive correlation between global HRQL measured at the 1st and 6th month after ARDS was also observed ($r = 0.68$, $p = 0.005$).

**CONCLUSIONS.** In our series, ARDS survivors have an early reduced quality of life, that significantly improve with time. Early HRQL measurement could be a good predictor of long term HRQL alterations.

## 0572

### ACUTE RESPIRATORY FAILURE (ARF) IN HAEMATOLOGY AND ONCOLOGY PATIENTS: EARLY PROGNOSTIC FACTORS OF 28-DAY MORTALITY

D. Mokart[1], A. Rabbat[2], J. Lambert[3], A. Kouatchet[4], V. Lemiale[5], F. Vincent[6], F. Bruneel[7], D. Gruson[8], R. Hamidfar-Roy[9], C. Cracco[10], E. Azoulay[5], GRRROH

[1]Institute Paoli-Calmetted, DAR, Marseille, France, [2]CHU Hôtel Dieu, Service de Réanimation Médicale et Respiratoire, Paris, France, [3]CHU Saint-Louis, Biostatistiques, Paris, France, [4]CHU d'Angers, Service de Réanimation Médicale et de Médecine Hyperbare, Angers, France, [5]CHU Saint-Louis, Service de Réanimation Médicale, Paris, France, [6]CHU Avicenne, Service de Réanimation Médico-Chirurgicale, Bobigny, France, [7]CH de Versailles, Service de Réanimation Médico-Chirurgicale, Versailles, France, [8]CHU Pellegrin Tripode, Service de Réanimation Médicale et de Médecine Hyperbare, Bordeaux, France, [9]CHU de Grenoble, Service de Réanimation Médicale, Grenoble, France, [10]CHU la Pitié-Salpêtrière, Service de Pneumologie et Réanimation, Paris, France

**INTRODUCTION.** In critically ill haematology and oncology patients, outcomes have improved over the past decade. The persistence or the degradation of organ failures over the first week of ICU admission is associated with mortality, in particular in case of ARF.

**OBJECTIVES.** The aim of this study was to determine early predictive factors of 28-day mortality that are available at the bedside within ICU admission.

**METHODS.** Prospective study including 219 cancer patients with ARF extracted from Réa-Minimax study. At ICU admission none of the patients was treated with invasive mechanical ventilation. Co-morbidities and clinical and biological data were tested as early prognostic factors of 28-day mortality. Significant variables ($p < 0.005$) were included in a multivariate logistic regression model.

**RESULTS.** 28-day mortality rate was 31.1%. The number of line of chemotherapy, the oxygen delivery (L/min), at least three quadrants with lung infiltrates on chest X-ray, an onset between the first respiratory signs and ICU admission of at least 2 days and a hyperbilirubinemia > 17micromol/L were associated with 28-day mortality by univariable analysis. By the multivariable analysis, independent predictors of day 28 mortality were: age(OR 1.03/year, IC95% [1.00–1.05], $p = 0.03$), Time since onset of respiratory signs and ICU admission of at least 2 days (OR 2.10, IC95% [1.11–3.96], $p = 0.02$), level of oxygen delivery (OR 1.08/L, IC95% [1.02–1.15], $p = 0.009$), bilirubine rate > 17 micromol/L (OR 2.30, IC95% [1.23–4.32], $p = 0.009$) and more than two lines of chemotherapy (OR 2.99, IC95% [1.38–6.50], $p = 0.01$).

**CONCLUSIONS.** These results suggest that early management of cancer patients with ARF may translate into better survival. Alarms should start from the onset of first respiratory symptoms and probably since oxyfen initiation. Cancer patients with ARF have an increased death when respiratory involvement is severe or associated with other organ dysfunction. Early ICU admission of cancer patients with ARF as to benefit from noninvasive diagnostic and therapeutic strategies is warranted and need to be per se the objective of another trial.

## 0573

### OUTCOMES OF FAILED EXTUBATION IN A TERTIARY HOSPITAL INTENSIVE CARE UNIT

F. Calçado[1], A. Vianna[1], P. Werneck[1], A. Neiva[1], F. Magno[1], P. Binato[1]

[1]São Vicente Clinic, Rio de Janeiro, Brazil

**INTRODUCTION.** Extubation failure is common in intensive care unit and has been associated with poor outcomes like increased morbity, higher costs, higher ICU length stay and mortality. These adverse outcomes highlight the importance of predictors of extubation failure.

**OBJECTIVES.** The aim of this study was to evaluate whether extubation failure is related to poor outcomes of medical ICU patient in our hospital.

**METHODS.** A retrospective cohort study was performed using data gathered in a 16 bed medical clinical and surgical ICU in a tertiary hospital. All adults admitted from 01/01/2007 to 31/12/2009 who required mechanical ventilation via an endotracheal tube for more than 24 h were included. Extubation failure was defined as reintubation within 48 h after planned extubation. The control cohort included patients who had successful planned extubation. The outcomes were ICU mortality, renal failure, use of vasopressors, and average duration of intubation. Data were analyzed in SPSS computer program using Chi-square test, Student's t test and Mann–Whitney test. Statistical significance was considerable when p valor < 0.05.

**RESULTS.** Two hundred and twenty patients were included. Two hundred and six were successfully extubated and fourteen had extubation failure. Extubation failure was 6% and causes were acute respiratory failure 43% (6), respiratory muscle weakness 22% (3), upper airway obstruction 14% (2), inability to protect airway 14% (2), and acute pulmonary edema 7% (1). Among then 57% (8) were female with mean age of 79 ± 14 years. Seventy-nine percent (11) were clinical patients and medium APACHE II score was 22 ± 8. ICU mortality was 64% (9), rate of renal failure was 43% (6), rate of vasopressors was 100% (14) and rate of tracheostomy was 64% (9). Age and rate of tracheostomy was significantly higher in patients who failed extubation ($p = 0$, 01 and $p = 0.003$, respectively), but there was no significant difference in ICU mortality, renal failure, use of vasopressors and length of intubation (all $p > 0$, 05).

**CONCLUSIONS.** Rate of extubation failure is acceptable when compared with medical literature. Extubation failure patients were older with higher rate of tracheostomy, but there was no difference in outcomes between groups. Further studies will be necessary to confirm these findings.

**REFERENCE(S).** Chest 2001;120:538–42.
Curr Opin Crit Care. 2003;9:59–66.
Crit Care. 2004;8:R322–7.
Crit Care Med. 2008;36(11):2986–92.
Indian J Crit Care Med. 2008;12 (1).
Am J Resp Crit Care Med. 2009;179:A5849

## 0574

### HIGH DRIVING PRESSURES DURING MECHANICAL VENTILATION ARE ASSOCIATED TO HIGHER MORTALITY RATE IN PATIENTS SUFFERING FROM ACUTE LUNG INJURY-ACUTE RESPIRATORY DISTRESS SYNDROME

G.F. Vazquez de Anda[1,2], S. Larrasa[2], L.A. De la Cruz Avila[3]

[1]Universidad Autonoma del Estado de Mexico, Centro de Investigacion en Ciencias Medicas, Toluca, Mexico, [2]Instituto de Salud del Estado de Mexico, Hospital Materno Perinatal, Departamento de Robotica en Areas Criticas, Toluca, Mexico, [3]Instituto de Seguridad Social del Estado de Mexico y Municipios, Unidad de Cuidados Intensivos del Centro Medico Issemym, Metepec, Mexico

**INTRODUCTION.** It has been recommended to keep low differential pressures during mechanical ventilation as to prevent ventilation lung injury [1]. Recently it has been suggested that Differential Pressures (DP), the difference between plateau pressures (PL) and positive end expiratory pressure (PEEP), higher than 16 $cmH_2O$ may be associate to higher mortality rate in patients receiving mechanical ventilation.

**OBJECTIVES.** The main objective of this study is to determine the association between Mortality and DP higher than 16 $cmH_2O$.

**METHODS.** We include data from 170 patients who were on mechanical ventilation, from March 2005 to February 2006 with acute respiratory failure (ARF), acute lung injury (ALI) and acute respiratory distress syndrome (ARDS). Patients were included in two groups. Group 1 patients with ARF who did not completed the American European Consensus Definition for ALI/ARDS and Group 2 patients with ALI and/or ARDS. PEEP, PL, Tidal Volume per kg ideal body weight (Vt/kg) and DP were included as independent variables. Mortality was the dependent variable. Statistics were calculated by using SPSS 17, cross table tabulation as to determine association and risk were performed. Additionally, Pearson's correlation was performed between DP and Static Compliance (Vt/PL-PEEP), $P(A\text{-}a)O_2$, $PaO_2$, pH, arterial ($SaO_2$) and venous oxygen saturation ($SvO_2$), $PaO_2/FiO_2$; creatinine, bilirrubine, platelets, systolic arterial blood pressure (SBP), diastolic arterial blood pressure (DBP), and mean arterial blood pressure (MAP).

**RESULTS.** There was association between mortality and high levels of PEEP 48.6 versus 20.0% low PEEP (P 0.001) and Odds Ratio for Group H/L of 3. 778 (95% confidence interval, from 1.722 to 8.288). There was association between mortality and high levels of PL 57.1 versus 23.1% low PL (P 0.010) and Odds Ratio of 4.444 (from 1.447 to 13.650). There was association between mortality and high levels of DP 57.5 versus 16.2.0% low DP (P 0.000) and Odds Ratio of 7.022 (from 3.213 to 15.346). Interaction between DP and Groups of ARF, ALI and ARDS. There were statistical association between high levels of DP; in G1 57.7% high DP versus 18.5% low DP (P 0.000) and G2 57.1 high DP versus 10.0% low DP (P 0.01) and Odds Ratio for G 1 H/L of 5.856 (from 2.287 to 14.993), and G 2 H/L of 12.0 (from 2.734 to 52.664). There was statistical correlation between high DP and high creatinine levels r 0.189 (p 0.015) and bilirrubine r 0.186 (p 0.015).

**CONCLUSIONS.** DP higher than 16 $cmH_2O$ is associated to an increase in organ disfunction and mortality in mechanically ventilated patients.

**REFERENCE(S).**

1. Lachmann et al. Applied physiology in clinical respiratory care. Nijhoff, Hague. 1982 l;141–176.

## 0575

### INCIDENCE AND OUTCOME OF ALI/ARDS IN THE AVERAGE DISTRICT GENERAL HOSPITAL

A. Joseph[1], S. Nagarajan[1], R. Middleton[1], T. Szakmany[1]

[1]Royal Glamorgan Hospital, Anaesthetics, Theatres and Critical Care, Llantrisant, UK

**INTRODUCTION.** The incidence of acute lung injury and ARDS varies widely in the literature [1]. Recently, the introduction of ventilator care bundles and the lung protective ventilation strategies provided means to reduce the mortality of this condition [2].

**OBJECTIVES.** The most recent large-scale epidemiology study on the incidence and outcome of this important disease is more than 5 years old, with national studies undertaken more recently. Although in the UK the ICNARC database collects nearly all information necessary to identify patients with ALI/ARDS, surprisingly no attempt has been made to re-establish the baseline. Therefore we decided to retrospectively analyze our electronic database to give the incidence and outcome of ALI/ARDS in a typical district general hospital in the UK.

**METHODS.** Retrospective analysis of the electronic database of an average 11-bedded ITU/HDU in a district general hospital. We have analysed the admission data of all patients who required mechanical ventilation on admission. Basic demographic data (age, sex, APACHE II score) on admission Lung Injury Score, ICU mortality and length of stay were collected over a 1-year period.

**RESULTS.** In 2008, 207 patients were admitted to the unit with the need of mechanical ventilation. Male/female ratio was 132/75. Mean (SD) age 59 (17) years. Mean (SD) LIS of the population was 1.3 (1). 17% of the patients had ARDS according to the LIS criteria, 26% moderate to severe ALI, 35% mild ALI and 18% no ALI.

The mortality was 46, 36, 32 and 24%, respectively. We found significantly higher LIS amongst the non-survivors ($p < 0.05$). The most common risk factor for ALI/ARDS was pneumonia followed by non-pulmonary sepsis. There was no significant difference in mortality according to risk factor. Significantly longer LOS was observed in the ARDS group compared to the No ALI and mild ALI group ($p < 0.05$). With regards to ventilation parameters mean positive end-expiratory pressure (PEEP) was 6.1 ± 2.1 $cmH_2O$. On the day of diagnosis of ALI/ARDS, patients received mechanical ventilation with a mean $V_t$ of 8.9 ± 2.0 ml/kg predicted body weight.

**CONCLUSIONS.** The incidence of ARDS is slightly higher on our unit than it is described in recent literature. The mortality of ALI/ARDS is comparable of the mortality of large randomized controlled trials, which shows that lung protective ventilation strategies are well embedded in our daily clinical practice.

**REFERENCE(S).**

1. Brun-Buisson C et al.: Epidemiology and outcome of acute lung injury in European intensive care units. Results from the ALIVE study. Intensive Care Med. 2004;30:51–61.
2. The ARDS Network investigators. Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. N Engl J Med. 2000;342:1301–8.

## 0576

### POST HYPERCAPNIC ALKALOSIS EFFECTS IN EXACERBATED COPD OUTCOME

C. Salinas-Martinez[1], J. Santiago-Toledo[1], J. Ramirez-Alvarado[1], C.I. Olvera[1], M. Poblano-Morales[1], J. Franco-Granillo[1]

[1]The American British Cowdray Medical Center, Intensive Care Unit, Mexico City, Mexico

**INTRODUCTION.** Chronic obstructive pulmonary disease (COPD) is a common disease and its incidence i son the rise. It has been estimated that 35–45% costs of COPD are due to their exacerbations. Post hypercapnic alkalosis (PHA) is a complication of COPD patients who have underlying chronic hypercapnic respiratory failure, and due to exacerbation are under Mechanical Ventilation (MV). PHA is a state of persistent metabolic alkalosis after return of $PaCO_2$ to baseline.

**OBJECTIVES.** To determine if the occurrence of PHA in COPD patients affects their outcome (days under MV, length of stay [LOS] and mortality).

**METHODS.** Retrospective study of 232 exacerbated COPD patient files; 30 of them required MV but 10 were excluded as it was non-invasive MV. Demographics were obtained and gasometric parameters were gathered to determine wheather or not they developed PHA. Results are expressed in mean ± standard deviation. Mexico city is 2,240 m above sea level and $paCO_2$ normal values are 30–35 mmHg.

**RESULTS.** We included 20 patients, 13 male (65%), mean age: 74 ± 11 years (58–92), APACHE II score: 18 ± 7 (8–38) and mortality of 20%. Results are shown in Table 1. Patients with PHA had longer LOS, 33% more days in ICU and to be more days under MV (66% more days, but p = NS). There is a persistent increment of $HCO_3$ without difference between groups in the utilization of bicarbonate, diuretics or gastrointestinal looses. Patients that developed PHA had a trend to have higher $PaCO_2$ before MV and it was reduced more agressively (39 vs. 34%, p = NS) than the ones that did not developed.

**TABLE 1**

| | Without PHA n = 11 (56%) | PHA n = 9 (45%) | P |
|---|---|---|---|
| APACHEIIscore | 19 ± 8 (838) | 17 ± 4 (10.23) | NS |
| $CO_2$ before Mechanical Ventilation(MV) | 70 ± 27 (31–114) | 87 ± 11 (68.99) | 0.09 |
| $CO_2$ day 1 | 44 ± 6 (30.50) | 61 ± 19 (35.89) | 0.01 |
| $CO_2$ day 3 | 48 ± 7 (38.59) | 52 ± 12 (35.67) | NS |
| $CO_2$ day 6 | 54 ± 7 (50.67) | 53 ± 9 (40.63) | NS |
| pH before MV | 7.28 ± 16 (7.05–7.48) | 7.20 ± 0.5 (7.15–7.30) | NS |
| pH day 1 | 7.38 ± 0.5 (7.30–7.45) | 7.34 ± 0.12 (7.11–7.50) | NS |
| pH day 3 | 7.35 ± 0.03 (7.31–7.40) | 7.45 ± 0.05 (7.37–7.53) | 0.0001 |
| pH day 6 | 7.38 ± 0.05 (7.32–7.45) | 7.47 ± 0.03 (7.43–7.52) | 0.0001 |
| $HCO_3$ before MV | 26 ± 64 (14.37) | 29 ± 7 (20.40) | NS |
| $HCO_3$ day 1 | 26 ± 39 (22.36) | 37 ± 7 (23.45) | 0.0001 |
| $HCO_3$ day 3 | 27 ± 4 (21.32) | 38 ± 55 (28.44) | 0.0001 |
| $HCO_3$ day 6 | 30 ± 5 (24.37) | 41 ± 6 (35.53) | 0.0001 |
| Mortality | 18.2% | 22.2% | NS |
| Days under MV | 10 ± 6 (4.20) | 16 ± 11 (3.30) | NS |
| ICU days | 16 ± 5 (8.22) | 24 ± 15 (5.45) | NS |
| Lerghtcf slay | 16 ± 4 (10.22) | 26 ± 15 (8.45) | 0.04 |

**CONCLUSIONS.** COPD patients that develop PHA are more days under MV, have longer stay in the ICU and longer LOS. Why some of them develop or not PHA has yet to be determined, probably it is associated with the $CO_2$ normalization rate.

## 0577

### EVALUATION OF ARDS PATIENTS SURVIVORS AFTER MECHANICAL VENTILATION IN VITORIA: BRAZIL

E. Caser[1], A.L. Potratz[2], H.S. Feitoza[2], J.R. Fonseca[2], T.M. Vago[2], L. Mule Junior[2], B.D. Leão[2], A.C. Gama[2], C.S. Barbas[3]

[1]University of Espirito Santo and São Paulo, São Paulo, Brazil, [2]University of Espirito Santo, Vitoria, Brazil, [3]University of São Paulo, São Paulo, Brazil

**INTRODUCTION.** ARDS patients that survived and were discharged from Hospital after ICU stay receiving mechanical ventilation can present many functional limitations.

**OBJECTIVES.** to evaluate respiratory function, thoracic tomography and mental status of ARDS patients that survived after mechanical ventilation in ICUs in Vitoria, Brazil.

**METHODS.** We retrieved the patients that were discharged from Hospital after an ARDS episode (64 survivals from 128 patients in a 2-year period). We performed: spirometry, 6-min walk test, thoracic tomography, arterial blood gas analysis and mini-mental test.

**RESULTS.** From the 64 ARDS that survived we were able to evaluate 22 patients. Their mean age was 40 ± 13 years, 14 males, mean BMI = 25.6 ± 7. Sixteen out of 22 patients returned to work. Twenty patients performed spirometry: mean FVC% (% of predict) = 97.85% (65–181%), mean FEV1% = 93.16 (40–126%), mean FEF25-75% = 83.05% (13–167%), Peak flow = 93.58% (26–175%). Mean 6-min walk distance was 443.4 (220–528 m), mean $SpO_2$ after 6 min was 98.68% (95–99%), mean HR after 6 min was 109.7 (83–155), mean MIP was 95.56 ± 27.09 $cmH_20$ and mean MEP was 104.9 ± 24.26 $cmH_20$. Mean $PaO_2/FIO_2$ was 503 ± 92 (room air). Thoracic tomography showed mild ground-glass opacities in 5/20, signs of air-trapping in 5/20, sub-segmentar atelectasis in 6/20 and bronchiectasis in 3/20. The mean mini-mental score was 25.91 (7–30). 7/22 patients have some cognitive dysfunctions.

**CONCLUSIONS.** The functional evaluation of our ARDS patients that were discharged from Hospital revealed some dysfunctions. However, 16 out of 22 returned to work.

**REFERENCE(S).**

Wilcox ME, Herridge MS. Long-term outcomes in patients surviving acute respiratory distress syndrome.Semin Respir Crit Care Med. 2010;31(1):55–65.

**GRANT ACKNOWLEDGMENT.** Unisersity of Espirito Santo and São Paulo-Brazil.

# Community- and ventilator-associated pneumonia: 0578–0591

## 0578

### THE COST BURDEN OF ANTIMICROBIALS IN THE TREATMENT OF VENTILATOR ASSOCIATED PNEUMONIA IN AN ADULT ICU

M. Sange[1], H. Kingston[2], V. Rey[3], A. Jepson[2], M. Stotz[3]

[1]St. Marys Hospital, Microbiology/Intensive Care Medicine, London, UK, [2]St. Marys Hospital, Microbiology, London, UK, [3]St. Marys Hospital, Intensive Care Medicine, London, UK

**INTRODUCTION.** Ventilator associated pneumonia (VAP) is a significant nosocomial infection. There are several devices now available that have been recommended to reduce its incidence. These include silver coated[1] and continuous sub-glottic drainage [2] endotracheal tubes. These devices incur a cost which has to be offset by the economic savings that could be made by prevention of VAP.

**OBJECTIVES.** We undertook a retrospective audit in an Adult ICU of a London teaching hospital over a 6 month period to determine the incidence and costs of antimicrobial therapy in patients developing VAP.

**METHODS.** The clinical records of patients present on the St Mary's Hospital ICU over a 6 month period were reviewed. Microbiology results from Broncho-Alveolar Lavage (BAL) samples and electronic records were compared to investigate whether they met criteria for VAP. The cost of antimicrobials used to treat all episodes of VAP was calculated which was used to find the average cost per episode.

**RESULTS.** A total of 260 patients were admitted to ICU during this period. Both the clinical + microbiological criteria for VAP were met in 8 of the 69 patients ventilated > 48 h, giving an incidence of 11.6%. Antibiotics were administered to these patients as per the sensitivities demonstrated.

PATIENTS ELIGIBLE FOR INCLUSION

| | N | % |
|---|---|---|
| Total patients | 260 | |
| Eligible for inclusion | 209 | |
| Patients ventilated > 48 h | 69 | 100 |
| Patients with significant BAL | 22 | 32 |
| Patients with VAP | 8 | 12 |

The cost of antibiotics used for treating patients with a positive BAL was €6,868.36, or €236.84 per episode [3]. As expected, patients who had VAP will use up more resources than those with a significant BAL only.

COST OF ANTIMICROBIALS

| | Number of episodes | Cost of antibiotics used (€) | Cost per episode (€) |
|---|---|---|---|
| Significant BAL only | 21 | 4,497.05 | 214.14 |
| VAP | 8 | 2,371.71 | 296.46 |

**CONCLUSIONS.** The cost of treating a patient with a VAP was €296.46. The total cost in antibiotics used when spread over all patients ventilated for > 48 h gives us a per patient cost of €99.54. This itself can easily justify the use of comparatively cheaper use of specialised endotracheal tubes.

**REFERENCES.** 1. Shorr AF, Zilberberg MD, Kollef M. Cost-effectiveness analysis of a silver-coated endotracheal tube to reduce the incidence of ventilator-associated pneumonia. Infect Control Hosp Epidemiol. 2009;30:759–63.

2. Bouza E, Perez MJ, Munoz P, Rincon C, Barrio JM, Hortal J. Continuous aspiration of subglottic secretions in the prevention of ventilator-associated pneumonia in the postoperative period of major heart surgery. Chest. 2008;134:938–46.
3. £1 = € 1.13 at the time of submission of abstract.

## 0579

### EPIDEMIOLOGY OF COMMUNITY ACQUIRED PENUMONIA IN THE GENOSEPT COHORT

A.P. Walden[1], G. Clarke[2], S. McKechnie[1], P. Hutton[1], F. Stueber[3], C. Hinds[4], C. Garrard[1], GenOSept

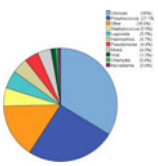
[1]John Radcliffe Hospital, Intensive Care Unit, Oxford, UK, [2]The Wellcome Trust Centre for Human Genetics, Department of Statistics, Oxford, UK, [3]Bern University Hospital and University of Bern, Anaesthesia, Bern, Switzerland, [4]William Harvey Research Institute, Queen Mary University, London, UK

**INTRODUCTION.** The GenOSept collaboration was established by the European Critical Care Research Network (ECCRN) of ESICM to investigate genetic influences on the host response to sepsis. Community acquired pneumonia (CAP) was a predefined patient cohort. The collection of high quality clinical data by the GenOSept investigators provides a unique and contemporary view of the microbiology and clinical phenotype of patients admitted to intensive care units (ICU) across Europe with CAP.

**OBJECTIVES.** To define the clinical phenotype, microbiology and independent risk factors for outcome of CAP in the GenOSept collection.

**METHODS.** Data was extracted from electronic case report forms. Patients were right censored at date of hospital discharge or 6 month follow up. Study end point was 6-month mortality. Kaplan–Meier analysis was used to determine 6-month mortality rates. Cox Proportional Hazards (PH) models were used to assess variables that were independently associated with 6-month mortality. A Bonferonni correction was used for multiple comparisons.

**RESULTS.** Data from 1,170 patients admitted to 102 centres across 14 countries between 29/09/2005 and 13/10/2009 was extracted. Average age was 61.6 ± 16. 2 years, 57.6% were male. ICU mortality rate (MR) was 19% with an in hospital MR of 25% and a MR of 27% at 6 months. *Streptococcus pneumoniae* was the commonest organism isolated (27% of cases) but no organism was isolated in 36% of cases (see graph). Risk of death was increased in those with *Stapylococcus aureus* CAP (RR 2.05, CI 1.40–3.00, p = 0.0002) and by the need for mechanical ventilation on day of admission (RR 2.22, CI 1.62–3.04, p < 0.0001); presence of shock (RR 1.61, CI 1.28-2.01, p < 0.0001); diffuse, bilateral changes on CXR (RR 1.52, CI 1.21–1.92, p = 0.0003) and the need for renal replacement therapy (RR 2.28, CI 1.78–2.93, p < 0.0001).



Pie chart of infecting oranisms in GenoSept CAP

**CONCLUSIONS.** The mortality rate amongst CAP patients admitted to ICU across Europe is 26.6% at 6 months. *Streptococcus pneumoniae* remains the most commonly isolated organism. When *Staphylococcus aureus* is the infecting agent the risk of death is doubled. presence of shock, need for mechanical ventilation, need for renal replacement therapy and bilateral changes on CXR also increase the risk of death.

**GRANT ACKNOWLEDGMENT.** Written on behalf of the GenOSept partners and investigators, funded by a grant from the European Commission and supported by the ESICM. Ms P. Hutton received funding from the UKCRN.

## 0580

### EARLY ONSET PNEUMONIA IN SURVIVORS OF OUT-OF-HOSPITAL CARDIAC ARREST

S. Perbet[1,2], N. Mongardon[1], F. Dumas[3], C. Bruel[2], V. Lemiale[1], B. Mourvillier[2], P. Carli[4], J.-P. Mira[1], M. Wolff[2], A. Cariou[1]

[1]Cochin Hospital, Medical Intensive Care Unit, Paris, France, [2]Bichat Hospital, Medical Intensive Care Unit, Paris, France, [3]Hotel-Dieu Hospital, Emergency, Paris, France, [4]Necker Hospital, SAMU de PARIS, Paris, France

**INTRODUCTION.** Early onset pneumonia (EOP) after Out-of Hospital Cardiac Arrest (OHCA) were little studied during therapeutic mild hypothermia (32–34°C > 12 h). Diagnosis remains difficult with occurrence of post resuscitation sepsis-like syndrome and absence of common criteria of evaluation (temperature, white blood cells (WBC), $PaO_2$).

**OBJECTIVES.** The objective of this study was to evaluate incidence, microbiology, risk factors and influence on outcome of EOP after OHCA.

**METHODS.** Retrospective, bicentric analysis of prospective database from 2002 to 2008. Patients with accidental hypothermia or hypoxemic pneumonia before OHCA and dying in the first 24 h were excluded. EOP was defined by new X-ray infiltrate, tracheal secretions, $PaO_2/FiO_2 < 240$, $4000 < WBC < 11000$ G/L and/or a positive quantitative culture (endotracheal aspiration > $10^6$ UFC/mL, blind distal sample > $10^3$ UFC/mL ou BAL > $10^4$ UFC/mL) in the first 3 days. Outcome was evaluated by in-hospital mortality and CPC score (favorable if CPC 1 or 2).

**RESULTS.** Of 845 patients admitted after OHCA, 641 were included, 419 (65%) developed an EOP, 314 with a positive quantitative sampleMicrobiology described 395 isolated microrganisms: *S. aureus* (19%), *H. influenzae* (18%), *S. pneumoniae* (15%), Streptococcus (7%), Enterobacteriae (32%), *P. aeruginosa* (3%), autres (6%). Polymicrobial flora was found in 8% of cases. Mild hypothermia was induced in 500 cases. OHCA characteristics in patients with or without EOP were not different :male sex (71 vs. 68%, p 0.39), age (IQR, p 0.15), no flow < 5 min (51 vs. 52%, p 0.77), low flow < 15 min (54 vs. 51%, p 0.46), adrenaline ≤ 3 mg (67 vs. 65%, p 0.66), post-resuscitation shock (59 vs. 61%, p 0.59). Cardiac (63 vs. 59%) and pulmonary etiology (23 vs. 19%) (p 0.02) and mild hypothermia > 12 h (82 vs. 71%, p = 0.001) were factors associated with EOP. Mortality (EOP + 59%, EOP − 64%, p 0.24) and favorable neurological outcome (EOP + 38%, EOP − 18%) were not significatively different. In multivariate analysis, EOP has not impact on in-hospital mortality (OR = 1.35; IC [0.89–2.07]; p = 0.162).

**CONCLUSIONS.** EOP are frequent after OHCA without modifying outcome. Bacteria were from oropharyngeal flora but the incidence of isolated Enterobacteriae is important. Absence of clear risk factors and risk of late diagnosis without common criteria of infection in patients treated by hypothermia after OHCA must impose the achievement of a pulmonary sample. Hypothermia has a dual role: confounding factor and risk factor.

## 0581

### AN IN VITRO ASSESSMENT OF ENDOTRACHEAL TUBE CUFF PRESSURE MAINTENANCE

A. Myers[1], P. Morgan[2], N. Al-Subaie[3]

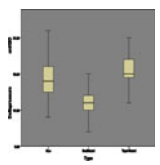
[1]Mayday University Hospital, Department of Anaesthesia, London, UK, [2]East Surrey Hospital, Redhill, UK, [3]St Georges University of London, London, UK

**INTRODUCTION.** Endotracheal tube (ETT) cuff inflation provides a mechanical barrier to the passage of oral contents into the trachea and subsequently reduces the risk of pulmonary aspiration. The integrity of this seal is related to ETT cuff pressure and therefore to the ability of the cuff to reduce aspiration. ETT cuff pressure should be maintained between 20 and 30 $cmH_2O$ to reduce the risks of aspiration and tracheal mucosal damage [1]. Aspiration has been reported at cuff pressures up to 60 $cmH_2O$ [2].

**OBJECTIVES.** We compared three different designs of Mallinckrodt ETTs: Hi-Lo® (polyvinyl chloride, barrel shaped cuff), SealGuard™ (polyurethane, tapered cuff) and Taperguard™ (polyvinyl chloride, tapered cuff).

**METHODS.** A universal container with internal diameter of 21 mm was employed to represent a trachea. The universal container was intubated with each variety of ETT in sizes 7.0 and 8.0. The cuffs were inflated using a standard hand held manometer (Portex CE0473) to 25 $cmH_2O$, as per the manufacturer's recommendation. The cuff pressure was re-assessed after one hour. Statistical significance was assessed by applying Mann–Whitney and Kruskal–Wallis tests.

**RESULTS.** 81 ETTs were assessed, 20 Taperguard (10 size 7, 10 size 8), 27 Hi-Lo (17 size 7, 10 size 8) and 34 Sealguard (17 size 7, 17 size 8). The median recorded pressure drop in $cmH_2O$ for the ETTs was as follows: Taperguard 15 (Interquartile range (IQR) 2.25), Hi-Lo 14 (IQR 3.5) and Sealguard 11(IQR 2). There was no difference in pressure drop over time between different size of ETT in all types of tube. There was a significant difference between the three designs of tube (p < 0.001) [Kruskal–Wallis]. Separately comparing the integrity of pressure maintenance between the Sealguard and both the Taperguard and Hi-Lo tubes also revealed a significant difference (p < 0.001) [Mann–Witney]. There was no difference between the Hi-Lo and Taperguard tubes in pressure drop over time (p = 0.136).



Cuff pressure drop in different types of ETT

**CONCLUSIONS.** The Sealguard polyurethane tube performed significantly better than the polyvinyl chloride tubes at maintaining cuff pressure over time.

**REFERENCE(S).**

1. Sengupta P, Sessler D, Maglinger P et al. Endotracheal tube cuff pressure in three hospitals, and the volume required to produce an appropriate cuff pressure. BMC Anaesthesiol. 2004;4:8
2. Dullenkopf A, Gerber A, Weiss M. FLuid leakage past tracheal tube cuffs: evaluation of the new Microcuff endotracheal tube. Intensive Care Med. 2003;29:1849–53.

## 0582

### AN IN VITRO STUDY COMPARING THE EFFECT OF ENDOTRACHEAL TUBE DESIGN ON SEAL INTEGRITY

A. Myers[1], P. Morgan[2], N. Al-Subaie[3]

[1]Mayday University Hospital, Department of Anaesthesia, London, UK, [2]East Surrey Hospital, Redhill, UK, [3]St Georges University of London, London, UK

**INTRODUCTION.** Ventilator Associated Pneumonia (VAP) occurs in up to 27% of ventilated patients [1]. Subglottic secretion clearance is recommended [1] and, when undertaken at hourly intervals, has been shown to reduce the incidence of VAP [2]. The cuff seal must be maintained between subglottic secretion drainage to prevent microaspiration.

**OBJECTIVES.** To compare the quality of the seal created by three Mallinckrodt endotracheal tubes (ETTs). Hi-Lo® (polyvinyl chloride, barrel shaped cuff) was compared with SealGuard™ (polyurethane, tapered cuff) and Taperguard™ (polyvinyl chloride, tapered cuff).

**METHODS.** A universal specimen container (internal diameter 21 mm) was used to represent a trachea. A clean dry container, positioned at 30°, to depict the semi-recumbent patient, was intubated with sizes 7.0 and 8.0 Hi-Lo, Taperguard and Sealguard tubes. Cuffs were inflated to 25 $cmH_2O$ (± 1). 2mls of Methylene Blue diluted in water was introduced above the cuff. At the end of 1 h, it was observed whether any fluid had leaked below the cuff. This was repeated using a viscous solution (50% dilute methylene blue and 50% KY jelly). A limit of 1 h was set to reflect intervals suggested for subglottic secretion drainage. Each experiment was repeated 10 times.

**RESULTS.** There was a significant difference between the performance of the different sizes of Taperguard ETTs (Fisher's Exact Test 0.003) with the smaller tube allowing less leak. The difference between sizes 7.0 and 8.0 in Hi-Lo was not significant as leakeage was observed in all of the size 8 tubes and 9 out of 10 in the size 7. Sealguard performed best with 1 and 2 tubes leaking in the size 7 and 8, respectively, and, again, there was no significant difference between the sizes. Analysis across all size 7.0 ETTs showed Sealguard and Taperguard performed better than Hi-Lo ($p < 0.001$). There was no leakage after 1 h for any of the ETTs when tested using the viscous solution.

LEAKAGE OF DILUTE FLUID

| ETT tradename | Cuff shape | Cuff material | ETT diameter (mm) | Leak present | Leak absent |
|---|---|---|---|---|---|
| Taperguard | Tapered | PolyVinylChloride | 7 | 1 | 9 |
| Taperguard | Tapered | PolyVinylChloride | 8 | 8 | 2 |
| Hi-Lo | Barrel | PolyVinylChloride | 7 | 9 | 1 |
| Hi-Lo | Barrel | PolyVinylChloride | 8 | 10 | 0 |
| Sealguard | Tapered | PolyUrethane | 7 | 1 | 9 |
| Sealguard | Tapered | PolyUrethane | 8 | 2 | 8 |

**CONCLUSIONS.** The size, shape and material of ETT cuff are important factors in the prevention of leakage of non-viscous fluid. In intubation of this container, smaller sized ETTs (7.0) performed better. In the smaller size, tapered cuffs (polyurethane and polyvinyl chloride) performed better than barrel shaped. Sealguard performed best overall. Increased viscosity of fluid reduced leakage.

**REFERENCE(S).** 1. Guidelines for the Management of Adults with Hospital-acquired, Ventilator-associated, and Healthcare-associated Pneumonia. Am J Respir Critical Care Med. 2005;171:388–416.

2. Smulders K, van der Hoeven H, Weers-Pothoff I, Vandenbroucke-Grauls C. A randomized clinical trial of intermittent subglottic secretion drainage in patients receiving mechanical ventilation. Chest. 2002;121(3):858–62.

## 0583

### EPIDEMIOLOGY OF LOWER RESPIRATORY TRACT COLONIZATION IN MECHANICAL VENTILATED PATIENTS

I. Vasiliadis[1], M. Sartzi[1], E. Peppa[1], F. Nanou[1], M. Charitidi[1], G. Kallitsi[1], M. Michalia[1], P. Clouva[1]

[1]General Hospital of Eleusis "Thriassio" Athens Greece, ICU, Eleusis Athens, Greece

**INTRODUCTION.** Tracheal intubation and mechanical ventilation may cause a disruption in the defensive mechanisms predisposing to lower respiratory tract (LRT) colonization and subsequent infection, which are an important cause of morbidity and mortality in critical care patients.

**OBJECTIVES.** We endeavored to study the epidemiology of Airway Colonization (AC) in mechanical ventilated patients of an interdisciplinary ICU.

**METHODS.** Retrospective study of 400 consecutive ICU patients ventilated > 48 h in the last 4 years. Patients age, gender, Apache II, prior illness, cause of admittance, vital signs, laboratory parameters, length of stay(LOS), time of mechanical ventilation(MV) before and during ICU stay, outcome, time of appearance of AC and isolated microorganisms were registered. CPIS and MODS were calculated on the day AC was documented. Bronchial secretions were cultured at admission, at least once a week and whenever there was a change in the amount and quality of bronchial secretions or clinical infection was suspected. We defined haemodynamic instability as low mean blood pressure and support with vasoactive and/or inotrop drugs and hypoxaemia as $PaO_2 < 80$ mmHg or $FiO_2 > 0.5$. Statistical evaluation was performed using Students t test and Pearson's Chi square test. Statistical significant level was set at $p < 0.05$.

**RESULTS.** From the 400 studied patients 68–17% developed AC after 3.1 ± 0.8 days, predominantly with Gram negative microorganisms. The AC patients were (mean ± SD) 39.1 ± 7.3 years old, had a APACHE II score 21.6 ± 3.7, duration of mechanical ventilation before ICU admission 3.06 ± 1.5 days and in the ICU 21.5 ± 12.5 days and LOS 26.2 ± 13.2 days. On the day of AC detection CPIS was 1.7 ± 0.6 and MODS 2.4 ± 0.5. Patients who did not develop AC were 35.8 ± 5.6 years old, had a APACHE II score 19.06 ± 2.3, ventilated before ICU admission 1.3 ± 1 days and in the ICU 19.4 ± 9.1 days. Age ($p < 0.03$), APACHE II ($p < 0.04$), haemodynamic instability ($p < 0.01$), hypoxaemia ($p < 0.01$) and longer time of mechanical ventilation before ICU admission ($p < 0.01$) were the strongest associated factors of AC development. Patients who developed AC, not followed by infections of the LRT, compared to those with AC who developed infections, did not have higher ICU ($p < 0.4$) or hospital ($p < 0.3$) mortality, or a longer duration of intubation ($p < 0.2$) or mechanical ventilation ($p < 0.5$). 25 (36.7%) of the colonized patients developed infections of the LRT (with the same pathogen). Colonized patients who developed infections of the LRT had more severe organ dysfunction ($p < 0.002$), longer MV duration ($p < 0.01$) and longer LOS ($p < 0.001$) but not higher mortality ($p < 0.6$).

**CONCLUSIONS.** AC seems to be associated with age, APACHE II, haemodynamic instability and hypoxaemia at admission in the ICU, time of mechanical ventilation before ICU admission and resulted in LRT infections in only on third of our patients without influencing the outcome of the affected patients.

## 0584

### VALIDATION OF THE ATS/IDSA GUIDELINES FOR HOSPITAL-ACQUIRED PNEUMONIA IN THE ICU

M. Ferrer[1], A. Liapikou[1], M. Valencia[1], M. Esperatti[1], A. Theessen[1], L.M. Saucedo[1], A. San Jose[1], J. Mensa[1], E. Zavala[1], A. Escorsell[1], J.M. Nicolas[1], R. Cartaña[1], A. Torres[1]

[1]Hospital Clinic, IDIBAPS, Barcelona, Spain

**INTRODUCTION.** In 2005, the ATS/IDSA guidelines for hospital-acquired pneumonia classified patients according to time of onset and risk factors for potentially resistant microorganisms (PRM) in order to select initial antibiotic therapy.

**OBJECTIVES.** We assessed the microbial prediction and validated the adequacy of these guidelines for antibiotic strategy.

**METHODS.** We prospectively evaluated 276 cases of pneumonia acquired in the ICU. Patients were classified in Group 1 (early-onset without risk factors for PRM, n = 38) and Group 2 (late onset or risk factors for PRM, n = 238). We determined the accuracy of the guidelines to predict the causative organisms and the influence of adherence to the guidelines on the outcome of patients. We also compared the 2005 ATS/IDSA guidelines with the previous 1996 ATS guidelines.

**RESULTS.** The rate of etiologic diagnosis (153, 55%), polymicrobial pneumonia, and the individual pathogens isolated, including PRM, were similar between the two groups. Microbial prediction was lower in group 1 than group 2 (12, 50 vs. 119%, 92%, $p < 0.001$), mainly due to the isolation of PRM (*P. aeruginosa* and methicillin-resistant *S. aureus*) in 10 (26%) patients from group 1. Adherence to the guidelines by physicians was higher in group 2 (153, 64% vs. 7, 18% in group 1, $p < 0.001$). Adherence to the guidelines resulted in more appropriate empirical antimicrobial treatment than non-adherence (69, 83% vs. 45, 64%, $p = 0.013$) and a trend toward better response to the empiric therapy only in Group 2 (98, 64 vs. 44%, 52%, $p = 0.087$), but did not affect mortality. Reclassifying patients according to the risk factors for PRM of the former 1996 ATS guidelines increased microbial prediction in Group 1 to 21 (88%, $p = 0.014$), and all except 1 patient with PRM were correctly identified by these guidelines.

**CONCLUSIONS.** The 2005 guidelines predict PRM worse than the 1996 guidelines, resulting in lower adherence by physicians in patients from group 1. Adherence to the guidelines resulted in more adequate treatment and a trend to a better clinical response in Group 2, but didn't influence mortality.

**GRANT ACKNOWLEDGMENT.** CibeRes (CB06/06/0028)-ISCiii, 2009 SGR 911, ERS Fellowship, IDIBAPS.

## 0585

### EFFECTS OF SELECTIVE DECONTAMINATION OF THE DIGESTIVE TRACT ON ACINETOBACTER BAUMANII RELATED VENTILATION ACQUIRED PNEUMONIA: PRELIMINARY DATA

E. Ferrari[1], L. Serio[2], C. Venturelli[3], M. Codeluppi[4], E. Righi[5], C. Mussini[4], P. Marchegiano[6], I. Bosi[7], M. Girardis[8]

[1]University of Modena and Reggio Emilia, Modena, Italy, [2]University Hospital of Modena, Intensive Care Unit, Modena, Italy, [3]University Hospital of Modena, Department of Microbiology, Modena, Italy, [4]University Hospital of Modena, Infectious Diseases Unit, Modena, Italy, [5]University Hospital of Modena, Department of Public Health Sciences, Modena, Italy, [6]University Hospital of Modena, Medical Direction, Modena, Italy, [7]University Hospital of Modena, Pharmacy Unit, Modena, Italy, [8]University of Modena and Reggio Emilia, Intensive Care Unit, Modena, Italy

**INTRODUCTION.** In the 2009 an outbreak of multidrug resistant (MDR) Acinetobacter baumanii occurred in our intensive care unit (ICU). As suggested by others (1), we hypothesized that selective decontamination of digestive tract (SDD) could be responsible, at least in part, for this MDR bacteria selection and, therefore, in August 2009 we withheld its routine use in mechanically ventilated patients.

**OBJECTIVES.** In this pre-post study we aimed to evaluate the effects of SDD on occurrence of ventilation acquired pneumonia (VAP), in particular of Acinetobacter baumanii related VAP.

**METHODS.** In all patients admitted for > 48 h in a 10-beds ICU of an University Hospital from February 2009 to August 2009 (SDD period) and from September 2009 to March 2010 (no-SDD period) we retrospectively collected age, SAPS II, type of admission (medical, surgical subdivided in elective or emergency and trauma) mechanical ventilation needing, length of mechanical ventilation and the occurrence of VAP according to the Helics definition [2] and its related ICU mortality. Our institutional protocol provided the oral and gastric administration of a amphotericin B, tobramycin and polymyxin E solution in all patients with expected mechanical ventilation > 48 h.

**RESULTS.** One hundred eighty-one patients in SDD period and 228 patients in no-SDD period were included in the study. Mean age, type of admission, number of ventilated patients and length of mechanical ventilation were similar in the 2 groups, whereas SAPSII was lower ($p < 0.05$) in SDD period (39 ± 20) than in no-SDD period (44 ± 21). VAP incidence was slightly lower ($p > 0.05$) in SDD period (16.7 episodes/1,000 days of mechanical ventilation) than in no-SDD period (19.7 episodes/1,000 days of mechanical ventilation). Acinetobacter baumanii caused VAP in 7 (3.9%) patients of the SDD-period and in 13 (5.7%) of the no-SDD period with a global ICU mortality of 35%.

**CONCLUSIONS.** The above preliminary data indicated that the withholding of SDD protocol did not substantially modify the global incidence of VAP and, in particular, of MDR Acinetobacter Baumanii related VAP. Therefore, the use of SDD seems to be not correlated with the outbreak of MDR *Acinetobacter baumanii* occurred in our ICU.

**REFERENCE(S).** 1. Al Naiemi et al. Emergence of multidrug-resistant Gram-negative bacteria during selective decontamination of the digestive tract on an intensive care unit. J Antimicrob Chemother. 2006; 58:853–6.

2. Hospital in Europe Link for Infection Control trough Surveillance (HELICS). Surveillance of Nosocomial Infections in Intensive Care Units. Protocol version 6.1. 2004;8–9.

## 0586

### FLUID LEAKAGE ACROSS TRACHEAL TUBE CUFF, EFFECT OF DIFFERENT CUFF MATERIAL, SHAPE AND POSITIVE EXPIRATORY PRESSURE: A BENCH-TOP STUDY

A. Zanella[1], V. Scaravilli[1], S. Isgrò[1], M. Milan[1], M. Giani[1], N. Patroniti[1,2], R. Fumagalli[1,2], A. Pesenti[1,2]

[1]University of Milano-Bicocca, Department of Experimental Medicine, Monza, Italy, [2]San Gerardo Hospital, Department of Perioperative Medicine and Intensive Care, Monza, Italy

**INTRODUCTION.** Standard polyvinylchloride (PVC) endotracheal tube (ETT) cuffs do not protect from aspiration across the cuff, a leading cause of ventilator-associated pneumonia (VAP).

**OBJECTIVES.** We compared, in an in vitro study, the effect of different cuff materials (PVC, polyurethane and guayule-latex), shapes (cylindrical, conical) and positive end expiratory pressures (PEEP) in reducing fluid leakage across the cuff.

**METHODS.** We compared for fluid leakage a cylindrical double-layer guayule-latex prototype cuff, three cylindrical PVC cuffs (Mallinckrodt Hi-Lo, Mallinckrodt High-Contour, Portex Ivory), one conical PVC cuff (Mallinckrodt TaperGuard) and two polyurethane cuffs (Mallinckrodt SealGuard, conical; Microcuff, cylindrical). Ten centimeters of die-water were poured above the cuffs inflated (pressure 30 $cmH_2O$) in a vertical cylinder (diameter 20 mm). A respiratory circuit connected the bottom of the cylinder to a breathing bag inflated at four pressures (PEEP = 0, 5, 10, 15 $cmH_2O$). Pictures were taken every 60 s for 24 h to measure leakage as a reduction in the water column above the cuff. Three new ETTs of each type were tested.

**RESULTS.** The guayule-latex cuffs showed no leakage at all the PEEP levels. Both the cylindrical and conical polyurethane cuffs showed limited leakage (3.8 ± 3.7 cm of water) only for PEEP zero. The PVC cuffs showed decrement leakage at incremental PEEP: 9.3 ± 1.5, 7.8 ± 2.2, 2.2 ± 1.0 and 0 cm of water. Among all the PVC cuffs, the conical shape ensured higher sealing properties.

**CONCLUSION.** The guayule-latex cuffs always prevented fluid leakage, the polyurethane and PVC cuffs required incremental levels of PEEP to prevent fluid leakage ever-present at zero PEEP.

## 0587

### VENTILATOR ASSOCIATED PNEUMONIA IN TRAUMA PATIENTS IS ASSOCIATED WITH LOWER MORTALITY: RESULTS FROM EUVAP STUDY

M. Magret[1], R. Amaya-Villar[2], J. Garnacho[2], T. Lisboa[3], E. Díaz[3], J. DeWaele[4], M. Deja[5], E. Manno[6], J. Rello[7]

[1]Sant Joan University Hospital, Reus, Spain, [2]Virgen del Rocío University Hospital, Sevilla, Spain, [3]Joan XXIII University Hospital, University Rovira i Virgili, Pere Virgili Health Institut and CIBER Enfermedades Respiratorias (CIBERES), Tarragona, Spain, [4]Ghent University Hospital, Ghent, Belgium, [5]Charite University Hospital, Berlin, Germany, [6]Maria Vittoria Hospital, Torino, Italy, [7]Vall d'hebron Univ Hospital, Barcelona, Spain

**INTRODUCTION.** VAP is the most common and serious infection among patients in trauma ICU. Trauma has been identified as an independent predictor to VAP development in large cohort studies [1]. However, contribution of VAP to death in trauma patients is still a matter of hot debate [2]. Differences in microbiology are of the utmost importance in clinical practice since inadequate empirical therapy of a VAP is an independent predictor of mortality in heterogeneous populations of ICU patients and also in trauma subjects [3]. EU-VAP/CAP is an observational survey conducted in ICUs from 9 European countries.

**OBJECTIVES.** The aim of this secondary analysis is to describe differences in etiology, diagnostic techniques, and outcomes in trauma and non-trauma patients with VAP in European ICUs.

**METHODS.** Prospective, observational study conducted in 27 ICUs from 9 European countries. We included patients requiring invasive mechanical ventilation for > 48 h who developed VAP. Logistic regression model was used to assess factors independently associated with mortality in trauma patients with VAP.

**RESULTS.** A total of 2,436 patients were evaluated; 465 developed VAP, 128 (27.5%) were in trauma patients. Trauma patients were younger than non-trauma (45.3 ± 19.4 vs. 61.1 ± 16.7, $p < 0.0001$). Non-trauma had higher SAPS II score compared to trauma patients (45.5 ± 16.3 vs. 41.1 ± 15.2, $p = 0.009$). Most prevalent pathogens in trauma patients with early-VAP were *Enterobacteriaceae* (46.9 vs. 27.8%, $p = 0.06$) followed by MSSA (30.6 vs. 13%, $p = 0.03$) and then *H. influenzae* (14.3 vs. 1.9%, $p = 0.02$), and the most prevalent pathogen in late-VAP was *A. baumannii* (12.2 vs. 44.4%, $p < 0.0001$). Mortality was higher in non-trauma patients than in trauma patients (42.6 vs. 17.2%, $p < 0.001$, OR = 3.55 95% CI 2.14 to 5.88). A logistic regression model adjusted for sex, age, severity of illness at ICU admission, and SOFA score at the day of VAP diagnosis confirmed that trauma was associated with a lower mortality compared to non-trauma patients(OR = 0.37 95% CI 0.21–0.65).

**CONCLUSIONS.** Trauma patients developing VAP had different demographic characteristics and episodes aetiology. After adjustment for potential confounders, VAP episodes in trauma patients are associated with lower mortality when compared to non-trauma patients.

**REFERENCE(S).** 1. Cook DJ et al. Incidence of and risk factors for ventilator-associated pneumonia in critically ill patients. Ann Intern Med. 1998;129:433–40.
2. Baker AM et al. Pneumonia in intubated trauma patients. Microbiology and outcomes. Am J Respir Crit Care Med. 1996;153:343–9.
3. Mueller EW et al. Effect from multiple episodes of inadequate empiric antibiotic therapy for ventilator-associated pneumonia on morbidity and mortality among critically ill trauma patients. J Trauma. 2005;58:94–101

**GRANT ACKNOWLEDGMENT.** Supported, in part, by Generalitat de Catalunya grant SGR 05/920, by CIBER Enfermedades Respiratorias, and by Carlos III Health Institute grants PI05/2410 and AI/07/90031.

## 0588

### HOSPITAL-ACQUIRED PNEUMONIA IN THE INTENSIVE CARE UNIT ACQUIRED OR NOT DURING MECHANICAL VENTILATION

M. Esperatti[1], M. Ferrer[1], A. Theessen[1,2], L. Adamantia[1], V. Mauricio[1], L.M. Saucedo[1], E. Zavala[3], A. Torres[1]

[1]Institut Clínic del Tòrax, Hospital Clinic, IDIBAPS, Universitat de Barcelona, Servei de Pneumologia, Barcelona, Spain, [2]Department of Respiratory Medicine, Medizinische Hochschule Hannover, Hannover, Germany, [3]UCI Quirurgica, Hospital Clinic, IDIBAPS, Universitat de Barcelona, Intensive Care Medicine, Barcelona, Spain

**INTRODUCTION.** Most of the current data on hospital-acquired pneumonia (HAP) are extrapolated from patients with ventilator-associated pneumonia (VAP). No studies have evaluated HAP in the intensive care unit (ICU) in non-ventilated patients.

**OBJECTIVES.** To compare pneumonia in the ICU acquired or not during ventilation.

**METHODS.** We prospectively collected 315 episodes of ICU-acquired pneumonia. We compared clinical and microbiological characteristics of patients with VAP (n = 164, 52%) and non-ventilator ICU-acquired pneumonia (NV-ICUAP, n = 151, 48%). Among NV-ICUAP patients, 79 (52%) needed subsequent intubation.

**RESULTS.** Compared with NV-ICUAP, patients with VAP were more severe (APACHE-II 17 ± 6 vs. 15 ± 5, $p < 0.001$) and pneumonia occurred later during the ICU stay (8 ± 8 vs. 5 ± 6 days, $p < 0.001$). Etiologic diagnosis (117, 71 vs. 63, 42%, $p < 0.001$), non-fermenting (28 vs. 15%, $p = 0.009$) and enteric gram-negative bacilli (26 vs. 13%, $p = 0.006$), and methicillin-sensitive *Staphylococcus aureus* (14 vs. 6%, $p = 0.031$) were more frequent in VAP patients, likely due to a higher proportion of patients with lower respiratory tract samples cultured (100 vs. 84%, $p < 0.001$). However, when considering patients with defined etiology only, the proportion of all pathogens was similar between groups. The hospital mortality was similar as well.

**CONCLUSIONS.** Hospital-acquired pneumonia in non-ventilated patients occurred earlier in the ICU than VAP. Despite a higher proportion of pathogens in VAP, the isolated pathogens and outcome are similar regardless pneumonia is acquired or not during ventilation, indicating they depend on patients' underlying severity rather than previous intubation. Therefore, both types of patients should receive similar empiric antibiotic treatment.

**REFERENCE(S).** 1. American Thoracic Society. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. Am J Respir Crit Care Med. 2005;171:388–416.
2. Sopena N, Sabria M. Multicenter study of hospital-acquired pneumonia in non-ICU patients. Chest. 2005;127:213–9.
3. Dorca J, Manresa F, Esteban L, Barreiro B, Prats E, Ariza J, Verdaguer R, Gudiol F. Efficacy, safety, and therapeutic relevance of transthoracic aspiration with ultrathin needle in nonventilated nosocomial pneumonia. Am J Respir Crit Care Med. 1995;151:1491–6.
4. Weber DJ, Rutala WA, Sickbert-Bennett EE, Samsa GP, Brown V, Niederman MS. Microbiology of ventilator-associated pneumonia compared with that of hospital-acquired pneumonia. Infect Control Hosp Epidemiol. 2007;28:825–31.
5. Ioanas M, Ferrer M, Cavalcanti M, Ferrer R, Ewig S, Filella X, Puig de la Bellacasa J, Torres A. Causes and predictors of non-response to treatment of the ICU-acquired pneumonia. Crit Care Med. 2004;32:938–45.

**GRANT ACKNOWLEDGMENT.** Funded By: CibeRes (CB06/06/0028)-ISCiii, 2009 SGR 911, ERS Fellowship, and IDIBAPS.

## 0589

### PRAVASTATIN PREVENTIVE THERAPY FOR VENTILATOR ASSOCIATED PNEUMONIA

S. Manoulakas[1], E. Papakrivou[1], N. Tzovaras[1], A. Hovas[2], M. Mpaka[1], E. Kostadima[1], D. Makris[1], A. Komnos[2], E. Zakynthinos[1]

[1]University Hospital of Larissa, Larissa, Greece, [2]General Hospital Larisa, Larissa, Greece

**INTRODUCTION.** Ventilator associated pneumonia (VAP) has been associated with considerable costs of hospitalization and morbidity. Several strategies have been implicated to minimize the risk of VAP and to manage effectively the disease.

**OBJECTIVES.** To investigate whether the use of pravastatin reduces the incidence of VAT and whether this strategy is related with favourable outcomes in ICU patients.

**METHODS.** The present is a two-centre prospective randomized open label controlled trial. Consecutive sampling was used to recruit patients hospitalized in the ICU of the University Hospital of Larissa and the General Hospital of Larissa in Greece between 2008 and 2010. Inclusion criteria were mechanical ventilation and ICU stay > 48 h. Exclusion criteria: Pregnancy, previous use of statins, contraindications to statin use, CPK > 3 of normal on admission, use of substances that affects statin metabolism, malabsorption. After inclusion patients were randomized either to receive oral pravastatin sodium 40 mg treatment (PG) or not (CG). Treatment was started on the first 24 h in ICU and ended a month later.

**RESULTS.** We studied 154 patients (71PG and 83CG); mean (IQR) age of participants were 56.5 (40–70), APACHE II score 13.7 (11–17), SOFA 8.3 (7–11). There was no significant difference between PG and CG in terms of baseline characteristics. ICU stay (days) were 21.6 (8–29) and 28.1 (10–34) in PG and CG, respectively ($p = 0.7$). VAP incidence was 25.3% in PG and 38.2 in CG ($p = 0.11$). The incidence of bacteremia was 23.9 and 32% in PG and CG ($p = 0.2$). ICU mortality was 14 and 29.6% in PG and CG, respectively, ($p = 0.03$).

**CONCLUSIONS.** Our results provide evidence suggesting that the use of pravastatin in ICU patients may be associated with decreased mortality.

### 0590

**VENTILATOR ASSOCIATED PNEUMONIA PREVENTIVE PROGRAM: A BRAZILLIAN ICU EXPERIENCE**

R. Beranger[1], M. Knibel[2], L.R. Carneiro[2], M. Murta[2], P. Azambuja[2], P.Y. Pinheiro[1]

[1]São Lucas Copacabana Hospital, Infection Control, Rio de Janeiro, Brazil, [2]São Lucas Copacabana Hospital, ICU, Rio de Janeiro, Brazil

**INTRODUCTION.** Nosocomial infections constitute a major complication in hospitalized patients, particularly in those who are critically ill and need intensive care. Ventilator-associated pneumonia (VAP) is the most frequent nosocomial infection in the Intensive Care Unit (ICU) and complicates the illness course by increasing mortality rate, length of hospital stay and costs for patients who acquire it.

**OBJECTIVES.** Decrease the rate of VAP with the implementation of simple and cost effective measures in a clinical intensive care unit.

**METHODS.** This study was performed in a 12 beds high complex clinical ICU in a private hospital in Rio de Janeiro, Brazil. Since 2005, the rates of VAP were tracked. For the diagnosis of VAP we used CDC criteria. We used the annual rates to compare the results trough the years. In January 2009, a new preventive program were instituted to try to decrease the rates of VAP in at least 30%. In order to acomplish that results we used simple and cost effective measures by strengthening in-service training and completing daily checklists involving the rightly use of barrier precautions, semi-recumbent position, adequacy of stress ulcer prophylaxis, antibiotic policy guided by the infection control department, daily interruption of sedation and minimal duration of mechanical ventilation, increasing hand washing opportunity and improvement patient's oral hygiene.

**RESULTS.** In 2005 we had a VAP rate of 10.6 cases per 1,000 ventilator-days. We had a stable rate during the following years, with a small increase in 2008. The respective VAP rates were 9.5 in 2006, 11.5 in 2007 and 12.1 in 2008. This scenario stimulated our group to work towards better numbers. After the implementing of the preventive program we had a fall of 36% in VAP rates when comparing with the mean VAP rates of 2005–2008 and a 42.1% decrease when comparing with the year of 2008 alone, with 7.0 cases of VAP per 1,000 ventilator-days in the year of 2009.

**CONCLUSIONS.** Ventilator-associated pneumonia is a major problem in critical ill enviroment. Simple measures can help combat it. We had a decrease of 42.1% in VAP rates in the first year of a implementing a new program, but this enforce must be sustain to garantee better numbers in subsequences years. The infection control team and the ICU team will continue to jointly work to achieve smaller VAP rates in a near future.

**REFERENCE(S).** 1. Centers for Disease Control and Prevention. Guidelines for preventing healthcare-associated pneumonia, 2003: recommendation of CDC and the Healthcare Infection Control Practices Advisory Committee. Morb Mortal Weekly Rep. 2004;53(RR-3):1–23.
2. Edwards JR, Peterson KD, Andrus MA, Tolson JS, Goulding JS, Dudeck MA et al. National Healthcare Safety Network (NHSN) report, data summary for 2006, issued June 2007. Am J Infect Control 2007;35: 290–301.

### 0591

**SUSPENDED ANIMATION LIKE: STATE INDUCER HYDROGEN SULFIDE REDUCES LUNG INJURY IN MECHANICALLY VENTILATED RATS WITH PNEUMONIA**

H. Aslami[1,2], A. Bos[1], M.T. Kuipers[1,2], C.J.P. Beurskens[1,2], C.W. Wieland[1,2], M.J. Schultz[1,2], N.P. Juffermans[1,2]

[1]Academic Medical Centre, Laboratory of Experimental Intensive Care and Anesthesiology (L.E.I.C.A.), Amsterdam, Netherlands, [2]Academic Medical Centre, Department of Intensive Care Medicine, Amsterdam, Netherlands

**INTRODUCTION.** *Streptococcus pneumoniae* pneumonia is the leading cause of community acquired pneumonia and frequent reason for ICU admission and mechanical ventilation. Hydrogen sulfide ($H_2S$)-induced suspended animation-like state reduces metabolism and shifts mitochondrial substrate utilization.

**OBJECTIVES.** To evaluate the effect of a suspended animation-like state in a ventilated rat model of *Streptococcus pneumoniae* pneumonia.

**METHODS.** After intratracheal challenge with $5.5 \times 10^6$ colonizing forming units (CFU) of *Streptococcus pneumoniae*, rats were sedated, connected to a mechanical ventilator and infused with $H_2S$ donor NaHS (2 mg/kg/h, $n = 8$ per group). Infected and uninfected controls received vehicle. After 4 h, rats were sacrificed and bronchoalveolar lavage fluid was obtained. Liver mitochondria were isolated by differential centrifugational steps. Mitochondrial respiratory complex 1 was evaluated with malate and glutamate. State 3 was initiated by adding ADP, indicating active phosphorylation.

**RESULTS.** Pneumonia was characterized by increased BALF cell counts (median with [IQR]) (31 [16–46] vs. 2 [2–4] $\times$ $10^5$ cells/ml), protein levels (1.3 [1.1–1.4] vs. 0.6 [0.3–0.8] mg/ml), IL-6 levels (0.9 [0.6 -1.5] vs. 0.1 [0.1–0.1] ng/ml) and CINC3 levels (1.7 [1.4–2.0] vs. 0.6 [0.2–1.5] ng/ml) compared to uninfected controls ($p < 0.05$ for all). Pneumonia was further characterized by reduced mitochondrial state 3 respiration (16 [12–18] vs. 20 [17–31] $O_2$ nmol/mg/min).

$H_2S$ infusion reduced mean body temperature (36 [35–37] to 25 [24–26]°C), heart rate (300 [280–330] to 153 [121–184] beats/min) and improved oxygenation (41 [37–43] to 23 [20–29] kPa) compared to placebo treated animals, ($p < 0.05$ for all). $H_2S$ reduced BALF cell counts (8 [7–9] $\times$ $10^5$ cells/ml), protein levels (0.8 [0.6–1.0] mg/ml, $p < 0.05$ for all) but not IL-6 levels (0.1 [0.1–0.6] ng/ml, $p = 0.056$) and CINC3 levels (0.6 [0.2–1.6] ng/ml, $p = 0.5$). Mitochondrial state 3 respiration was restored by $H_2S$ infusion (20 [19–21] $O_2$ nmol/mg/min). Bacterial outgrowth was not reduced in BALF (43 [1–133] vs. 5 [3–52] $\times$ $10^5$ CFU/ml) and lung (1.8 [0.7–31] $\times$ $10^5$ vs. 8.5 [0.7–143] $\times$ $10^5$ CFU/gram lung) compared to untreated animals with pneumonia.

**CONCLUSIONS.** A suspended animation like state dampened the inflammatory response and improved liver mitochondrial phosphorylation in a model of ventilated *S. pneumoniae* pneumonia, without affecting bacterial outgrowth.

## Experiences from the H1N1 inuenza pandemics: 0592–0605

### 0592

**EXTRACORPOREAL MEMBRANE OXYGENATION FOR SEVERE INFLUENZA A (H1N1) ACUTE RESPIRATORY DISTRESS SYNDROME: A PROSPECTIVE OBSERVATIONAL COMPARATIVE STUDY**

A. Roch[1], R. Lepaul-Ercole[1], D. Grisoli[2], M. Castanier[1], S. Dizier[1], O. Brissy[1], C. Guervilly[1], J.-M. Forel[1], F. Collart[2], L. Papazian[1]

[1]Hopitaux Sud, Réanimation Médicale, Marseille, France, [2]Hôpital de la Timone, Chirurgie cardiaque, Marseille, France

**OBJECTIVES.** To describe characteristics, clinical evolution and outcomes in adult patients treated in Marseille south hospital for confirmed influenza A (H1N1) Acute Respiratory Distress Syndrome (ARDS) with or without extracorporeal membrane oxygenation (ECMO).

**METHODS.** We developed a mobile team allowing ECMO therapy for severe ARDS patients in referral hospitals of our region followed by a transfer to our center. The details of ECMO therapy were prospectively collected and we compared clinical features and outcomes of patients with or without ECMO.

**RESULTS.** From October 2009 to January 2010, 18 patients were admitted for confirmed influenza A (H1N1) ARDS, of whom 9 were treated with ECMO after a median (interquartile range (IQR]) duration of mechanical ventilation of 10 (6–96) h. In six patients, ECMO was initiated in a referral hospital by a mobile team, in median (IQR) 3 (2–4) h after the phone call. Before ECMO, patients had severe respiratory failure with a median (IQR) $PaO_2$ to $FiO_2$ ratio of 52 (50–60) mmHg and a $PaCO_2$ of 85 (69–91) mmHg under a positive end-expiratory pressure of 12 (11–14) cmH2O. Patients treated with ECMO and without ECMO had the same hospital mortality rate (56%, 5/9). ECMO survivors had similar respiratory failure before ECMO than ECMO non survivors but showed a greater early improvement in $PaO_2$.

**CONCLUSIONS.** ECMO may be an effective salvage treatment for influenza A (H1N1) ARDS patients with rapid refractory respiratory failure, notably if provided by a mobile team allowing early cannulation followed by a transfer to a reference centre.

### 0593

**H1N1 EXPERIENCE IN A TERTIARY REFERRAL CENTER IN SAUDI ARABIA DURING FALL AND WINTER OF 2009: RMH IS THE TERTIARY REFERRAL HOSPITAL IN K.S.A.THE STUDY'S OBJECTIVES ARE TO ESTIMATE THE NUMBER OF H1N1 INFECTED ICU PATIENTS ADMITTED TO THE INTENSIVE CARE SERVICES DEPT IN RMH, AND THEIR OUTCOMES IN THE 1TH AND THE 2ND WAVE OF INFLUENZA A H1N1 OUTBREAK IN FALL AND WINTER OF 2009**

A. Shaban[1], Y. Mandourah[1]

[1]Military Hospital Riyadh, Intensive Care Unit, Riyadh, Saudi Arabia

**METHODS.** This is a Cohort study that surveyed all ICU patients query of H1N1During fall and winter of 2009. Data was gathered on a computer database case-report forms, it included general information, medical history, LOS, isolation, vital signs, laboratory tests and ICU procedures. To confirm the diagnosis patients must have a number of eligibility criteria regarding symptoms and PCR confirmation.the end point of this survey was to determine what reliable data can be used to predict the outcome of H1N1 patients in the ICU.

**RESULT.** 28ICU patients were admitted and confirmed diagnosis of influenza A H1N1, Diagnosis were confirmed to have H1N1 via PCR. The median age was 37.8 years. Dm and HTN were the commonest co-morbidity. The average ICU LOS was 14.2 days. All patient developed hypoxemic respiratory failure with average $PaO_2/FIO_2$ ratio 120. 85% patients received mechanical Ventilation. 25% required HFO. 17% had refractory hypoxemia and required proning. 25% had barotraumas. 35% developed AKI and 80% of them required RRT. Other complication included secondary infection, Myocarditis, and encephalopathy were reported. Mortalaty Rate was 17.8%.

**CONCLUSION.** H1N1 critical illness is characterized with sever respiratory failure and require mechanical ventilation. More than half of the patient would need unconventional mechanical ventilation. AKI and secondary infections are the commonest complications. In a good tertiary critical care set up H1N1 critical illness has a favorable outcome compared usual ARDS reported outcome. Riyadh Military Hospital is the tertiary referral hospital in Saudi Arabia.This study's objectives are to estimate the number of H1N1 infected ICU patients admitted to the intensive care services Department in RMH, and their outcomes in the first and the second wave of Influenza A H1N1 outbreak in fall and winter of 2009.

## 0594

### VENTILATORY STRATEGIES FOR PANDEMIC 2009 INFLUENZA A ($H_1N_1$) PATIENTS WITH ALI/ARDS

I. Grigoras[1,2], A.-I. Ciumanghel[2], D. Pulbere[2], A. Gavrilut[2], O. Apopei[2], M. Tarasi[2]

[1]University of Medicine and Pharmacy, Anesthesia and Intensive Care, Iasi, Romania, [2]University Emergency Hospital 'Sf. Spiridon', Anesthesia and Intensive Care, Iasi, Romania

**INTRODUCTION.** Pandemic 2009 A ($H_1N_1$) influenza represented a challenge for critical care community. Several studies reported the management and the outcome of influenza patients with pulmonary injury.

**OBJECTIVES.** Our study aimed to identify the particularities of ventilatory support and outcome in ALI/ARDS patients with A ($H_1N_1$) influenza admitted to a Romanian University hospital.

**METHODS.** This prospective observational study included patients (pts) admitted to the ICU, "Sf.Spiridon" Hospital, Iasi between 8.11.2009 and 18.01.2010. The recorded parameters were demographic data, co-morbidities, acute dysfunctions, ventilation strategies, ventilatory parameters, complications and outcome. Statistical analysis was performed using SPSS.1.3 and Microsoft Excel.

**RESULTS.** 74 patients were included: admission $PaO_2/FiO_2$ was 187.7 ± 109.7 (29 pts with ALI, 42 pts with ARDS). At ICU admission, 57 pts (77%) required ventilatory support—19 pts (26%) non-invasive mechanical ventilation (NMV) and 38 pts (51%) invasive mechanical ventilation (IMV) with admission $PaO_2/FiO_2$ 186.4 and 149.7, respectively. 8 pts. (42.1%) who received NMV ultimately required IMV. During theirs ICU stay, 16 patients required NMV and 46 pts IMV. As NMV, CPAP was used in 14 pts and BIPAP in 2 pts with a mean duration of 2.8 ± 1.4 days. As IMV, lung protective strategy BIPAP was used in 46 pts with $P_{plateau}$ 23.7 ± 4.7, PEEP 9.2 ± 2.8 and mean IMV time 8.2 ± 6.6 days. In patients with severe ARDS, a higher PEEP, neuromuscular blockade and increased $FiO_2$ (28 pts) were used in order to improve oxygenation. As part of the protective strategy, 26 pts (56%) had permissive hypercapnia, with an average $PaCO_{2worst}$ 68.2 ± 18.7. $PaO_2/FiO_{2worst}$ was 141.9 ± 55 in NMV and 102.7 ± 73 in IMV. All NMV patients survived. 25 of all IMV patients died ($PaO_2/FiO_{2\ worst}$ 67.2 ± 40.8). Comparative analysis survivors/non-survivors showed that $PaO_2/FiO_{2\ worst}$ ($p < 0.001$) and admission $PaO_2/FiO_2$ ($p < 0.023$) are risk factors for death in $AH_1N_1$ influenza patients.

**CONCLUSIONS.** Admission $PaO_2/FiO_2$ influenced the type of ventillatory support and outcome. $PaO_2/FiO_{2\ worst}$ in nonsurvivors pointed to the pulmonary cause of death.

**REFERENCE(S).** 1. The ANZIC Investigators. Critical care services and 2009 H1N1 influenza in Australia and New Zealand. NEJM 2009;361.

2. CDC. Intensive-care patients with severe novel influenza A (H1N1) virus infection—Michigan, June 2009. MMWR 2009;58:749–52.
3. Domínguez-Cherit G, Lapinsky SE, Macias AE et al. Critically ill patients with 2009 influenza A(H1N1) in Mexico [published online October 12, 2009]. JAMA.
4. Kumar A, Zarychanski R, Pinto R et al. Canadian Critical Care Trials Group H1N1 Collaborative. Critically ill patients with 2009 influenza A(H1N1) infection in Canada JAMA. 2009;302(17).

**GRANT ACKNOWLEDGMENT.** The study had no financial support.

## 0595

### TREATMENT OF A/H1N1 RELATED SEVERE ARDS BY EXTRACORPOREAL MEMBRANE OXYGENATION IN PREGNANT AND POSTPARTUM WOMEN, DURING THE 2009 FLU PANDEMIC. SINGLE CENTER EXPERIENCE

G. Panarello[1], G. Occhipinti[1], G. Capitanio[1], V. Ferrazza[1], P. Vitulo[2], M. Pilato[3],

G. Di Lorenzo[3], A.F. Arcadipane[1]

[1]ISMETT, Anesthesia and Critical Care, Palermo, Italy, [2]ISMETT, Pneumology, Palermo, Italy, [3]ISMETT, Cardiac Surgery, Palermo, Italy

**INTRODUCTION.** Pregnant women are at high risk of getting flu and developing severe complications; H1N1 outbreak confirmed the finding and pregnant women were over represented in the group of patients requiring intensive care management for respiratory impairment [1, 2].

**OBJECTIVES.** Aim of our paper was to confirm the effectiveness of extracorporeal membrane oxygenation as bridge to recover in patients suffering of fulminant respiratory failure due to H1N1 infection.

**METHODS.** From October 2009 through January 2010, 16 patients were referred to our ICU because of severe ARDS secondary to virus A/H1N1 infection; in 12 cases ECMO was required as rescue therapy [3]. Among patients requiring extracorporeal oxygenation, three were pregnant or recently post partum women; one patient was bearing twins siblings. In one case our ECMO team had to place the extracorporeal support in the referring Institute [4, 5].

**RESULTS.** All three patients after a mean of 16 days were weaned from ECMO and required percutaneous tracheostomy to be weaned from mechanical ventilation. The pregnant woman had the cesarean delivery done while still on ECMO. The mean LOS was 37 days; all patients were discharged home in good general conditions and not requiring oxygen supply. None of the four newborns got flu infection; all infants required NICU admission; invasive mechanical ventilation was necessary for the infant born while the mother was on ECMO support.

TABLE 1 CHARACTERISTICS OF PATIENTS DATA AT BAS

| Demographics | Case 1 | Case 2 | Case 3 |
|---|---|---|---|
| Age at admission (years) | 38 | 31 | 23 |
| Parity (number) | 2 | 2 | 1 |
| Body mass index | 28 | 20.8 | 23.47 |
| Gestational age at symptoms onset | 25 | 33 | 39 |
| Steroids for fetal indications | n | y | n |
| Steroids for maternal indications | y | n | y |
| Comorbidities | n | n | n |

TABLE 2 PRE-ECLS VENTILATOR AND CLINICAL PARAMET

| PRE ECMO | Case 1 | Case 2 | Case 3 |
|---|---|---|---|
| Apache II score | 14 | 14 | 11 |
| Murray Score | 3.75 | 3.5 | 3.75 |
| Sofa score day 1 | 4 | 7 | 9 |
| $FiO_2$/PEEP (%/mmHg) | 100/14 | 100/15 | 100/17 |
| Respiratory rate | 30 | 30 | 33 |
| Duration of MV (days) | 5 | 1 | 6 |
| Tracheostomy | n | n | n |
| CRRT | n | n | y |
| ICU LOS (days) | 5 | 1 | 6 |

TABLE 3 PERINATAL OUTCOMES

| Perinatal outcome | Case 1 | Case 2a | Case 2b | Case 3 |
|---|---|---|---|---|
| Gestation | 25 | 33 | 33 | 39 |
| Birth weight | 1,200 | 2,100 | 1,820 | 2,400 |
| Apgar score 5 min | 2 | 9 | 9 | 9 |
| Admission to NICU | y | y | y | y |
| Assisted mechanical ventilation | y | n | n | n |
| NICU LOS (days) | 30 | 4 | 4 | 10 |
| Documented H1N1 infection | n | n | n | n |
| Outcome | Discharged | Discharged | Discharged | Discharged |

**CONCLUSIONS.** ECMO treatment is still a debatable therapeutic option for refractory respiratory failure in adults because of results and costs [6]. Our very small case series demonstrates ECMO to be an efficacious bridge to recover, despite an underlying clinical condition burdened by mortality of 80% or greater. ECMO treatment should be considered in high specialized centers to reach such good results. The next future will rely on so advanced and biocompatible extracorporeal oxygenation technology that this therapeutic option might be validated for increasing numbers of ICUs and might become so popular such as CRRT is now.

**REFERENCES.** 1. ANZ ECMO Influenza investigator. Critical illness due to 2009 A/H1N1 influenza in pregnant and postpartum women: population based cohort study. BMJ. 2010;340.

2. Janice KL. Severe 2009 H1N1 influenza in pregnant and postpartum women in California. N Engl J Med. 2010;362:27–35.

3. ANZ ECMO Influenza investigator. Extracorporeal Membrane Oxygenation for 2009 Influenza A (H1N1) Acute Respiratory Distress Syndrome. Jama 2009;302 (17):1888–95.

4. David SF. A review of 100 patients transported on extracorporeal life support. ASAIO J. 2002;48:612–9.

5. Arlt M. Emergency use of extracorporeal membrane oxygenation in cardiopulmonary failure. Artif Organs. 2009.

6. Peek GJ. Efficacy and economic assessment of conventional respiratory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicenter randomized controlled trial. Lancet. 2009;374:1351–63.

## 0596

### ACUTE RESPIRATORY DISTRESS SYNDROME ON THE BASIS OF 2009 NOVEL SWINE-ORIGIN INFLUENZA A (H1N1) INFECTION: REPORT FROM AN ECMO-CENTER IN GERMANY

S. Nitsch[1], A. Kalenka[1]

[1]University Hospital Mannheim, Department of Anesthesiology an Critical Care Medicine, Mannheim, Germany

**INTRODUCTION.** During 2009 H1N1 influenza A pandemia sometimes rescue therapies such as high frequency oscillation ventilation (HFOV), pumpless extracorporeal lung assist (PECLA) and extracorporeal membrane oxygenation (ECMO) have been necessary for the treatment of refractory hypoxemia and hypercapnia.

**OBJECTIVE.** This report describes the clinical features of 14 adult patients with confirmed 2009 H1N1 influenza A infection and ARDS admitted to a surgical intensive care unit (ICU), that is specialized for advanced ventilator support and ECMO therapy.

**RESULTS.** The patients had a median age of 44 years (range 24–65), 64.3% had underlying diseases. Severity of illness was documented by a median APACHE II sore of 23 (range 14–41) and a median SAPS II score of 60 (range 43–95).

The viral infection was confirmed by polymerase chain reaction (PCR) from tracheal aspirates. Multiplex PCR (SeptiFast®, Roche Diagnostics, Germany) in the blood could not identify bacterial or fungal pathogens.

All patients fulfilled the diagnostic criteria of ARDS, the median $PaO_2/FiO_2$ ratio was 102 mmHg (range 51–188). At time of takeover the patients required invasive mechanical ventilation with a median PEEP level of 17 mbar (range 13–24) and a median peak inspiratory pressure of 34 mbar (range 26–47). Six patients were treated with veno-venous ECMO, two were supported by PECLA and two received HFOV. In five patients prone positioning or adequate levels of PEEP could provide sufficient gas exchange during conventional ventilation. Time from symptom start to hospital admission varied between 2 and 7 days (median 4.9 days). It took in average 3.9 days (range 1–10) until the patient was transferred to ECMO-center. Conventional ventilation was used for median 2.4 days (range 1–5) until support by ECMO, PECLA or HFOV was started. Six patients (43%) died during ICU stay, the mortality on day 28 was equal. In comparison to survivors non-survivors were older (median age 49.5 vs. 39.6 years) and had a greater severity of illness demonstrated by APACHE II (25.7 vs. 20.9) and SAPS II score (64 vs. 56.9). The non-surviving patients were transferred later (4.5 vs. 3.5 days after admission to hospital), also shown by a difference in ventilator days before starting ECMO, PECLA or HFOV (3.4 vs. 1.25 days). In three patients connection to ECMO was performed by our team before inter-hospital transfer. Median $PaO_2/FiO_2$ ratio at admission was lower among non-survivors (96 vs. 106 mmHg).

**CONCLUSION.** The described limited series of patients represents the most severely ill subgroup of persons infected with 2009 H1N1 influenza A. The results indicate that an early transfer to ECMO-center and a shorter time of mechanical ventilation until ECMO, PECLA or HFOV is started are associated with a better outcome. Although more than half of them had risk factors, also previously healthy individuals developed life threatening hypoxemia where extracorporeal life support might be a rescuing solution.

## 0597

### CLINICAL AND MANAGEMENT CHARACTERISTICS OF TWENTY-ONE PATIENTS WITH SEVERE H1N1-ASSOCIATED ARDS AT A TERTIARY REFERRAL HOSPITAL

H.E. Lang Orrem[1], G.K. Bentsen[1], T.A. Aasmundstad[1], J.H. Laake[1]

[1]Rikshospitalet Medical Centre, Oslo University Hospital, Oslo, Norway

**INTRODUCTION.** During the 2009 H1N1 pandemic Norway had 174 ICU-admissions (37 per million inhabitants) and 29 deaths (6.2 per million inhabitants). We report the clinical and management characteristics of 21 patients with severe ARDS associated with 2009 influenza A H1N1. All patients were transferred to our hospital from other ICUs due to severe hypoxaemic respiratory failure despite maximal efforts with conventional mechanical ventilation.

**OBJECTIVES.** To characterize clinical and management features associated with successful outcome.

**METHODS.** We reviewed patient records of all h1n1 admissions. Data were analysed with non-parametric tests, i.e. descriptive statistics and univariate comparisons of survivors versus non-survivors. All values are medians unless otherwise stated. The study was approved by the ethics committee. A requirement for informed consent was waived.

**RESULTS.** Twenty-one patients were admitted following h1n1-associated ARDS (6 female, 15 male; median age 27 years). Only two patients had received antiviral treatment before hospital admission. Following transfer, all patients were initially managed with nitric oxide (median duration 5 days) to facilitate protective ventilation. Six patients were managed with ECMO. Eight patients died; two on ECMO. Patients who survived had shorter length-of-stay at the referring hospital before transfer than patients who died (3 vs. 4.5 days). Survivors had fewer risk factors; i.e. lower body mass index (25 vs. 31) and less co-morbidity, as well as lower SAPS II score on admission (29 vs. 38) and lower median daily SOFA-score (6 vs. 7). Survivors also had less severe respiratory failure on admission (median $PaO_2/FiO_2$ ratio 9.9 vs. 6.3 kPa). Survivors were successfully managed with protective ventilation (tidal volume of 6.7 vs. 7.5 ml/kg ideal body weight) and forced diuresis or haemofiltration to maintain negative fluid balance (median daily fluid balance −181 vs. +629 mL).

**CONCLUSIONS.** Survival was associated with rapid transfer, fewer risk factors and co-morbidities, less severe disease and strict adherence to a management protocol with protective ventilation and fluid restriction.

**REFERENCE(S).** Fuhrman C et al (2010) Severe hospitalised 2009 pandemic influenza A(H1N1) cases in France, 1 July–15 November 2009. Euro Surveill 15(2), pii: 19463.

## 0598

### IS MOBILE EXTRACORPOREAL MEMBRANE OXYGENATION A SAFE TOOL TO TRANSFER SEVERELY HYPOXAEMIC PATIENTS IN CASE OF INFLUENZA A/H1N1 INFECTION?

J.-B. Nicolas[1], J.-F. Cambier[1], S. Bouhon[1], P. Bulpa[1], M. Gonzalez[1], I. Michaux[1], E. Installé[1], A. Dive[1], P. Evrard[1]

[1]Mont-Godinne University Hospital, Intensive Care, Yvoir, Belgium

**BACKGROUND AND OBJECTIVE.** Severe hypoxaemia due to acute respiratory distress syndrome (ARDS) still cause a high mortality rate in spite of the improvement of therapeutic measures. In these severely hypoxaemic patients, Extracorporeal Membrane Oxygenation (ECMO) may be a good additional therapeutic option. However, inter-hospital transfer of patients who need an ECMO can be very dangerous because extreme hypoxaemia or hemodynamic instability may be associated with cerebral hypoxia and death. In this work, we report our experience mobile ECMO system initiated in the referal hospital to secure the transfer, considering 2 groups of patients: first, patients with cardiac failure and ARDS, and secondly, patients with ARDS due to influenza A/H1N1.

**MATERIAL AND METHODS.** Our database was retrospectively analyzed and we report on 18 consecutive patients transferred to our hospital under ECMO assistance. Three of them required this technique because of cardiocirculatory failure unresponsive to best therapy, 12 others because of ARDS due to various causes and the last 3 because of ARDS specifically due to influenza A/H1N1 pneumonia. Percutaneous veno-venous (VV; n = 14) or veno-arterial (VA; n = 4) ECMO support consisted in a single membrane oxygenator and a centrifugal pump.

**RESULTS.** The transfer of all patients was feasible thanks to a systemic oxygenation and hemodynamic status improvement by the ECMO, after a median door to door transfer time of 73 min (range: 26–105 min) in the first group and 96 min (90–115 min) in the second group. No significant complication was noted during the transfer except a transient loss of electric power supply. In the first group, $PaO_2/FiO_2$ improved from 57.2 (26–88 mmHg) to 219 mmHg (47–390 mmHg), and from 62.7 (54–74 mmHg) to 254 mmHg (126–334 mmHg) in the second group, respectively, before and after the initiation of ECMO. The mean weaning length for the ECMO system was 7 days in the first group and 19 days in the influenza A/H1N1 group, mean ICU stay duration was 26 (1–110 days) and 29 days (15–54 days), while mean hospital stay duration was, respectively, 31 (1–110 days) and 30 days (17–54). Four patients died because of brain death due to neurotrauma, pneumonia, candidemia and hemorrhagic abscesses associated to a subarachnoïdal hemorrhage, with a mean period of 5 days after the initiation of the ECMO system. The mortality rate at 1 month was 26.6% in the first group while all patients suffering from ARDS due to influenza A/H1N1 survived.

**CONCLUSION.** In severely hypoxaemic patients, ECMO support is a safe transfer tool with an experimented team. According to our 100% survival rate in the influenza A/H1N1 pneumonia it should be impossible to die from severe hypoxaemia due to influenza A/H1N1 infection in a primary hospital in Belgium, since there is always a mobile ECMO support and experimented team available.

## 0599

### LUNG HISTOPATHOLOGICAL FINDINGS IN FATAL PANDEMIC INFLUENZA A (H1N1)

N. Nin[1], J.A. Lorente[1], C. Sanchez-Rodriguez[1], L. Soto[2], P. Cardinal[3], A. Deicas[3], N. Campos[4], O. Rocha[5], D.H. Ceraso[6], A. Ferruelo[1], L.S. Ver[7], M. El Assar[1], J. Ortin[7], P. Fernández-Segoviano[1], A. Esteban[1]

[1]Hospital Universitario de Getafe, CIBERES, Madrid, Spain, [2]Instituto Nacional del Torax, Santiago de Chile, Chile, [3]Sanatorio CASMU, Montevideo, Uruguay, [4]Hospital Regional de Salto, Montevideo, Uruguay, [5]Sanatorio Gremeda, Montevideo, Uruguay, [6]Hospital Juan A. Fernández, Buenos Aires, Argentina, [7]Centro Nacional de Biotecnología, CSIC, Madrid, Spain

**OBJECTIVE.** To describe the histopathology of lung tissue from patients with pandemic influenza A (H1N1) viral pneumonia.

**METHODS.** We have examined by light microscopy lung tissue from six patients with pandemic influenza A (H1N1) virus infection. Immunofluorescence for oxidized dihydroethydium, 3-nitrotyrosine, inducible NO synthase (NOS-2) and human influenza A nucleoprotein (NP) (for analysis under confocal microscopy) was studied in lung tissue specimens.

**RESULTS.** Age ranged from 15 to 50 years. Three patients were women, and five had preexisting medical conditions. Diffuse alveolar damage (DAD) was present in five cases (as evidenced by membrane hyaline formation, alveolo-capillary wall thickening and PMN infiltrates), and interstitial fibrosis was apparent in one case. DAD was associated with intense hemorrhage in one patient. In the immunofluorescence studies there were signs of oxygen radical generation and increased NOS-2 protein and protein nitration in all tissue samples, regardless of the duration of ICU admission. Viral NP was found in the lungs of three patients. Type I pneumocytes and macrophages harbored viral NP, as evidenced by confocal immunofluorescence microscopy.

**CONCLUSIONS.** Lung tissue from patients with pandemic influenza A (H1N1) viral pneumonia shows histological findings consistent with DAD. Prolonged nitro-oxidative stress is present despite antiviral treatment. Viral proteins may remain in lung tissue for prolonged periods of time, lodged in macrophages and type I pneumocytes.

**GRANT ACKNOWLEDGMENT.** Instituto de Salud Carlos III, FIS 07/1275.

## 0600

### EXTRACORPOREAL MEMBRANE OXYGENATION FOR SEVERE RESPIRATORY FAILURE RELATED TO INFECTION WITH NOVEL INFLUENZA A/H1N1. EXPERIENCE FROM THE ECMO CENTRE KAROLINSKA, SWEDEN

B. Holzgraefe[1], M. Broomé[1], H. Kalzén[1], K. Palmér[1], B. Frenckner[2]

[1]Karolinska University Hospital, Ecmo Centre Karolinska, Stockholm, Sweden, [2]Karolinska University Hospital, Paediatric Surgery, Stockholm, Sweden

**INTRODUCTION.** Severe respiratory failure related to infection with the pandemic novel strain of Influenza A/H1N1 is uncommon but possibly life threatening. If, in spite of maximal conventional critical care, the patient condition deteriorates, ECMO may be a life saving procedure. According to recent reports, patients treated with ECMO for H1N1 related respiratory distress have a 21–49% mortality rate. Here the experiences from the ECMO Centre Karolinska shall be reported.

**OBJECTIVES.** To describe characteristics, course and outcome of all patients who were treated with ECMO at the Karolinska University Hospital due to influenza A/H1N1 related severe respiratory failure.

**METHODS.** An observational study with approval of the local ethical committee was performed. Data of all patients with confirmed novel influenza A/H1N1 infection and severe respiratory failure cannulated for ECMO were analysed. Main outcome measure was survival 3 month after discharge from our department.

**RESULTS.** Between July 2009 and January 2010 13 patients with pandemic influenza A/H1N1 related severe respiratory failure were treated with ECMO.

DEMOGRAPHIC AND CLINICAL DATA, MEAN (MIN–MAX)

| Parameters | Female N = 5 (3 pregnant) | Male N = 8 |
|---|---|---|
| Age (years) | 30 (21–47) | 40 (22–54) |
| Weight (kg) | 70 (50–100) | 95 (68–100) |
| $PaCO_2$ (mmHg) | 44 (35–49) | 52 (39–71) |
| Ph | 7.33 (7.2–7.5) | 7.34 (7.2–7.4) |
| $PaO_2/FiO_2$ ratio (mmHg, $FiO_2$ 1.0) | 47 (31–72) | 54 (36–70) |
| Peak insp pressure ($cmH_2O$) | 33 (28–37) | 38 (29–48) |
| Peep ($cmH_2O$) | 15 (8–20) | 18 (15–20) |
| ECMO treatment (days) | 20 (8–37) | 20 (3–50) |
| 3 month survival | 5 | 7 |

Mean length of ventilator treatment before ECMO was 3 days (0–10). 12 patients were cannulated for veno-venous ECMO at the referring hospital and transported on ECMO to Stockholm, one patient was cannulated in our hospital for veno-arterial support due to combined respiratory and circulatory failure. Four patients were converted from veno-venous to veno-arteriell ECMO because of right heart failure (three) or life threatening cardiac arrhythmias (one). In case of no oxygen delivery via the lungs all patients could be supported with flow rates high enough to meet their oxygen needs, mean flow 4.6 l/min (2–6). All patients survived ECMO. One patient died 4 days after discharge because of intracranial bleeding.

**CONCLUSIONS.** Patients who were treated at the ECMO Centre Karolinska showed a rapid deterioration after start of ventilator treatment. The outcome was favourable even with prolonged treatment. A shift in the cause of respiratory failure requiring ECMO could be seen during the 2009 influenza A/H1N1pandemia but no large increase in the number of patients treated with extracorporeal life support as reported by other investigators.

**REFERENCE(S).** 1. ELSO. http://www.elso.med.umich.edu/H1N1.htm.
2. ANZ ECMO. JAMA 2009.
3. Freed DH et al. Can J Anaesth. 2010.
4. Buckley E et al. Br J Anaesth. 2010.

## 0601

### MECHANICAL VENTILATION DURING EXTRACORPOREAL RESPIRATORY SUPPORT IN H1N1 PATIENTS

F. Mojoli[1,2], M. Belliato[3], G. Dell'Avanzo[1], I. Currò[1], A. Bottazzi[3], F. Fava[1], C. Verga[3], G.A. Iotti[3], A. Braschi[1,2]

[1]Fondazione IRCCS Policlinico S. Matteo, Servizio di Anestesia e Rianimazione I, Pavia, Italy, [2]Università degli Studi di Pavia, Dipartimento di Scienze Chirurgiche, Rianimatorie, Riabilitative e dei Trapianti d'organo, Pavia, Italy, [3]Fondazione IRCCS Policlinico S. Matteo, Servizio di Anestesia e Rianimazione II, Pavia, Italy

**OBJECTIVES.** To evaluate mechanical ventilation (MV) settings in H1N1 patients undergoing extracorporeal membrane oxygenation (ECMO).

**METHODS.** Ventilator settings ($FiO_2$, PEEP, Pplat, TV/kg) were recorded every two hours before, during and after ECMO. We considered "Protective" a TV < 6 ml/kg, a Pplat < 30 $cmH_2O$ and a $FiO_2$ < 0.6 and "Ultra-protective" a TV < 4 ml/kg, a Pplat < 26 $cmH_2O$ and a $FiO_2$ < 0.45.

**RESULTS.** During November–December 2009 6 H1N1 patients underwent ECMO in our center. Three patients were transferred already on ECMO from other hospitals. In the other 3, length of MV before ECMO was, in our ICU, 2.7 ± 3.0 days, with the following ventilator settings: $FiO_2$ 0.83 ± 0.15, PEEP 17 ± 2, Pplat 31 ± 2, TV/kg 6.9 ± 0.6; $PaO_2/FiO_2$ was 73 ± 8. During extracorporeal support that was maintained for 12.5 ± 3.5 days, $FiO_2$ was 0.69 ± 0.1, PEEP 17 ± 2, Pplat 28 ± 3, and TV/kg 4.4 ± 1.6. Five patients were weaned from ECMO with ongoing MV; one patient was already weaned from MV when ECMO was removed, but he needed reintubation 4 days later. Length of MV after extracorporeal support was 7.1 ± 4.5 days; in this phase, ventilator settings were $FiO_2$ 0.47 ± 0.8, PEEP 12 ± 2, Pplat 27 ± 3, TV/kg 8.6 ± 0.7. Figures 1 and 2 show the proportion of time spent on "Protective" and "Ultraprotective" MV before, during and after extracorporeal support according to TV/kg, Pplat and $FiO_2$ values.

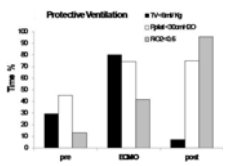



Figure 1 Protective ventilation

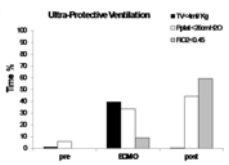



Figure 2 Ultraprotective ventilation

**CONCLUSIONS.** The use of ECMO was justified by refractory hypoxemia and impossibility to keep ventilation protective. Extracorporeal support allowed substantial decrease of Pplat and TV and increase of time spent on protective ventilation. $FiO_2$ remained at quite high levels during ECMO.

## 0602

### THE AFFECT OF INFLUENZA A H1N1 INFECTION ON A HIGH RISK POPULATION, THE ROLE OF A MANAGED CLINICAL NETWORK IN PANDEMIC PLANNING IN SUCH A SETTING, AND THE TRANSFER FOR ADVANCED RESPIRATORY TECHNIQUES IN MANAGING SEVERE ACUTE REFRACTORY HYPOXAEMIA WITHIN THE NETWORK

A.J. Parry-Jones[1], T. Szacmany[2], G.P. Findlay[3], S. Shah[3], SEWCCN

[1]Aneurin Bevan Health Board, Royal Gwent Hospital, Newport, UK, [2]Cwm Taf Health Board, Royal Glamorgan Hospital, Llanrisant, UK, [3]University Hospital of Wales, Critical Care, Cardiff, UK

**INTRODUCTION.** The South East Wales Critical Care Network (SEWCCN) is a managed network dating from 2007. It is comprised of 6 critical care units covering a population of 1.4 million and is lead by a manager and lead clinician. The geographical area comprises two main cities, Cardiff and Newport, and the ex-mining valley towns of South East Wales. It is an area of chronic social deprivation, with a very high incidence of chronic lung disease from Industrial exposure and cigarette smoking, and includes 7 of the top 10 obesity ares for the UK. H1N1 infection was therefore expected to have a higher than average impact. There is no provision in Wales for ECMO but the tertiary hospital (UHW) does provide a HFOV and NO service. HFOV was planned as primary rescue for refractory hypoxaemia rather than ECMO but at the discretion of the on-site clinician. A proforma for referral for HFOV was used and was very similar to the ECMO referral proforma for Leicester. H1N1 infection came in two waves with the first wave predominantly affecting two hospitals and the second wave affecting all.

**RESULTS.**

COMPARISION BETWEEN AUSTRALASIAN DATA AND SEWCCN

| Country | H1/N1 cases/million population | Critical care days/million population | HFOV provision/millio population | ECMO provision/million population | Mortality (%) |
|---|---|---|---|---|---|
| Australasia | 28 | 350 | N/A | 2 | 15 |
| SEWCCN | 59 | 608 | 3.6 | 1.43 | 7.9 |

CASES/UNIT AND HFOV VERSUS ECMO VERSUS NO

| Hospital | Level 2 days | Level 3 days | HFOV days | Nitric oxide days | ECMO days (Leicester) | Transferred in | Transferred out for HFOV | Transferred out for ECMO | Mortality |
|---|---|---|---|---|---|---|---|---|---|
| Royal Gwent | 36 | 44 | N/A | N/A | 0 | 1 (to free up ECMO bed) | 2 | 0 | 2 (1 died UHW cardiac failure) |
| Nevill Hall | 73 | 149 | N/A | N/A | 23 (13 + 10) | 0 | 0 | 2 | 1 ECMO |
| Prince Charles | 4 | 13 | N/A | N/A | 0 | 0 | 0 | 0 | 0 |
| Royal Glamorgan | 29 | 87 | N/A | N/A | 0 | 0 | 2 | 0 | 0 |
| University Hospital of Wales | 120 | 273 | 55 | 45 | 0 | 4 | 0 | 0 | 5 |

Despite a vaccination programme, with a good uptake, between the first and second wave the requirement for critical care services was high. This likely reflects a population at higher than average risk of severe complications of infection. Despite this, mortality was low with a comparatively lower use of ECMO and the use of HFOV and NO as primary rescue therapy for refractory hypoxaemia.

**CONCLUSIONS.** The SEWCCN, covering a population of 1.4 million with a high incidence of morbid obesity and chronic lung disease, managed despite high critical care requirements to keep the mortality at least in line with comparative data available. Proforma for referral and agreement between centres was essential for this. HFOV with NO appears to be a viable alternative to ECMO with this particular influenza infection and in this setting.

**REFERENCES.** Critical Care Services and 2009 H1N1 Influenza in Australia and New Zealand.N Engl J Med. 2009;361.

## 0603

### CORTICOSTEROID THERAPY IN EARLY ARDS SECONDARY TO INFLUENZA A/H1N1 (2009) PNEUMONIA: DATA FROM THE REVA-SRLF REGISTRY

C. Brun-Buisson[1], J.-C.M. Richard[2], A. Mercat[3], L. Brochard[1], for the REVA-GRIPPE-SRLF Registry

[1]AP-HP CHU Henri Mondor, Créteil, France, [2]CHU Charles Nicolle, Rouen, France, [3]CHU Hôtel-Dieu, Angers, France

**INTRODUCTION.** The potential value of corticosteroid therapy in ARDS remains controversial. Steroid therapy has been advocated in ARDS secondary to viral pneumonia. The recent H1N1 pandemic provided an opportunity to investigate the potential value of such therapy.

**OBJECTIVES.** To evaluate the potential benefit associated with corticosteroid therapy in influenza A (H1N1) ARDS.

**METHODS.** Patients with ARDS secondary to Influenza (A/H1N1) 2009 infection and having no comorbidity, to the exception of possible obesity, were selected from the REVA-SRLF registry, in which data from patients admitted with viral pneumonia were prospectively collected. Severity at presentation, length of stay, and mortality were compared in patients receiving or not steroid therapy either for ARDS or for associated sepsis syndrome.

**RESULTS.** There were 120 patients without any other comorbidity than obesity in the REVA registry; 11 patients were excluded because they were included in a randomised trial ($n = 7$) or received steroids for "other reason" ($n = 4$). In the remaining 109 patients, 42 (38%) recieved corticosteroids for sepsis ($n = 16$) or for pneumonia ($n = 26$) after 2 days (median) following ICU admission. Therapy included mostly hydrocortisone (73%) (200–300 mg/day) or methylprednisolone (1–2 mg/kg/day). Patients receiving or not steroids were quite similar in terms of age (43 ± 15 vs. 42 ± 13 years), SAPS 3 (51.3 ± 12 vs. 52.4 ± 15), SOFA score (7.3 ± 3 vs. 7.8 ± 4), P/F ratio (111 ± 58 vs. 115 ± 64) at ICU admission. There were 40 and 36% obese patients, and 9 (21%) and 22 (33%) patients with bacterial co-infection at admission, in the steroid group and the other group respectivelly. Antiviral therapy was administered, respectivelly, 7 ± 6 and 6 ± 3 days after onset of the influenza syndrome; 11 (26%) and 13 (19%) patients received ECMO. The overall mortality in the 109 patients was 20%; it was twice higher in patients receiving steroids (26 vs. 13%, $P = 0.15$), even after excluding patients receiving ECMO (19 vs. 9%, $P = 0.2$). The length of stay in the ICU was 28 ± 20 and 21 ± 16 days, respectively, in patients receiving or not receiving steroids, and comparable when considering survivors only. The ICU-acquired infection rate was similar in the 2 groups, at 31 and 27%.

**CONCLUSIONS.** These results do not suggest that steroids can improve the outcome of patients with ARDS secondary to influenza pneumonia.

**GRANT ACKNOWLEDGMENT.** The registry was made possible thanks to grants from Société de Réanimation de Langue Française (SRLF), the French Agency ANRS and the French Minister of Health.

## 0604

### EFFECTS OF EXTENDED PRONE POSITION VENTILATION IN ARDS SECONDARY TO PNEUMONIA DUE TO THE NOVEL A (H1N1) INFLUENZA

R. Cornejo[1], A. Zamorano[1], G. Diaz[1], C. Romero[1], E. Tobar[1], O. Llanos[1], L.R. Galvez[1], L. Fabrega[1], W. Neira[1], D. Arellano[1], C. Repetto[1], D. Aedo[1], R. Gonzalez[2], D. Goñi[2]

[1]Hospital Clínico Universidad de Chile, Unidad de Pacientes Críticos, Santiago, Chile, [2]Universidad de Chile, Facultad de Medicina, Santiago, Chile

**INTRODUCTION.** In the context of pandemic influenza A (H1N1), Chile achieved one of the highest rates of cases per habitant worldwide. Our Hospital, a national reference center, received 34 severe patients. Considering the preliminary data that alerted about the high incidence of severe hypoxemia and frequent necessity of rescue therapies in these patients, we wanted to evaluate the impact of extended prone-position ventilation (PPV) on respiratory function in patients with severe acute respiratory distress syndrome (ARDS) secondary to pneumonia due to the novel influenza A (H1N1), and compare it with the results obtained in patients with other ARDS causes.

**METHODS.** Prospective interventional study in a mixed medical-surgical ICU in a tertiary care university Hospital. Consecutive patients with severe ARDS, previously unresponsive to positive end-expiratory pressure (PEEP) adjustment, were treated with extended PPV for 48 h or until the oxygenation index (OI) was < 10. If this therapy was insufficient, extracorporeal membrane oxygenation (ECMO) was early implemented according our ARDS protocol. We measured changes in oxygenation parameters before PPV, every 6 h during PPV, and 2 and 12 h after. The effects of PPV in this population were compared with the obtained in other ARDS causes.

**RESULTS.** 10 patients with severe ARDS (age 42 ± 12 years, 3 females, APACHE II 16 ± 6, SOFA 8 ± 3) receiving volume-controlled ventilation (tidal volumes of 6 ml/kg of predicted body weight) required PPV. The time between onset of mechanical ventilation and PPV was 26 ± 27 h. The first time on PPV was 82 ± 49 straight hours (three patients required two periods on PPV). None of the patients experienced life-threatening complications or hemodynamic instability during the procedure, four patients developed grade II pressure ulcers and one patient grade III. The patients showed a statistically significant improvement in $PaO_2/FiO_2$ (79 ± 23 vs. 249 ± 67, $p < 0.0001$) and OI (28 ± 12 vs. 8 ± 2, $p < 0.0001$) and reduction of $PaCO_2$ (45 ± 16 vs. 39 ± 6, $p < 0.0001$) with PPV, and did not worse upon returning to the supine position. Two patients were subjected to ECMO, one of them did not recieive PPV and the other only did for 2 h. In-hospital mortality was 30%, and remained without changes at 6 months follow-up. This behavior did not differ with the obtained for our team in other ARDS populations.

**CONCLUSIONS.** The results obtained suggest that extended PPV as rescue therapy might be useful in refractory hypoxemic patients with severe ARDS secondary to the novel A (H1N1) influenza. This approach improved oxygenation parameters. Moreover, it is feasible and relatively safe, when it is carried out by a trained staff and within an established protocol. Although the limited number of patients does not allow major conclusions to be drawn, we believe that this strategy could be used to face severe cases of A (H1N1) influenza.

## 0605

### MECHANICAL VENTILATION AND ECMO IN ARDS DUE TO INFLUENZA INFECTION: DATA FROM THE FRENCH REVA-SRLF-REGISTRY

L. Brochard[1], J.-C.M. Richard[2], T. Pham[1], C. Brun-Buisson[1], A. Mercat[3], for the REVA-GRIPPE-SRLF Registry

[1]AP-HP CHU Henri Mondor, Créteil, France, [2]CHU Charles Nicolle, Rouen, France, [3]CHU Hôtel-Dieu, Angers, France

**OBJECTIVES.** To describe the clinical characteristics and outcome of patients with ARDS associated with severe A (H1N1)2009 Influenza infection and receiving conventional mechanical ventilation (MV) only compared to those receiving ECMO.

**METHODS.** Data extracted from a dedicated French web based registry for the flu epidemic. We describe the management of patients with early ARDS within the first 3 days of ICU admission.

**RESULTS.** Of 550 adult patients admitted to the 121 ICUs contributing to the REVA registry during the flu pandemic, 326 had a final diagnosis of ARDS, and 180 had a complete form, fulfilling strict criteria for the syndrome ($P/F \leq 200$ and bilateral infiltrates) within the first 3 days of ICU admission. These 180 patients with early ARDS were aged 47 ± 15 years, 45 (25%) had no identified risk factor, 49 (27%) were immunocompromised, 8 (4.5%) were pregnant, 31 (17%) had chronic bronchopulmonary disease, including asthma. Mean Body Mass Index (BMI) was 28, and 59 (33%) had obesity ($BMI \geq 30$). The mean $PaO_2/FiO_2$ ratio was 128 ± 47.Assist-control ventilation was the most commonly used ventilatory mode (166/180), others mostly receiving pressure support ventilation. Paralyzing agents were used in 107 (59%) of them. During the first 3 days of MV, vasopressors were required in 71% and renal replacement therapy in 22%. Rescue therapies included iNO (46, 26%), prone positioning (38, 21%), and ECMO (31, 17%). The overall ICU mortality was 31% (56/180), and length of ICU stay 24 ± 19 days.Patients receiving ECMO (17%) were younger, less often immunocompromised (23 vs. 28%), had a slightly higher frequency of obesity (39 vs. 32%) and of pregnancy (13 vs. 3%), were more severely ill, had a more severe lung impairment (oxygenation and compliance). Mortality, length of mechanical ventilation and of ICU stay were higher in this group. Before ECMO, ventilation was delivered with smaller tidal volumes, higher PEEP but similar plateau pressure (Pplat) than in MV patients (Table 1).

**TABLE 1** % OR MEAN SD; VT: ML/KG OF PREDICTED BODY WEIGHT

| ARDS | Age | SAPS3 | PF ratio | Vt (ml/kg) | PEEP ($cmH_2O$) | Pplat ($cmH_2O$) | Comp ($ml/cmH_2O$) | Duration MV (day) | Deaths (%) |
|---|---|---|---|---|---|---|---|---|---|
| MV (n = 149) | 49 ± 14 | 56 ± 16 | 131 ± 46 | 6.7 ± 1.1 | 10.5 ± 4 | 27 ± 4 | 28 ± 10 | 19 ± 15 | 29.5 |
| ECMO (n = 31) | 39 ± 14 | 65 ± 17 | 112 ± 48 | 4.5 ± 2.3 | 12.9 ± 3 | 27 ± 7 | 18 ± 10 | 28 ± 22 | 38.7 |

**CONCLUSIONS.** The overall high mortality rate observed in this series confirms the severity of H1N1-associated early ARDS. Our findings suggest that ECMO was administered to the most severely ill and hypoxemic patients. Clinicians reduced Vt and increased PEEP while keeping Pplat in a reasonable range and switched to ECMO.

**GRANT ACKNOWLEDGMENT.** The registry was made possible thanks to grants from Société de Réanimation de Langue Française (SRLF), the French Agency ANRS and the French Minister of Health.

# Optimalization of hemodynamics: 0606–0619

## 0606

### LEVOSIMENDAN VERSUS INTRAAORTIC BALLOON PUMP IN HIGH RISK CARDIAC PATIENTS OPERATED UNDER CARDIOPULMONARY BYPASS: PRELIMINARY REPORT

V.V. Lomivorotov[1], V.A. Boboshko[1], I.A. Kornilov[1], L.G. Kniazkova[1], M.N. Deryagin[1], A.M. Cherniavsky[1]

[1]Research Institute of Circulation Pathology, Department of Anesthesiology and ICU, Novosibirsk, Russian Federation

**INTRODUCTION.** Patients with low ejection fraction of the left ventricle scheduled for coronary artery bypass grafting are at the high risk of the development of acute heart failure intra- or postoperatively. The choice of a method of hemodynamic support is the crucial moment in the management of such patients.

**OBJECTIVES.** The purpose of this study was to compare the efficiency of levosimendan and intraaortic balloon pump in high risk cardiac patients (LV EF $< 35\%$) operated under cardiopulmonary bypass (CPB).

**METHODS.** From August 2009 till February 2010 26 patients with coronary artery disease, operated under CPB were studied. Before operation patients were randomized in two groups. Groups were comparable in physical status, anesthetics management, duration of CPB, Aortic cross clamp time and number of grafts performed. In the first group levosimendan infusion (0.1 mcg/kg/min for 24 h with initial 12 mcg/kg bolus) was started after anesthesia induction. In the second group intraaortic balloon was started in ICU 1 day before operation. The IABP was withdrawn when hemodynamic stability was restored with only minimal pharmacologic inotropic support. Hemodynamic was assessed at the following points: after induction; 5 min before CPB; 5 and 30 min after CPB; end of operation; 2, 4, 6 h after the operation and 1 postoperative day. The level of Troponin I was assessed before operation, at the end of operation, 6, 24 and 48 h after the operation. Blood loss, duration of mechanical ventilation, inotropic support, ICU-stay and hospitalization were analyzed. Data are presented as M (mean) and SD (standard deviation). A p value of $< 0.05$ was considered significant.

**RESULTS.** Cardiac index (CI) in patients with the use of Levosimendan was significantly higher from 5 min after CPB to 6 h postoperatively as to compare with IABP group. The increase of CI in the first group was accompanied by simultaneous significant increase in stroke index 30 min after CPB ($32.0 \pm 8.9$ vs. $28.7 \pm 4.8$ ml/beat/m$^2$, $p < 0.05$) and at the end of operation ($31.5 \pm 9.7$ vs. $27.3 \pm 4.6$ ml/beat/m$^2$, $p < 0.05$). There were no differences between groups in the duration of mechanical ventilation, need for additional inotropic support and length of hospital stay. Duration of ICU-stay was significantly lower in Levosimendan group. The level of Troponin I 6 h after the operation was significantly lower in the Levosimendan group ($p < 0.05$).

**CONCLUSIONS.** The use of Levosimendan in high risk cardiac patients is superior to IABP in terms of maintaining stable hemodyamic during and after operation under CPB and reduction of ICU-stay. Low level of Troponin I 6 h after the operation suggests cardioprotective properties of levosimendan.

**REFERENCE(S).** 1. Ferguson e.a.J Am Coll Cardiol. 2001;38:1456–62.
2. Zangrillo e.a. J Cardiothoracic Vasc Anest. 2009;23:474–8.

## 0607

### INFLUENCE OF VENTILATORY SETTINGS ON STATIC AND FUNCTIONAL HEMODYNAMIC PARAMETERS DURING EXPERIMENTAL ACUTE LUNG INJURY AND HYPOVOLEMIA

F.J.S. Ramos[1], E.M. Oliveira[1], G.P.P. Schettino[1], M. Park[1,2], L.C.P. Azevedo[1,2]

[1]Hospital Sirio Libanes, Research and Education Institute, São Paulo, Brazil, [2]University of Sao Paulo, School of Medicine, Emergency Medicine, São Paulo, Brazil

**INTRODUCTION.** Functional hemodynamic variables (pulse pressure variation—PPV; stroke volume variation—SVV; systolic pressure variation—SPV) have been constantly used to evaluate hemodynamic status and fluid responsiveness in the ICU. However, during conditions into which respiratory system compliance may vary, such as Acute Lung Injury (ALI), the role of these parameters to evidence fluid responsiveness is less understood. In addition, the use of a protective ventilation strategy which includes increased PEEP levels and low tidal volume (VT) during ALI may theoretically influence the measurement of these variables.

**OBJECTIVES.** In this study, our purpose was to evaluate the effects of different ventilatory strategies on static and functional hemodynamic parameters in pigs with ALI during normovolemia and hypovolemia.

**METHODS.** Eight anesthetized Agroceres$^{TM}$ pigs ($40 \pm 1.9$ kg) were instrumented with pulmonary artery, PICCO$^{TM}$ and arterial catheters and mechanically ventilated with VT 8 mL/kg, PEEP 5 cm$H_2O$ and I:E ratio 1:2 (initial ventilation). Three different ventilatory settings were then randomly performed during 15 min each: VT 15 mL/kg; PEEP 13 cm$H_2O$; and VT 6 mL/kg + PEEP 13 cm$H_2O$. Functional and static hemodynamic as well as respiratory data were collected with the different ventilatory adjustments at baseline and after ALI [induced by lung lavage with saline (3 mL/kg) + tween (1.25%)] and ALI + hypovolemia (withdraw of 20% of the animal's estimated volemia).

**RESULTS.** The analysis of functional hemodynamic parameters at baseline depicted that high VT significantly increased PPV ($11.3 \pm 5.2$ vs. $19.3 \pm 7.2$), SVV ($13.6 \pm 3.9$ vs. $20.4 \pm 5$) and SPV ($5.5 \pm 1.7$ vs. $10.3 \pm 3.6$) ($P < 0.05$ for all). Significant changes were observed with high VT during ALI for PPV ($8.3 \pm 4.5$ vs. $15.5 \pm 5.6$) and VVS ($13.9 \pm 5.7$ vs. $19.4 \pm 5.4$), but not for SPV ($5.1 \pm 2.6$ vs. $7.1 \pm 1.8$). During hypovolemia, only PPV demonstrated a significant increase ($18.5 \pm 3.5$ vs. $24.3 \pm 3.9$, $P < 0.05$) with VT 15 mL/kg. Concomitant high PEEP and low VT settings, on the other hand, induced no significant alterations on these variables during the three study steps. High PEEP isolated did not influence the functional hemodynamic variables. Static and volumetric parameters obtained by PICCO$^{TM}$ catheter were not influenced by acute changes in ventilatory settings. The best variables to detect hypovolemia during ALI were cardiac output (CO) ($P < 0.001$), stroke volume (SV) ($P < 0.002$) and global ejection fraction (GEF) ($P < 0.001$).

**CONCLUSIONS.** This study demonstrated that the ventilatory parameter which mostly influences functional hemodynamics during ALI and hypovolemia is VT. The protective ventilatory strategy during ALI limits the use of functional hemodynamic variables. In this condition, measurements of CO, SV and GEF may be more useful to disclose hypovolemia.

**GRANT ACKNOWLEDGMENT.** Research and Education Institute, Hospital Sírio-Libanês.

## 0608

### HAEMODYNAMIC OUTCOME OF LOW DOSE LEVOSIMENDAN INFUSION FOR ACUTE HEART FAILURE IN CRITICALLY ILL PATIENTS: AN EIGHTEEN MONTH SINGLE CENTRE EXPERIENCE

R.W. Hewson[1], W. Berry[1], C.J. Langrish[1], N.A. Barrett[1]

[1]Guy's and St. Thomas' Foundation Hospital, King's Health Partners, London, UK

**INTRODUCTION.** Levosimendan provides a new axis for inotropy and lusitropy through calcium sensitisation without increasing myocardial oxygen demand. It provides an alternative to other inotropic agents that have been associated with adverse outcomes. Despite evidence of sustained improvement in cardiac index and decreased filling pressures, concern remains with regard to mortality benefit [1], excess hypotension, vasopressor requirements and tachycardia with levosimendan administered as an infusion following a loading dose [2].

**OBJECTIVES.** To review the effect of using levosimendan given with no bolus dose in patients with acute heart failure.

**METHODS.** We reviewed the electronic notes of patients who had received levosimendan for acute heart failure over an 18 month period (July 2008–December 2009) in our tertiary referral ICU seeing 1,200 patients per year. Demographics and mortality data were collected for each patient. Doses of inotropes and vasopressors and haemodynamic parameters were all recorded for the duration of the infusion as well as the 24 h before and after. Data analysis was carried out using Excel 2007 (Microsoft Corp).

**RESULTS.** 86 patients who received levosimendan for acute heart failure (acutely decompensated chronic heart failure ($n = 16$), post cardiac surgery ($n = 35$) or following acute myocardial infarction ($n = 36$)). All patients received a continuous infusion for 24 h at a rate of 0.10 µg/kg/min and none received a loading dose. Mean age was 70, mean ICU length of stay was 22 days, ICU mortality was 43% and in-hospital mortality was 51%. Haemodynamic data is recorded in Table 1.

**TABLE 1** HAEMODYNAMIC PARAMETERS. *$P < 0.05$

| | Pre levosimendan infusion | Immediately post levosimendan infusion | 24 h post levosimendan infusion |
|---|---|---|---|
| Mean heart rate | 92 | 92 | |
| Mean MAP | 69.4 | 71.6 | |
| Mean BE | −2.67 | −0.40* | |
| Mean Lactate (mmol/L) | 3.01 | 1.72* | |
| Mean CI (L/min/m$^2$) | 2.38 | 2.98* | 2.64* |
| Median noradrenaline dose µg/kg/min ($n = 70$) | 0.22 | 0.15 | 0.1* |
| Median dobutamine dose µg/kg/min ($n = 63$) | 7.35 | 0* | 0* |
| Median milrinone dose µg/kg/min ($n = 28$) | 0.1 | 0.05 | 0.01 |
| Median SOFA score | 8 | 8 | 8 |

**CONCLUSIONS.** Patients receiving levosimendan had a lower mortality (51%) than the over 60% expected for patients with severe acute heart failure and an unchanging SOFA score. Omitting a loading dose has avoided the significant problems of hypotension and tachycardia which have been reported previously [2]. Infusion of levosimendan over 24 h produced a sustained improvement in cardiac index as well as surrogate markers of tissue perfusion. We were able to rapidly wean the doses of other inotropes, especially dobutamine whose dose reduction was significant and sustained. Thus levosimendan may allow for the earlier introduction of cardiovascular therapies such as beta-blockade in this group of patients.

**REFERENCE(S).** 1. O'Connor et al. Am Heart J. 1999;138:78–86.
2. Mebazaa et al. JAMA. 2007;297:1883–91.

## 0609

### THE RELATIONSHIP BETWEEN CENTRAL VENOUS OXYGEN STAURATION ($SCVO_2$) AND OXYGEN DEBT IN NORMOVOLAEMIC ANAEMIA

S. Kocsi[1], G. Demeter[1], D. Érces[2], K. Soós[1], E. Nagy[2], J. Kaszaki[2], Z. Molnár[1]

[1]University of Szeged, Anaesthesiology and Intensive Therapy, Szeged, Hungary, [2]University of Szeged, Institute of Surgical Research, Szeged, Hungary

**INTRODUCTION.** Due to hypovolaemia and anaemia $ScvO_2 < 70\%$ may reflect imbalance of oxygen delivery ($DO_2$) and consumption ($VO_2$) [1]. In current guidelines the transfusion trigger is haemoglobin (Hb) less than 70 g/l, but there is no recommendation for $ScvO_2$ [2].

**OBJECTIVES.** The aim of this study was to investigate the value of $ScvO_2$ in indicating oxygen debt in normovolaemic anaemia.

**METHODS.** After splenectomy mini-pigs ($n = 10$, weight range: 18–30 kg) were bled ($\sim$ 10% of estimated blood volume/5 min, $T_0$–$T_5$) and blood loss was replaced by the same volume of colloid, after which haemodynamic measurements and blood gas analysis were performed. Data are presented as median [interquartile range], and analysed by Friedman test and Pearson correlation.

**RESULTS.** The Hb dropped significantly as compared to $T_0$ ($T_0 = 119$[110–130], $T_5 = 49$[43–53] g/l, $p < 0.001$), which was accompanied by significant changes in oxygen delivery index ($DO_2I$) and $VO_2/DO_2$ ($T_0 = 399$[338–448], $T_5 = 244$[217–292] ml/p/m$^2$, $p < 0.001$; $T_0 = 29$[26–34], $T_5 = 44$[38–48] %, $p < 0.001$, respectively). There was also a significant drop in $ScvO_2$ ($T_0 = 74$[67–80], $T_5 = 63$[58–76] %, $p = 0.007$), which showed significant correlation with $DO_2I$ and $VO_2/DO_2$ ($r^2 = 0.149$, $p = 0.003$; $r^2 = 0.469$, $p < 0.001$, respectively). The physiological threshold of $ScvO_2 < 70\%$ was only achieved at $T_4$: Hb = 58[53–63] g/l and $ScvO_2 = 67$[57–75] %.

**CONCLUSION.** More than 50% drop in Hb resulted in a significant reduction of $DO_2$ and significant increase in $O_2$-extraction ($VO_2/DO_2$). This change was well monitored by the $ScvO_2$. The finding that $ScvO_2$ dropped below the physiological threshold of 70% only after the fourth bleeding event, suggests that $ScvO_2$ may be an important physiologic transfusion trigger in normovolaemic anaemia.

**REFERENCES.** 1. Rivers E et al. NEJM 2001;345:1368.
2. Napolitano LM. CCM 2009;37:3124.

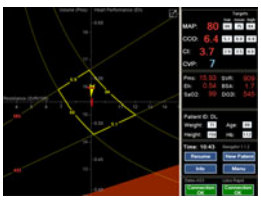
## 0610

### INITIAL EXPERIENCES WITH THE NAVIGATOR™ CARDIOVASCULAR DECISION SUPPORT SYSTEM IN PERIOPERATIVE MONITORING

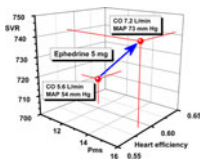
S. Sondergaard[1], T. Rudolph[1], J. Torngren[1]

[1]Sahlgrenska University Hospital, Anaesthesia and Intensive Care, Gothenburg, Sweden

**INTRODUCTION.** There is presently an expanding literature and research interest in outcome-related desirable cardiovascular waypoints/endpoints for high-risk peri- and postoperative patients. Attainment of optimal pressure, blood and oxygen flow goals requires therapeutic manipulation of intravascular volume, resistance and heart performance. Consideration of the Guytonian determinants of venous return enables the creation of simple mathematical transforms of standard dynamic variables(MAP, CO, RAP) into volume (Pms), resistance (SVR) and heart performance (Eh = (Pms − RAP)/Pms) "states" where Pms is the mean systemic filling pressure. Graphical depiction of the patient's position in relation to clinician-determined pressure and flow targets within a "state" diagram allows continuous appreciation of the next therapeutic course to target.
**OBJECTIVE.** To evaluate the graphical volume, resistance and heart performance guidance of the Navigator™ cardiovascular decision support system in high risk perioperative patients undergoing major surgery.
**METHODS.** Continuous sampling from patients undergoing high-risk surgical procedures of cardiac output (CO), mean arterial pressure (MAP) and central venous pressure (CVP) were processed by the Navigator™ and displayed as result of heart efficiency, vasomotor tone and volume state. These three parameters are amenable to intervention to reach physician set targets of CO (or $DO_2I$) and MAP. A clinical example of pharmacological intervention is demonstrated in terms of the cardiovascular parameters.



Navigator screen




3D Navigator intervention

**CONCLUSIONS.** The Navigator™ provides immediate information on patient's position in terms of the three cardiovascular parameters and clearly demonstrates indication for and effect of intervention.

**REFERENCE.** Parkin G, Leaning M. Therapeutic control of the circulation. J Clin Monit Comput. 2008; 22:391–400.

## 0611

### IMPACT OF MECHANICAL VENTILATION AND SEDATION ON HEART RATE AND BLOOD PRESSURE VARIABILITY

V. Zvonicek[1], P. Leinveber[2], J. Halamek[2], P. Jurak[2], V. Vondra[2], I. Cundrle[1], V. Sramek[1]

[1]St. Anna's University Hospital of Masaryk University and ICRC Brno, Department of Anaesthesiology and Intensive Care, Brno, Czech Republic, [2]Institute of Scientific Instruments ASCR v.v.i., Brno, Brno, Czech Republic

**INTRODUCTION.** Heart rate (HR) and blood pressure (BP) variability is lowered by sedation and is almost absent in brain death patient. Respiratory frequency (RF) may also impact on HR and BP variability in spontaneously breathing subjects [1].
**OBJECTIVES.** We hypothesised that different respiratory frequencies and level of sedation influence HR and BP variability during mandatory mechanical ventilation (MV).

**METHODS.** Seven severely ill ICU patients and 8 brain death patients on mechanical ventilation were studied. Invasive arterial BP, ECG, airway pressure (Pao), flow and oesophageal pressure (Pes) were continuously recorded and evaluated by acquisition system (ISI Brno, CR). During study RF was changed in 5 min intervals and inspiratory pressure was adjusted to maintain end tidal $CO_2$ stable. Protocol was done on two predefined sedation levels controlled by bispectral index (BIS). BP and HR variability are given as standard deviations (SD) of systolic arterial pressure (BPSD) and RR intervals on ECG (RRSD) at each RF. Variability parameters were further adjusted to tidal volume (TV), Pes and Pao changes (e.g. BPSD/TV, BPSD/Pes and BPSD/Pao, respectively).Analysis was done by software Scopewin (ISI Brno, CR) and data are presented as median (IQR). Nonparametric statistics was used as appropriate.

**RESULTS.** Altogether BPSD in ICU patients was 3.3 (2.3–5.8) mmHg and RRSD was 3.8 (2.6–5.7) ms at BIS level of 35 (31–39.5). In brain death patients (BIS 0) BPSD did not differ (3.2 (2.2–4.2) mmHg; NS) but RRSD was lower (2.7 (2.0–4.2)ms; $p = 0.01$)) compared to ICU patients.

BIS values at two different sedation levels differed : 32 (21–39.5) and 37 (35–52); $p < 0.001$. Heavy sedation decreased RRSD from 4.1 (3.2–7.2) to 3.2 (2.3–4.7) ms; $p < 0.001$ but had no impact on BPSD ((3.7 (2.1–6.1) and 3.4 (2.3–5.9) mmHg)).

Variability parameters were compared at lower (6–8 breaths/min) and higher (12–15 breaths/min) RF with corresponding tidal volumes values of 880 (820–1000) ml and 520 (480–610) ml. BPSD was higher at lower RF [5.7 (3.5–8.6)] than at higher RF [2.8 (2.2–3.5) mmHg; $p = 0.001$]. RRSD also differed at lower [3.9 (2.7–5.7)] and higher RF [2.8 (2.2–4.4) ms;$p = 0.017$)].

After adjustment on respiratory parameters only BP variability remained higher at lower RF—i.e. BPSD/TV 6.0 (4.2–8.3) versus 5.2 (4.3–6.4) mmHg/L; $p = 0.04$, BPSD/Pao 0.4 (0.2–0.4) versus 0.3 (0.2–0.3); $p = 0.02$ and BPSD/Pes 1.0 (0.5–1.4) versus 0.7 (0.6–1.0) mmHg/$cmH_2O$; $p = 0.04$.

**CONCLUSIONS.** Blood pressure and heart rate variability in ICU patients on mechanical ventilation are low and depend on level of sedation. Blood pressure variability is higher at lower respiratory rate frequencies.

**REFERENCE(S).** Halámek J, Kára T, Jurák P, Soucek M et al. Variability of phase shift between blood pressure and heart rate fluctuations: a marker of short-term circulation control. Circulation 2003;108:292–7.

**GRANT ACKNOWLEDGMENT.** Supported by IGA Ministry of Health CR, NS 10105-3/2008.

## 0612

### LONG TERM SURVIVAL AFTER USE OF LEVOSIMENDAN AS AN AID TO WEANING FROM INVASIVE VENTILATION IN PATIENTS WITH CARDIAC DYSFUNCTION AFTER CARDIAC SURGERY: THE EXPERIENCE OF TWO INTENSIVE CARE UNITS

S.R. Ford[1], S. Vercaeren[1], S. Uddin[1]

[1]Barts and The London NHS Trust, London, UK

**INTRODUCTION.** Ventilator dependent patients with severe heart failure can be difficult to wean after cardiac surgery. Levosimendan has been used to wean patients with heart failure in general critical care patients. The longer term outcome of these patients is not known.

**OBJECTIVE.** To describe the outcomes of patients with severe cardiac failure who were prescribed Levosimendan as a rescue therapy to facilitate weaning from invasive ventilation, where traditional therapy had failed.

**METHODS.** Design—A retrospective cohort study utilising database records and a manual search of individual medical records of patients who had undergone cardiac surgery between March 2007 and March 2009. Setting—Two tertiary cardiothoracic intensive care units within one NHS trust. Patients—Post-cardiac surgery patients with myocardial dysfunction (cardiac index < 2.5 l/min/$m^2$ and left ventricular ejection fraction < 35%) on maximal standard therapy (diuretics, vasodilators and inodilators—dobutamine or milronone) who were unable to wean from invasive ventilation were prescribed Levosimenden (on a named patient basis) if they fulfilled the local institution's criteria.

**RESULTS.** Post cardiac surgical patients (n = 10) who had undergone a variety of procedures (4 CABG, 3 valve replacements, 3 combined operations), were ventilated for more than 7 days after their procedure and met the criteria for Levosimendan were included. Nine (90%) were successfully weaned from invasive ventilation and discharged from critical care. Eight (80%) survived until hospital discharge and for at least 6 months thereafter.

**CONCLUSIONS.** Levosimendan has an established role in patients with acute decompensated systolic cardiac failure [1] and its use as an adjunct for weaning from invasive ventilation has been described in non-surgical patients with cardiac dysfunction [2]. Our experience suggests that patients failing to wean from invasive ventilation after cardiac surgery due to cardiac dysfunction may benefit from the adjunctive use of Levosimendan. Additionally most studies to date have no longer term outcome data, in this series we have demonstrated survival at 6 months in a patient population whose predicted survival is poor [3].

**REFERENCES.** 1. Nieminen MS, Bohm M, Cowie MR et al. Executive summary of the guidelines on the diagnosis and treatment of acute heart failure. The Task Force on Acute Heart Failure of the European Society of Cardiology. Eur Heart J. 2005;26 (4):384–416.
2. Sturba M, Banerjee A, Mudaliar Y. Prospective observational study of Levosimendan and weaning of difficult-to-wean ventilator-dependent intensive care patients. Crit Care Resusc. 2008;10:182–6.
3. Nozawa E, Azeka E, Ignez M et al. Factors associated with failure of weaning from long-term mechanical ventilation after cardiac surgery. Int Heart J. 2005;46:819–31

## 0613

### HEMODYNAMIC INFLUENCE OF LEVOSIMENDAN IN CARDIAC SURGERY PATIENTS WITH SUSPECTED POSTOPERATIVE MYOCARDIAL FAILURE

L. van Wijngaarden[1], A. de Zoete[1], N. Hunfeld[2], B. Westerhof[3]

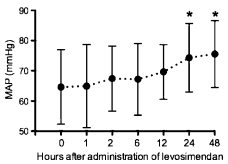
[1]HagaZiekenhuis, Intensive Care, Den Haag, Netherlands, [2]HagaZiekenhuis, Hospital Farmacy, Den Haag, Netherlands, [3]HagaZiekenhuis, Anesthesiology/Intensive Care, Den Haag, Netherlands

**INTRODUCTION.** Levosimendan is a calcium sensitizing agent developed for the treatment of congestive heart failure. It increases myocardial contractility, reduces the filling pressure and dilates both the peripheral and coronary vessels.

**OBJECTIVES.** To investigate the haemodynamic influence of levosimendan in cardiac surgery patients.

**METHODS.** Retrospective analysis. Levosimendan was administered to patients with suspected postcardiac surgery myocardial failure (left ventricular ejection fraction of < 40% before start of infusion). Levosimendan was administered as a single-dose infusion of 0.05 or 0.1 µg/kg/min for 24 h starting peroperative or immediate after arrival at the intensive care. MAP was measured at baseline (t = 0), t = 1, 2, 6, 12, 24 and 48 h.

**RESULTS.** 14 male, 10 female; mean age was 68 years, median apache 4 score at admission was 80; mean BMI was 26. Three patients died within 48 h postoperatively. Extracorporal circulation: median 143 min; aortic cross clamp: median 105 min. Surgical procedures : 9 CABG, 3 AVR, 12 combined procedures (AVR, MAZE, TVP, MVP/R, ASD, Bentall). Mean MAP is shown in Fig. 1. MAP increased after infusion and reached significance after 24 h of administration. Infusion of other inotropics remained stable.




**CONCLUSIONS.** Levosimendan seems to be an effective inotropic in post cardiac surgery patients with suspected myocardial failure. It's effect on MAP is significant at 24 and 48 h after administration. Further prospective analysis in this particular patient group is needed.

Figure 1

**REFERENCE(S).** De Hert SG et al. J Cardiothorac Vascular Anesth. 2008;22 (5):6999–705.

## 0614

### COMPARISON OF CENTRAL VENOUS PRESSURE AND PERIPHERAL VENOUS PRESSURE IN CRITICALLY ILL PATIENTS: A PRELIMINARY STUDY

L.A. DeLuca[1], N. Baker[2], L. Stoneking[1], G. Rizzo[1], K.R. Denninghoff[1]

[1]University of Arizona, Department of Emergency Medicine, Tucson, USA,
[2]University of Arizona, College of Medicine, Tucson, USA

**INTRODUCTION.** Central Venous Pressure measurements are essential to guide fluid resuscitation during Early Goal-Directed Therapy (EGDT). However, central lines are time-consuming to place and can cause serious complications including pneumothorax, vascular injury, infection, and inadvertent arterial cannulation. A less invasive, lower-risk means of monitoring venous pressures could improve patient safety and allow for more rapid and efficient resuscitation of critically ill patients.

**OBJECTIVES.** To determine whether or not Peripheral Venous Pressure (PVP) can provide an accurate estimate of Central Venous Pressure (CVP) in the monitoring of critically ill patients.

**METHODS.** Prospective convenience sample of ED and ICU patients who had existing subclavian or internal jugular central lines were enrolled. Patients had simultaneous, consecutive pressure measurements conducted every 10 min for 1 h. Data was analyzed using the methods outlined by Bland and Altman.

**RESULTS.** 7 patients were enrolled, for a total of 49 paired measurements. Mean difference between CVP and PVP (VPDIFF) was 5.45 ± 5.99 mm Hg with a 95% confidence interval of (−6.29, 17.19). CVP and PVP trended consistently for each patient regardless of the absolute difference between the measurements.

**CONCLUSIONS.** PVP measurement can provide a useful estimate of CVP in critically ill patients. PVP trends may be more useful than single measurements in the ongoing management of critically ill patients.

**REFERENCE(S).** 1. Adar R, Mozes M. Fatal complications of central venous catheters. Br Med J. 1971;3(5777):746.
2. Carlbom DJ, Rubenfeld GD. Barriers to implementing protocol-based sepsis resuscitation in the emergency department—results of a national survey. Crit Care Med. 2007;35(11): 2525–32.
3. Anter AM, Bondok RS. Peripheral venous pressure is an alternative to central venous pressure in paediatric surgery patients. Acta Anaesthesiol Scand. 2004;48(9):1101–4.
4. Tugrul M et al. Relationship between peripheral and central venous pressures in different patient positions, catheter sizes, and insertion sites. J Cardiothorac Vascular Anesth. 2004;18(4):446–50.
5. Vinayak AG et al. Usefulness of the external jugular vein examination in detecting abnormal central venous pressure in critically ill patients. Arch Internal Med. 2006;166(19):2132–7.
6. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Lancet. 1986;1(8476):307–10.

## 0615

### THE PROGNOSTIC SIGNIFICANCE OF SERUM LACTATE AND CENTRAL VENOUS OXYGEN SATURATION DYNAMICS IN CRITICALLY ILL PATIENTS

S. Petros[1], A. Peschka[1], K. Schwabe[1], F. Seidel[1], L. Weidhase[1]

[1]University Hospital Leipzig, Medical ICU, Leipzig, Germany

**INTRODUCTION.** Central venous oxygen saturation ($ScvO_2$) has been shown to be a useful marker of systemic perfusion. Based on this finding, this variable is included in the management strategy of sepsis. However, it is yet controversial whether $ScvO_2$ on patient admission is a robust prognostic parameter. Recent publications stress that plasma lactate and lactate clearance may be better indicators of systemic perfusion in sepsis.

**OBJECTIVES.** The aim of this ongoing prospective study is to investigate whether the dynamics of $ScvO_2$ and lactate as well as the ratio of lactate to $ScvO_2$ in the first 48 h of patient admission give more insight regarding mortality in the ICU population.

**METHODS.** Patients admitted to a medical ICU of a university hospital, in whom a central venous catheter is considered necessary and placed within the first 4 h of admission, were included. Exclusion criteria were age under 18 years, pregnancy and referral from another ICU. Mean arterial pressure (MAP), central venous pressure (CVP), central venous blood gas analysis and plasma lactate were recorded on study admission, as well as after 6, 12, 24 and 48 h. APACHE-II and SOFA scores as well as volume and vasopressor treatment were also recorded. Lactate clearance was calculated for the whole group as well as only for those patients with a plasma lactate of $> 4$ mmol/l on study admission. Patients are managed according the standard procedure of the ICU based on international guidelines. The data are analysed regarding their influence on ICU mortality.

**RESULTS.** The data from the first 89 patients with a mean age of 65.8 ± 15.7 years are presented here, of whom 63 patients survived and 26 patients died in the ICU. APACHE-II score was 21.3 ± 5.6 in survivors and 26.8 ± 6.5 in non-survivors ($p = 0.001$). Plasma lactate on study admission and after 6 h correlated with ICU mortality ($p = 0.002$). $ScvO_2$ on admission was lower in survivors than in non-survivors (64.6 ± 13.9 vs. 72.7 ± 18.4%, $p = 0.025$). There was no correlation between $ScvO_2$ and survival at any time point. Lactate clearance calculated for the whole study population did not reveal any correlation with ICU mortality. However, lactate clearance at 6 and 12 h in patients with an initial lactate of $> 4$ mmol/l did correlate with survival. The ratio between plasma lactate and $ScvO_2$ on admission and after 6 and 12 h showed a significant correlation with ICU mortality.

**CONCLUSIONS.** Plasma lactate has a prognostic significance in the management of critically ill patients. However, the role of $ScvO_2$ seems doubtful. The ratio between plasma lactate and $ScvO_2$ may be a useful marker of systemic perfusion and prognosis. Further investigation in a large patient population is yet necessary.

## 0616

### CENTRALVENOUS-ARTERIAL $PCO_2$-DIFFERENCE IN CARDIAC SURGICAL PATIENTS

M. Habicher[1], C. Spies[1], C. von Heymann[1], M. Sander[1]

[1]Charité Universitätsmedizin Berlin, Department of Anaesthesiology and Intensive Care Medicine, Berlin, Germany

**INTRODUCTION.** The concept of goal-directed hemodynamic therapy should be the basis of hemodynamic intervention in intensive care medicine. In the last decade parameters such as stroke volume variation (SVV), centralvenous oxygenation ($ScvO_2$), cardiac index (CI) and mean arterial pressure (MAP) have been used increasingly to monitor adequate hemodynamic treatment. However, it still remains challenging to identify patients with assumed adequate circulatory status quantified by the parameters above that suffer from microcirculatory hypoperfusion. The centralvenous-arterial $pCO_2$-difference ($dCO_2$) could serve as a new parameter to evaluate the adequacy of microcirculatory perfusion [1, 2].

**OBJECTIVES.** The aim of the study was to evaluate the impact of $dCO_2$ on outcome in cardiac surgery patients based on clinical parameters and ICU scores.

**METHODS.** After approval by the local ethics committee 60 patients were included in this study. The $dCO_2$ was measured after cardiac surgery on arrival to intensive care unit (ICU), and at the time points 1 h ICU, 6 h ICU and 18 h ICU. $dCO_2$ was compared with ICU-related outcome parameters. According to the first measurement on the ICU patients were divided into two groups, the high-$dCO_2$-group ($\geq$ 10 mmHg) and the low-$dCO_2$-group ($<$ 10 mmHg)[3]. Data are represented as median (25th percentile–75th percentile). Statistical analysis was performed by the Mann–Whitney-U Test and receiver operating characteristics analysis.

**RESULTS.** Based on the postoperative measurement, 11 patients were assigned to the high-$dCO_2$-group. There were no differences between the basic characteristics (Age, BMI, duration of surgery, clamping time) in the two groups. The SOFA- and the SAPS-score showed comparable values at the admission to the ICU whereas on the first postoperative day there was a significant increase of the SOFA- (8; 7–9 vs. 5; 3–7; $p = 0.04$) and the SAPS-score (42; 36–44 vs. 24; 18–31; $p = 0.03$) in the high-$dCO_2$-group compared to the low-$dCO_2$-group. There was no difference in hemodynamic parameters (MAP, CI, SVV, $ScvO_2$) between the two groups. $ScvO_2$ was significantly higher in the high-$dCO_2$-group 18 h after ICU-admission (74.6%; 71.5–76.7 vs. 67.0%; 62.7–70.5; $p < 0.01$). In the high-$dCO_2$ group a significantly prolonged need for mechanical ventilation was observed (12 h; 10–29; vs. 10 h; 8–12; $p = 0.03$). The $dCO_2$ on admission to ICU was predictive for prolonged mechanical ventilation (AUC ROC 0.72; $p = 0.03$).

**CONCLUSIONS.** This is the first study describing $dCO_2$ as a measure of compromised microcirculation in cardiac surgical patients. Patients with a high gradient despite having higher $ScvO_2$ values were significantly longer on mechanical ventilation and had significantly higher SOFA- and SAPS-scores on the first postoperative day. This might be a hint to a reduced oxygen extraction rate in these patients due to microcirculatory shunting.

**REFERENCE(S).** 1. Vallée ICM. 2008.
2. Dubin Front Biosci. 2008.
3. Adrogue N Engl J Med 1989.

## 0617

### SYNTHETIC BACTERIAL DNA MEDIATES A POSTCONDITIONING EFFECT IN MYOCARDIAL INFARCTION AND REPERFUSION VIA DIFFERENTIAL CYTOKINE EXPRESSION

S.-C. Kim[1], G. Schleifer[1], O. Boehm[1], G. Baumgarten[1], A. Hoeft[1], R. Meyer[2], P. Knuefermann[1]

[1]University Hospital Bonn, Anesthesiology and Intensive Care Medicine, Bonn, Germany, [2]University Bonn, Institute of Physiology, Bonn, Germany

**INTRODUCTION.** Studies have shown that TLR ligands have dichotomous effects depending on the pathological conditions. It has been demonstrated that LPS and bacterial DNA (CpG-ODN) mediate cardiodepressive effects via TLR4 and TLR9, respectively [1, 2]. Conversely, studies have shown a protective preconditioning effect of TLR-ligands when applied before myocardial ischemia [3].

**OBJECTIVES.** We hypothesized that the TLR9 ligand CpG-ODN has a postconditioning effect in a murine model of myocardial ischemia and reperfusion mediated by a differential expression of myocardial cytokines.

**METHODS.** C57BL/6 mice (12 weeks, male) underwent thoracotomy for chronic instrumentation of the LAD. Following a 5 day interval, mice were reanesthetized for a 30 min ischemia followed by 120 min of reperfusion. PBS-Group received 250 µl PBS, CpG-Group received 5 nmol CpG-ODN (Thioat 1668), each 5 min before onset of reperfusion. Ischemic postconditioning (IPC)-Group received three repetitive cycles of each 20 s reperfusion and occlusion with beginning of reperfusion. Treatment was blinded. Infarct size was determined with triphenyltetrazolium (TTC) staining. Planimetry was performed blinded. Myocardial RNA expression of TNF, IL-1$\beta$, IL-6 and IL-10 was assessed.

**RESULTS.** Infarct size was significantly higher in PBS-group ($n = 15$; 17.15 ± 3.47% of area at risk) compared with CpG-ODN-group ($n = 7$; 1.921 ± 1.12%) and IPC-group ($n = 6$; 1.98 ± 1.03%, $p < 0.05$), respectively. There was a robust increase of TNF and IL-10 RNA-expression in the CpG-Group compared to all other groups (TNF: *PBS*: 1.41 ± 0.43 RQ; *IPC*: 1.93 ± 0.38 RQ; *CpG*: 10.46 ± 2.06; IL-10: *PBS*: 24.81 ± 5.87 RQ; *IPC*: 24.74 ± 4.69 RQ; *TNF*: 53.96 ± 10.47 RQ, $n = 6$–9, $p < 0.05$). However, a differential expression pattern for IL-1$\beta$ and IL-6 in PBS and IPC-groups was observed. IL-1$\beta$ RNA-expression was significantly higher in CpG-group (13.85 ± 2.11 RQ) compared to IPC-group (6.48 ± 2.41 RQ) but not when compared to PBS-group (9.9 ± 2.9 RQ, $n = 6$–9, $p < 0.05$). IL-6 RNA expression was significantly higher in IPC-group (568.0 ± 98.91 RQ) and CpG-group (606.8 ± 49.49 RQ) when compared to PBS-group (335.4 ± 50.0 RQ, $n = 6$–9, $p < 0.05$).

**CONCLUSIONS.** Our data support the hypothesis that the TLR9 ligand CpG-ODN mediates a cardioprotective postconditioning effect after myocardial infarction and reperfusion. Expression of proinflammatory TNF and antiinflammatory IL-10 may initiate mechanisms of protection which needs further investigation. IL-6 expression seems to play a role in ischemic postconditioning. The dichotomous effects of bacterial DNA leading to myocardial dysfunction on the one hand and cardioprotection on the other hand warrant further investigations of the underlying mechanisms.

**REFERENCE(S).** 1. Baumgarten G et al. J Infect Dis. 2001.
2. Knuefermann P et al. Cardiovasc Res. 2008.
3. Ha T et al. Cardiovasc Res. 2008.

## 0618

### MIP MEASUREMENTS MAY RESULT IN OPPOSITE CARDIOVASCULAR EFFECTS IN CRITICAL ILL PATIENTS: CASE SERIES

D. Makris[1], J. Papanikolaou[1], M. Karvouniaris[1], P. Zigoulis[1], D. Baga[1], E. Zakynthinos[1]

[1]University Hospital of Larissa, ICU, Larissa, Greece

**INTRODUCTION.** The measurement of maximal inspiratory pressure(MIP) is a diagnostic method for respiratory muscle assessment. Previous studies suggested that MIP measurements have no adverse effects [1]. However, MIP-trial is virtually a Mueller maneuver and development of maximum inspiratory efforts for MIP measurement may result in opposite cardiovascular effects.

**OBJECTIVES.** To evaluate LV hemodynamics during MIP-study by using echocardiographic monitoring.

**METHODS.** We prospectively studied 10 consecutive ICU patients, hemodynamically stable, who fulfilled previously accepted criteria for a 30-min-SBT through T-tube. MIP was measured as previously suggested [1]. Echocardiography (TTE) was performed before, during and after the MIP trial. Transmitral early diastolic velocity (E)/Tissue Doppler Imaging-derived early diastolic velocity (E′) at the lateral border of the mitral annulus (E/E′ ratio) was used as a surrogate of LV filling pressures during the procedure [2].

**RESULTS.** Median (IQR) age of patients were 60 (48–73) years. Baseline $SpO_2$% was 99 (98–100), Mean Arterial Pressure was 94 (83–95) mmHg. Four patients were intubated and 6 were breathing through tracheostomy. MIP was −34(−17, −37) $cmH_2O$. Baseline transmitral early diastolic velocity (E) was 92.8 (80.7–114.5) cm/s, tissue Doppler Imaging-derived early diastolic velocity (E′) was 10 (6.4–13.6) cm/s, E/E′ was 8.6(6.9–13.4). E/E′ changed significantly from the baseline during the MIP trial [− 2.49(−4.5, −0.93), ($p = 0.01$)] whereas E/E' changes between baseline and after MIP, were not significant [0.92 (−0.8, 3.3) ($p = 0.2$)]. Two patients (one of them with history of heart failure and pre-trial E/E′ ratio > 15) presented typical features of acute pulmonary edema (APE), requiring immediate reconnection to the ventilator, PEEP and diuretics. However, none of them increased E/E′ during either MIP (in line with the remainders) or APE; presumably, acute changes in cardiac loading conditions and intrapulmonary fluid shifts due to negative intrathoracic pressures rather than acute LV dysfunction might have triggered these adverse events.

**CONCLUSIONS.** Our case-series point out that MIP measurement in tracheostomized or intubated patients might result in opposite cardiovascular events. Thus, MIP-trial should be performed cautiously in patients with medical history of cardiovascular disease. Additionally, those with elevated pre-trial E/E′ ratios reflecting volume overload or LV dysfunction may require further investigation.

**REFERENCE(S).** 1. Vitacca M, Paneroni M, Bianchi L et al. Maximal inspiratory and expiratory pressure measurement in tracheotomised patients. Eur Respir J 2006;27(2):343–9.
2. Nagueh SF, Middleton KJ, Kopelen HA et al. Doppler tissue imaging: a noninvasive technique for evaluation of left ventricular relaxation and estimation of filling pressures. J Am Coll Cardiol. 1997;30(6):1527–33.

## 0619

### PREDICTING VOLUME RESPONSE DURING SPONTANEUS, ASSISTED AND CONTROLLED VENTILATION

S. Joeken[1], A. Santos[2], F. Suarez-Sipmann[2]

[1]CERES GmbH Evaluation and Research, Loerrach, Germany, [2]Fundacion Jimenez Diaz-Capio, Intensive Care Unit, Madrid, Spain

**INTRODUCTION.** Dynamic volume responsiveness indexes such as pulse pressure (PPV) and stroke volume (SVV) variations are useful clinical parameters that help to decide the appropriateness of fluid administration in hemodinamically unstable patients. However, they can only be used during fully controlled mechanical ventilation.

**OBJECTIVES.** To evaluate the ability of a new fluid responsiveness index (FRI) to dynamically predict the response to volume expansion during assisted and spontaenous modes of ventilation.

**METHODS.** The FRI is based on the fast Fourier transformation and spectral analysis of CVP and AP waveforms to independently determine the influence of respiration and cardiac activity on the changes in the arterial blood pressure waveform. In 17 pigs (weight 22–57 kg) we compared three different volemic conditions: hypovolemia (blood withdrawal), normovolemia (blood reinfusion) and hypervolemia (6% hydroxyl-ethyl starch-HES infusion). At each condition fluid resposiveness was assessed during three randomly applied ventilatory modes: 1)controlled ventilation (CMV) using volume controlled ventilation Vt 6 mL kg, PEEP 5 $cmH_2O$, RR adjusted to a normal $EtCO_2$, 2)assisted ventilation (AMV) in assisted/controlled pressure controlled ventilation with similar settings but maintaining the animal respiratory drive and 3)spontaneous breathing(SB) CPAP of 5 $cmH_2O$. At each condition we evaluated the ability of FRI to predict changes in stroke volume in response to fluid administration and compared it with PPV and SVV.

**RESULTS.** At baseline all animals were in a stable hemodynamic condition with normal preload values. To induce hV blood an average (± 2 SD) of 17 ± 24 mL/kg of blood was withdrawn, whereas to induce hypervolemia a mean of 45 ± 24 ml/kg 6% HES was infused. FRI showed a high correlation and good correspondence with the measured changes in stroke volume at the different preload conditions and all ventilatory modes ($r^2 = 0.851$, bias = −0.49%, 2 SD = 24.47% in CMV; $r^2 = 0.872$, bias = 3.22, 2SD = 21.57% in AMV; and $r^2 = 0.854$, bias = −1.96%, 2 SD = 21.29 in SB). FRI < 80% predicted an increase more than 10% in cardiac output after fluid administration in CMV (ROC 0.92), AMB (ROC 0.84) and SB (ROC 0.85). PPV and SVV performed as good as FRI during CMV but showed a poor correlation during AMV and SB.

**CONCLUSIONS.** The fluid responsiveness index performed as good as pulse pressure and stroke volume variations during controlled mechanical ventilation. During assisted and spontaneous modes of ventilation FRI levels below 80% could reliable predict clinical significant increases in stroke volume in response to volume administration.

**GRANT ACKNOWLEDGMENT.** Pulsion Medical System.

# Hemodynamics of septic shock: 0620–0631

## 0620

### SEPTIC MYOCARDIAL DEPRESSION: DIAGNOSTIC AND PROGNOSTIC IMPLICATION OF BRAIN NATRIURETIC PEPTIDE AND CARDIAC TROPONIN

A.E. Elhadidy[1], N. Ismail[1], K. Hussein[1], M. Ashraf[1], S. Abd El Shafy[1], I. Mohamed[1], H. Mowafy[1]

[1]Cairo University, Critical Care Department, Cairo, Egypt

**INTRODUCTION.** Septic shock is a life-threatening illness. The commonest presentation is cardiovascular instability because the underlying illness has advanced to shock.Among all natriuretic peptides, currently Brain Natriuretic Peptide (BNP) is the most promising candidate for predicting myocardial dysfunction in septic patients, as it is of ventricular origin and its release is related to ventricular wall stretch and volume overload.
**OBJECTIVES.** This study was to assess myocardial dysfunction in sepsis and analyze the elevations of BNP and cardiac Troponin I (cTn-I) in patients with sepsis, severe sepsis and septic shock and evaluate their relationships with echocardiographic data and the impact on outcome .
**METHODS.** 43 patients (pts) having various degrees of sepsis admitted to Critical Care Department at Cairo University from October 2007 to February 2009 were recruited in the study, in addition to ten healthy volunteers served as a control group for BNP, cTn-I levels and echocardiographic parameters. All pts were subjected to APACHE II, SOFA score O/A and day 2, echocardiography O/A, as well as BNP and cTn-I sampling O/A, and day 2. The studied pts were divided into group I with sepsis (23pts, 12 males; mean age 46.7 ± 21 year) and group II with severe sepsis and septic shock (20 pts, 11 males; mean age 54.6 ± 17 year).
**RESULTS.** BNP level O/A was significantly higher in group I and group II than control ($p = 0.048$); BNP level on day 2 was significantly higher in group II than group I ($p = 0.004$). cTn-I in day 2 was higher in group II than control ($p < 0.001$). BNP and cTn-I were correlated positively with APACHE- II, MODS, SOFA (O/A and day2). cTnI O/A was found negatively correlated to LVEF ($r = -0.348$; $p = 0.022$ and $r = -0.334$; $p = 0.029$, respectively), whereas Neither BNP O/A nor at day 2 in the study group was correlated to LV diameters, volumes, LVEF,CO& CI. BNP was highly correlated to cTnI at day 2 ($p = 0.044$). BNP O/A and day 2 as well as cTnI were higher in non-survivors than survivors but with no statistical significant differences ($p > 0.05$). BNP measurements should be interpreted with great caution in the critically ill. We can conclude that BNP and cTn-I cannot be used as a diagnostic marker of myocardial dysfunction nor a prognostic marker in patients with severe sepsis or septic shock.
**CONCLUSIONS.** BNP measurements should be interpreted with great caution in the critically ill. We can conclude that BNP and cTn-I cannot be used as a diagnostic marker of myocardial dysfunction nor a prognostic marker in patients with severe sepsis or septic shock.
**REFERENCE(S).** Kandil E et al. B-type naturetic peptide: a biomarker for the diagnosis and risk stratification of patients with septic shock.Arch Surg. 2008;143(3):242–6.

Mehta NJ et al.cardiac troponin I predicts myocardial dysfunction and adverse outcome in septic shock. Int J Cardiol 2004;95:13–7.

**GRANT ACKNOWLEDGMENT.** Prof Hosam Moafi, Critical Care Department Cairo University.

## 0621

### CENTRAL VENOUS OXYGEN SATURATION IN PATIENTS WITH SEPTIC SHOCK: A SINGLE CENTER OBSERVATIONAL STUDY

F.M. Jacobs[1], D. Prat[1], F.G. Brivet[1]

[1]Hopital Antoine Beclere, Clamart, France

**INTRODUCTION.** Since the French 2005 consensus conference on sepsis [1] central venous oxygen saturation ($ScvO_2$) value (after correction of hypovolemia and vasoplegia) should be used as a goal of initial resuscitation and as a tool to guide transfusion or inotropic support in septic shock (SS).
**OBJECTIVES.** To assess the adherence with guidelines and the impact of $ScvO_2$ on treatment options and patients prognosis.
**METHODS.** Prospective,monocentric study in 38 consecutive patients with SS during 8 consecutive months. Inclusion criteria: all patients with a diagnosis of SS. $ScvO_2$ monitoring: intermittent measurement. Data collection: age, sex, SAPS II and SOFA score at admission, mortality, length of stay$ScvO_2$, hematocrit (Ht), blood lactate concentration, pH, mean arterial pressure (MAP), fluid challenges, catecholamine dose.

**RESULTS.**

DEMOGRAPHIC DATA

| | All patients n = 36 | High $ScvO_2$ init n = 24 | Low $ScvO_2$ init n = 12 | p |
|---|---|---|---|---|
| Age (years) | 70.8 ± 13.2 | 62.2 ± 14.2 | 77.7 ± 7.2 | <0.002 |
| Sex (M/F) | 23/13 | 18/6 | 5/7 | |
| SAPS II | 62.5 ± 25.3 | 60.1 ± 19.1 | 67.4 ± 25 | NS |
| SOFA Score | 9.1 ± 3.2 | 9.1 ± 3.5 | 9.2 ± 2.5 | NS |
| Death (n) | 22 | 14 | 8 | NS |
| LOS (days) | 21.2 ± 13.1 | 20.9 ± 13.5 | 21.7 ± 12.6 | NS |

Only 3 patients have no $ScvO_2$ measurement (femoral venous catheter:2, no order:1) 168 measurements were done 297 min (median) after admission, after 1,717 1,542 ml of fluid loading and with a mean dose of norepinephrine of 2.99 ± 2.58 mg/h.

Median initial $ScvO_2$ ($ScvO_2$init) is 74%. 24 values are > 70% ($HSvO_2$ init) and 12 < 70% ($LSvcO_2$ init). The median number of determination per patient is 3 (range 1–18). Only 41.7% of low $ScvO_2$ are associated with high lactate values.

VARIABLES AND $SCVO_2$

| | $HSvcO_2$ init n = 24 | $LSvcO_2$ init n = 12 |
|---|---|---|
| $SvcO_2$ (%) | 82.5 ± 7.7 | 59.8 ± 11.4 |
| Lactate (mmol/l) | 3 ± 3.6 | 3.1 ± 2.6 |
| pH | 7.32 ± 0.11 | 7.35 ± 0.11 |
| Ht (%) | 33.4 ± 5.5 | 30.7 ± 2.8 |
| MAP (mmHg) | 80.6 ± 18.4 | 73.3 ± 15.8 |
| Norepinephrine (mg/h) | 2.5 ± 2.1 | 3.9 ± 3.2 |
| Fluid loading (ml) | 1845 ± 1525 | 1450 ± 1623 |

16 therapeutic decisions were made on low $ScvO_2$ values: intoduction of inotropic support 11 times, red blood cell transfusion 5 times.
**CONCLUSIONS.** 94.7% of patients with SS have at least one $SvcO_2$ measurement (after fluid loading and initiation of vasoconstrictors).
We found a higher proportion of patients with low initial values that recent papers [2], probably highlighting the burden of comorbiditiesd and confounding factors in $ScvO_2$ values. Only 9.5% of collected values lead to therapeutic changes.
**REFERENCE(S).** 1. Haemodynamic management of severe sepsis. Ann Fr Anesth Reanim. 2006.

2. Perel A. Critical Care. 2008;12:223.

## 0622

### EFFECTS OF VASOPRESSORS ON SEPSIS-INDUCED CARDIAC DYSFUNCTION. A COMPARATIVE ANALYSIS USING POSITRON EMISSION TOMOGRAPHY AND CONDUCTANCE CATHETER

N. Ducrocq[1], A. Kimmoun[1,2], C. Montemont[1], F. Maskali[3], S. Poussier[3], P.Y. Marie[3], B. Levy[1,2]

[1]Groupe Choc Contrat Avenir INSERM, Faculté de médecine de Nancy, Vandoeuvre les nancy, France, [2]CHU Nancy, hôpitaux de Brabois, réanimation médicale, Vandoeuvre les nancy, France, [3]CHU Nancy, Nancyclotep, département de médecine nucléaire, Vandoeuvre les Nancy, France

**INTRODUCTION.** Sepsis is the leading cause of death in intensive care, half of which is secondary to cardiovascular failure. Early use of vasopressors is part of routine international standards of care. Unfortunately, there is little data as to their direct or indirect effects on myocardial function.

**OBJECTIVES.** Two techniques were used to explore myocardial function: the conductance catheter (the reference method for intraventricular measurement), and PET (Positron Emission Tomography), a new technology for cardiac exploration.

The aims of the study were:

- To describe the cardiovascular effects of vasopressors
- To compare information provided by both methods on vascular and cardiac functions

**METHODS.** In the present study, we used a rat model of septic shock with caecal ligation and puncture (CLP). Eighteen hours after surgery, male Wistar rats were randomized in 5 groups. Animals from Group 1, 2, 3 received 5 mL of 0.9% NaCl for 10 min, followed by a continuous infusion of catecholamines (norepinephrine, epinephrine or phenylephrine) in order to increase mean arterial pressure by 20% compared to baseline value. Sham animals (laparotomy without CLP) and CLP animals were included in group 4 and 5, respectively. Rats in group 4 and 5 received no treatment.

**RESULTS.** Results revealed an impairment of cardiac function in septic rats, irrespective of the explorative method used, with alterations in both systolic and diastolic functions. Emax and PRSW, two load independent measures of systolic function, were markedly lower in septic animals than in sham animals (−35%). Cardiac output and left ventricular ejection fraction were reduced in CLP rats by 29 and 36%, respectively. End diastolic ventricular pressure was increased by 42% in septic rats. End diastolic volume and heart rate were comparable in the five groups. No morphological abnormalities or ischemic lesions were observed in PET imaging. Both norepinephrine and epinephrine showed beneficial effects on systolic and vascular functions whereas phenylephrine infusion was deleterious. All measures of systolic function reached baseline values of sham rats with norepinephrine and epinephrine. This improvement in cardiovascular function was accompanied by a significant rise in myocardial oxygen consumption, especially under epinephrine treatment. Both explorative techniques were complementary: PET imaging allowed the examination of cardiac morphology which complemented functional measurements derived from the conductance catheter study.

**CONCLUSIONS.** In our hypodynamic septic shock model in rats norepinephrine and epinephrine display comparable effects with regard to cardiovascular function, albeit at the expense of an increase in myocardial oxygen consumption which was more pronounced with epinephrine.

## 0623

### DEFINING THE PLACE OF MICROCIRCULATORY ASSESSMENT DURING SEPTIC SHOCK

G. Hernandez[1], C. Ruiz[1], C. Godoy[1], M.A. Diaz[1], S. Bravo[1], K. Eduardo[1], E. Morales[1], C. Martin[1], M. Andresen[1], M. Rovegno[1], A. Bruhn[1]

[1]Pontificia Universidad Católica de Chile, Departamento de Medicina Intensiva, Santiago, Chile

**INTRODUCTION.** Microcirculatory abnormalities may not be predicted by hemodynamic or perfusion parameters during septic shock. Recent research has evaluated potential therapies but has not addressed a fundamental problem: in whom is it worth to perform a microcirculatory assessment? In fact, the place of microcirculatory monitoring has not been established, nor a specific subpopulation with higher probability of presenting severe derangements has been identified. Our aim was to evaluate potential risk factors associated with the finding of severe microcirculatory flow abnormalities.

**METHODS.** We performed a retrospective analysis of a prospective database including 56 microcirculatory assessments in 35 septic shock patients. Under our current septic shock management protocol (ARAS-3), sublingual microcirculation (SDF, MicroScan®; Microvision Medical, NL, USA) is evaluated in patients with established septic shock presenting severity criteria such as progressive hyperlactatemia or norepinephrine (NE) requirements > 0.3 mcg/kg/min; or when discrepancies among perfusion parameters arise. Whenever a microcirculatory assessment is performed, cardiac index (CI), lactate, mixed venous $O_2$ saturation ($SmvO_2$), MAP and NE levels are registered in parallel. In order to identify specific parameters correlated with the finding of severe microcirculatory flow abnormalities (defined by both a MFI < 2 and a PPV < 80%) we performed different analyses. Categorical data were analysed with Fisher's Exact Test, and continuous variables with Spearman's rho correlation.

**RESULTS.** The 35 patients (age 59; SOFA 11 ± 3; APACHE 23 ± 6; NE dose 0.49 ± 0.7 mcg/kg/min; lactate 4.6 ± 3.7 mmol/l; CI 3.9 ± 1.4 l/min/m2; $SmvO_2$ 71 ± 8%) presented an ICU mortality of 37.8%. The mean microcirculatory flow values were PPV 79 ± 13% and MFI 2.2 ± 0.5. When analyzing the incidence of severe flow abnormalities according to specific cut-offs for septic shock severity criteria, we found a higher incidence with NE requirements > 0.3 mcg/kg/min (11/31 (35%) vs. 2/23 (9%); p = 0.024) and lactate > 4 mmol/l (10/25 (40%) vs. 3/31 (10%); p = 0.009). Lactate exhibited a good correlation with PPV values (Spearman's rho = 0.6; p < 0.0001). Only lactate and APACHE II were associated with severe microcirculatory flow abnormalities in a logistic regression model. The risk of presenting severe flow abnormalities significantly increased with every 1 mmol/l of lactate increment (OR 1.6; 95% CI 1.2–2.2; p = 0.002).

**CONCLUSIONS.** We found that severe microcirculatory flow abnormalities are concentrated in patients requiring NE doses > 0.3 mcg/kg/min or with a lactate > 4 mmol/l. In contrast, patients with NE requirements < 0.3 mcg/kg/min or lactate < 4 mmol/l exhibit a very low incidence of severe flow abnormalities. These data may help to position microcirculatory assessment in septic shock monitoring and challenge the view that microcirculatory abnormalities cannot be predicted by lactate or other septic shock severity criteria.

## 0624

### DYNAMICS OF RECOVERY OF PERIPHERAL AND METABOLIC PERFUSION PARAMETERS DURING SEVERE SEPSIS RESUSCITATION: A PRELIMINARY REPORT

G. Hernandez[1], A. Bruhn[1], C. Romero[2], S. Bravo[1], C. Pedreros[1], J. Ramirez[1], C. Godoy[1], M.A. Diaz[1], A. Bujes[1], E. Kattan[1], J.L. Navarro[2], R. Neira[2], M. Rovegno[1]

[1]Pontificia Universidad Católica de Chile, Departamento de Medicina Intensiva, Santiago, Chile, [2]Hospital Clinico Universidad de Chile, Unidad de Pacientes Criticos, Santiago, Chile

**INTRODUCTION.** Perfusion assessment can be a very difficult task in patients with severe sepsis. Metabolic parameters such as lactate and $ScvO_2$ may be misleading or non-interpretable. On the other hand, peripheral perfusion can be severely compromised in this setting, which has been correlated with hyperlactatemia and organ dysfunctions. However, no study has addressed the temporal profile of changes in peripheral perfusion during severe sepsis. Our aim was to evaluate the dynamics of recovery of metabolic and peripheral perfusion parameters during severe sepsis resuscitation.

**METHODS.** We included hypotensive septic patients undergoing fluid resuscitation or requiring vasopressors after ICU admission. Several perfusion parameters including lactate, $ScvO_2$, venous-arterial $pCO_2$ gradient (Δ v-a $pCO_2$), capillary refill time (CRT) and central versus toe temp gradient (Δ t° C–T), were assessed at baseline and then at 2, 6 and 24 h of resuscitation. All patients were managed with a common protocol including additional fluid challenges, norepinephrine (NE), mechanical ventilation (MV) or dobutamine according to specific indications. The percentage of patients with normal values for every parameter at each time-point was assessed. Changes along time were analyzed by Fisher exact test.

**RESULTS.** We enrolled 25 patients (mean age 61.4; SOFA 9, APACHE 18, NE 68%, MV 52%, ICU mortality 20%), of whom 24 survived the study period. More than 50% of patients exhibited abnormal values for each parameter at baseline. Although all parameters tended to normalize at 24 h, only CRT exhibited significant changes at 6 h (Fig. 1).

**CONCLUSIONS.** Both peripheral and metabolic perfusion parameters exhibited a similar recovery trend in successfully resuscitated septic patients, but CRT normalized earlier than the other parameters. Future studies should address the role of dynamic peripheral perfusion assessment in severe sepsis.

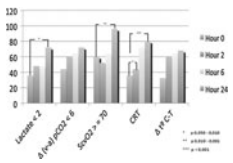



Figure 1

## 0625

### HYPERDYNAMIC MICROCIRCULATORY ALTERATIONS IN PATIENTS WITH SEVERE SEPSIS AND SEPTIC SHOCK

E. Klijn[1], K. Moeksim[1], C. Ince[1], J. Bakker[1], J. Van Bommel[1]

[1]Erasmus Medical Center, Intensive care, Rotterdam, Netherlands

**INTRODUCTION.** Although microcirculatory alterations are frequently being described in patients admitted to the ICU with severe sepsis and septic, the severity of these alterations seems to vary between several studies. The main purpose of our study was to establish the severity and time course of microcirculatory alterations in patients with severe sepsis and septic shock in our ICU and investigate whether the severity could differentiate between survivors and non survivors.

**METHODS.** Patients admitted with severe sepsis and septic shock were eligible for enrollment. Within 24 h of admittance and every other day clinical and hemodynamic measurements were made, until discharge or death. Additionally sublingual and skin microcirculatory perfusion was measured using sidestream dark field imaging, peripheral flow index and forearm-to-fingertip skin-temperature difference.

**RESULTS.** Data of 30 patients admitted with severe sepsis or septic shock were collected. Of these patients 19 survived and 11 died. The non survivors had a significantly higher APACHE II and SOFA score than the survivors. Additionally at baseline mean arterial pressure was lower in the non survivors group and lactate concentrations were higher compared to survivors. At baseline both groups had a high microcirculatory flow index, proportion of perfused vessels and vessel density, which did not differ between the survivors and non survivors (Fig. 1 shows the parameters of sublingual microcirculatory perfusion over time). Over time the microcirculatory parameters did not change in the survivors nor in the non survivors.

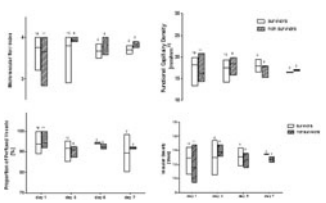


Figure 1

**CONCLUSIONS.** In our study microcirculatory parameters exhibited a hyperdynamic profile after the initial resuscitation phase but within 24 h of admittance. This was less clear for the parameters of skin microcirculatory perfusion. It was not possible to differentiate between survivors and non survivors based on parameters of sublingual or skin microcirculatory perfusion.

## 0626

### EFFECT ON TISSULAR SATURATION ($STO_2$) AT BASELINE AND AFTER A VASCULAR OCCLUSION TEST AT THREE LEVELS OF MEAN ARTERIAL PRESSURE, OBTAINED BY DECREASING NOREPINEPHRINE REGIMEN, IN STABILIZED SEPTIC SHOCK PATIENTS

J.F. Georger[1], M. Tchir[1], S. Chettab [1], R. Gondret[1], E. Barsam[1], P. Lehericey[1], A. Montefiore[1]

[1]CHI Villeneuve Saint Georges, Reanimation Polyvalente, Villeneuve Saint Georges, France

**INTRODUCTION.** In patients with septic shock consensual recommendation is to maintain a mean arterial pressure (MAP) above 65 mmHg. It still remains unclear if MAP values > 65 mmHg can induce microcirculatory changes. With Near Infrared Spectrometry (NIRS) the tissular haemoglobin saturation ($StO_2$) and the recovery slope after a vascular occlusion test (VOT), which is a predictive factor in septic shock, can be analyzed.

**OBJECTIVE.** To determine if values of MAP at three different levels (> 80 mmHg, 70–80 mmHg, 65–70 mmHg) obtained by adjusting the doses of norepinephrine can modify the $StO_2$ parameters at baseline and after a VOT in stabilized septic shock patients.

**METHOD.** Thirty-two patients with septic shock without fluid loading responsiveness and with MAP > 80 mmHg receiving norepinephrine were included in this prospective, observational study. Norepinephrine regimen was decreased if MAP was above 80 mmHg to obtain three levels of MAP: > 80 mmHg (point 1), 70 mmHg > MAP < 80 mmHg (point 2), 65 mmHg > MAP < 70 mmHg (point 3). All patients were monitored with a NIRS device (Inspectra 840®, Hutchinson technology®) for $StO_2$ at baseline and for analysis of the recovery slopes after VOT. Cardiac Index (CI) was assessed with trans thoracic echocardiography, arterial and central mixed venous oxygen saturation ($ScvO_2$, $SaO_2$) were measured. All these parameters were evaluated at the three different levels of MAP. Statistical analysis was performed with Friedman test for multiple intra-group comparisons.

**RESULTS.** Three groups of patients were identified when decreasing MAP: Group 1 (N = 17, 53%) showed patients who decreased their recovery slope by more than 20%, in Group 2 (N = 10, 31%) the recovery slopes were not modified (± 20%), and in Group 3 (N = 5, 16%) the recovery slopes increased by more than 20%. Intra-group comparison for $StO_2$ at baseline was equivalent at the different levels of MAP. In group 1, CI decreased with the recovery slope. In group 2 and group 3 there was no significant change of CI. The oxygenation parameters were not statistically different in each group.

Results are presented in the following table.

MICRO AND MACROCIRCULATORY RESULTS

| | Groupe 1 (n = 17) | | | Groupe 2 (n = 10) | | | Groupe 3 (n = 5) | | |
|---|---|---|---|---|---|---|---|---|---|
| Pressure level | Point 1 | Point 2 | Point 3 | Point 1 | Point 2 | Point 3 | Point 1 | Point 2 | Point 3 |
| Recovery slope (%/s) | 1.67<br>0.54–4.51 | 1.45*<br>0.19–4.23 | 1.28*<br>0.23–3.13 | 1.75<br>0.78–4.03 | 1.69<br>0.52–4.12 | 1.82<br>0.88–3.60 | 0.91<br>0.41–3.64 | 0.96*<br>0.48–4.31 | 1.34*<br>0.57–4.54 |
| $StO_2$ (%) | 78<br>54–89 | 79<br>53–88 | 77<br>51–89 | 85<br>76–91 | 84<br>77–91 | 85<br>78–92 | 79<br>61–86 | 75<br>63–83 | 78<br>68–86 |
| Cardiac Index (l/min/m$^2$) | 3.27<br>1.87–5.77 | 3.01<br>1.48–5.59 | 2.87*<br>1.69–4.83 | 3.57<br>1.31–5.97 | 3.40<br>2.29–5.81 | 2.72<br>1.98–5.77 | 2.12<br>1.74–4.01 | 2.48<br>1.91–4.50 | 2.45<br>2.16–4.81 |
| $ScvO_2$ (%) | 75<br>51–89 | 73<br>51–87 | 72<br>51–84 | 75<br>58–83 | 73<br>56–84 | 74<br>57–80 | 66<br>59–75 | 71<br>56–76 | 68<br>59–70 |

Data are shown with median value (superior) and range values (inferior)
*Means $p < 0.05$ versus point 1 in the same group

**CONCLUSION.** Modifying the MAP of stabilized septic shock patients with changes of norepinephrine dosage can improve or deteriorate the recovery slope after VOT measured by NIRS but not the basal value of $StO_2$. In some patients recovery slope can be improved without modification of the CI. This findings suggest that monitoring of the recovery slope after a VOT could be helpful to select the most appropriate MAP level and norepinephrine regimen to improve microcirculation.

## 0627

### THE PERSISTENCE OF MICROVASCULAR DYSFUNCTION IS ASSOCIATED WITH A WORSE OUTCOME IN PATIENTS WITH SEVERE SEPSIS

J. Creteur[1], G. Ospina[1], A.P. Neves[1], D. De Backer[1], J.-L. Vincent[1]

[1]Hopital Erasme, Université Libre de Bruxelles, Brussels, Belgium

**INTRODUCTION.** Despite adequate resuscitation, microvascular alterations may persist in severe sepsis and may be associated with a poorer outcome. Near infrared spectroscopy (NIRS) and sublingual capnometry have been proposed as valuable tools to quantify microvascular dysfunction in patients with sepsis.

**OBJECTIVES.** We hypothesized that the persistence of microvascular dysfunction as assessed by sublingual capnometry and NIRS would be associated with a worse outcome in patients with severe sepsis.

**METHODS.** All patients admitted to the ICU with early severe sepsis were included in the study. Central venous oxygen saturation ($ScvO_2$), sublingual $PCO_2$ ($PslCO_2$) and NIRS-derived variables were simultaneously measured at admission and after 6 h of resuscitation. $PslCO_2$ was measured using a microelectrode $CO_2$ sensor ($PslCO_2$ monitor sensor; Exostat Medical Inc, USA). $PslCO_2$gap was calculated as the difference between $PslCO_2$ and arterial $PCO_2$. Thenar muscle oxygen saturation ($StO_2$) was measured using a tissue spectrometer (InSpectra™ Model 650, Hutchinson Technology Inc, USA) during a vaso-occlusive test (upper limb ischemia induced by rapid pneumatic cuff inflation around the upper arm). The following NIRS-derived variables were recorded: "steady-state" $StO_2$ ($StO_2$) and the $StO_2$ reperfusion rate following the ischemic period (reperf rate; %/s). The predictive values for outcome (ICU death) of the variables measured at 6 h were calculated from ROC curves, and the areas under the curve (AUC) were computed.

**RESULTS.** We studied 50 patients (APACHE score: 23 ± 7), with a 36% mortality rate. The changes in $ScvO_2$ and $StO_2$ over the 6 h period were similar in survivors (S) and non-survivors (NS), but the changes in reperf rate and $PslCO_2$gap were significantly different: the reperf rate increased in S but not in NS and the $PslCO_2$gap decreased in S but not in NS (Table 1: data presented as median and interquartile ranges; * $p < 0.05$: S vs. NS; $p < 0.05$ vs. baseline). The AUCs for $PslCO_2$gap, reperf rate, $StO_2$, and $ScvO_2$ were 0.91, 0.89, 0.59 and 0.53, respectively.

**TABLE 1**

| | Baseline | 6 h |
|---|---|---|
| $ScvO_2$(%); S | 68 (59; 71) | 72 (59; 75) |
| $ScvO_2$(%); NS | 63 (58; 78) | 72 (68; 75) |
| $PdCO_2$gap (mm Hg); S | 27 (24; 31) | 11 (9; 15)* |
| $PdCO_2$gap (mm Hg); NS | 34 (24; 39) | 21 (19; 33) |
| $StO_2$(%); S | 80 (75; 84) | 85 (82; 90) |
| $StO_2$(%); NS | 79 (66; 85) | 84 (72; 88) |
| Reperf rate (%/s); S | 2.1 (1.5; 2.9) | 4.4 (3.7; 5.3)*$^{\$}$ |
| Reperf rate (%/s); NS | 1.5 (0.9;2.1) | 2.2 (1.8;3.0) |

**CONCLUSIONS.** Despite seemingly adequate early resuscitation, the persistence of microvascular alterations as detected by sublingual capnometry or NIRS is associated with a worse outcome in patients with severe sepsis. These techniques may help to guide the resuscitation of patients with severe sepsis.

## 0628

### MICROCIRCULATORY EFFECTS OF ENALAPRILAT IN AN OVINE MODEL OF SEVERE SEPSIS

D. Ribeiro Salgado[1,2], X. He[1], F. Su[1], D. Barros de Sousa[1], L. Penaccini[1], L. Kfuri Maciel[1], F. Taccone[1], J.R. Rocco[2], E. Silva[3,4], D. De Backer[1], J.-L. Vincent[1]

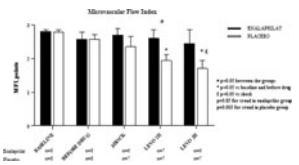
[1]Université Libre de Bruxelles, Department of Intensive Care, Brussels, Belgium, [2]Universidade Federal do Rio de Janeiro, Department of Internal Medicine, Rio de Janeiro, Brazil, [3]Universidade Federal do Estado de São Paulo, Department of Experimental Surgery, São Paulo, Brazil, [4]Albert Einstein Hospital, Intensive Care Unit, São Paulo, Brazil

**INTRODUCTION.** Patients with severe sepsis present high levels of angiotensin II (ang II), a hormone with vasoactive, proinflammatory, and procoagulant properties. Despite seemingly adequate hemodynamic resuscitation, microcirculatory abnormalities are frequently observed. Increased serum levels of ang II may play a role in this microcirculatory dysfunction during severe sepsis.

**OBJECTIVES.** To evaluate the microcirculatory effects of enalaprilat in an experimental model of severe sepsis.

**METHODS.** Prospective, randomized, double-blind, placebo controlled study including 16 adult female anesthetized, mechanically ventilated sheep. One hour after injection of 1.5 g/kg body weight of feces into the abdominal cavity, animals were randomized to receive either enalaprilat 2.5 mg or saline. A combination of Ringer's lactate (RL) and hydroxyethyl starch solutions was titrated to prevent hypovolemia. When fluid-resistant hypotension (MAP < 65 mmHg) developed, the animals were given norepinephrine up to a maximal dose of 3 µg/kg/min. The sublingual microcirculation was evaluated using sidestream dark-field videomicroscopy (Microscan, MicroVision Medical) at baseline (just before feces injection), before drug administration, before norepinephrine infusion (shock), and after the 1st and 2nd hour of norepinephrine infusion. Capillary density, proportion of perfused vessels, and microvascular flow index (MFI) were calculated. A cut-off of 20 µm was used to differentiate small and large vessels. Experiments were pursued until the sheep's spontaneous death or a maximum of 30 h. Results are presented as mean ± SE.

**RESULTS.** There were progressive and significant reductions in the proportion of small perfused vessels ($p = 0.006$ for trend) and in the MFI ($p = 0.003$ for trend) during shock and the first 2 h of norepinephrine infusion in the placebo group, which were prevented by the administration of enalaprilat ($p = 0.83$ and $p = 0.85$ for trend in the proportion of small perfused vessels and MFI, respectively) (Fig. 1). There were no differences between treated and placebo groups in global hemodynamic variables, time to shock (18.1 ± 2.4 h vs. 17.6 ± 2.1 h, $p = 1.0$) or median survival time (23 ± 1.7 vs. 24 ± 1.9 h, $p = 0.49$). However creatinine concentrations increased more in the treated group (from 0.60 ± 0.09 to 1.15 ± 0.19, $p = 0.04$) than in the control group (from 0.62 ± 0.10 to 1.01 ± 0.23, $p = 0.12$).




**CONCLUSIONS.** Enalaprilat prevented the worsening of microcirculatory variables in this fluid-resuscitated, hyperdynamic model of septic shock without significant effect on arterial pressure, but possibly associated with an earlier impairment of renal function.

## 0629

### BI-VENTRICULAR MYOCARDIAL DYSFUNCTION IN SEPSIS AND ITS CORRELATION TO ENDOTHELIAL DYSFUNCTION AND VASCULAR INFLAMMATION

C. Aguiar Ribeiro[1], T. Furian[1], R. Pinto Ribeiro[1], K. Prado[1], L. Quintana Becker[1], N. Clausell[1], L.E. Rohde[1]

[1]Hospital de Clinicas de Porto Alegre/UFRGS, Serviço de Cardiologia e Medicina Intensiva, Porto Alegre, Brazil

**INTRODUCTION.** Myocardial dysfunction is a marker of worse prognosis in severe sepsis, but the molecular mechanisms involved are not fully understood.

**OBJECTIVES.** In this prospective study we evaluated serial echocardiography-based indices of myocardial function and markers of vascular inflammation and endothelial dysfunction in the early phases of severe sepsis.

**METHODS.** Adult patients admitted to the Intensive Care Unit with up to 24 h after fulfilling criteria for severe sepsis or septic shock were studied. Patients with history of heart failure were excluded. Clinical, laboratory (endothelin-1[ET1], vascular cellular adhesion molecule 1 [sVCAM-1] by ELISA) and echocardiographic data were collected at 24 h, 72 h and 7 days after admission. Flow-mediated vasodilation (FMD) of the brachial artery was measured using a high-frequency linear transducer (7.5–10 MHz) according to internationally accepted protocols.

**RESULTS.** We studied 45 patients (67% females; age = 51 ± 18 years) with an APACHE score of 23 ± 7 and intra-hospital mortality of 35% (16 deaths). Left ventricular dysfunction (LVD: LF ejection fraction less than 55%) was identified in 15(33%) patients while right ventricular dysfunction (RVD: peak systolic velocity of RV tissue Doppler imaging < 12 cm/seg) was present in 14(30%) patients. LogET1 was significantly increased in patients with LVD (2.3 ± 0.6 vs. 1.8 ± 0.4; $p = 0.01$) and RVD (2.5 ± 0.5 vs. 1.8 ± 0.4; $p < 0.001$). FMD and sVCAM-1 values were similar in patients with or without LVD and RVD. We observed a significant negative correlation between LogET1 and LV ejection fraction ($r = -0.50$; $p = 0.002$), peak systolic RV tissue Doppler imaging ($r = -0.67$;$p < 0.001$) and FMD ($r = -0.40$; $p = 0.02$).

**CONCLUSIONS.** Myocardial dystunction is a prevalent and early phenomenon in sepsis, being directly associated to markers of endothelial dysfunction.

**REFERENCE(S).** 1. Brauner JS, Rohde LE, Clausell N. Intensive Care Med 2000; 26:305–13

2. Cowley HC, Heney D, Gearing AJ, Hemingway I, Webster NR.Crit Care Med. 1994;22:651–7
3. Bouhemad B, Nicolas-Robin A, Arbelot C, Arthaud M, Féger F, Rouby JJ. Crit Care Med. 2009;37:441–7.

## 0630

### PROGNOSTIC VALUE OF THE RECOVERY SLOPE MEASURED BY NIRS DURING A VASCULAR OCCLUSION TEST IN SEPTIC SHOCK PATIENTS

C. Mayeur[1], J.M. Robert[1], J.F. Georger[1], C. Richard[1], J.L. Teboul[1]

[1]Hopital de Bicêtre, Medical Intensive Care Unit, Kremlin Bicêtre, France

**INTRODUCTION.** Septic shock is characterized by macro and microcirculatory derangements. The latter can be approached by the use of Near Infrared Spectroscopy (NIRS), which allows measuring the tissular oxygen saturation ($StO_2$). During a vascular occlusion test (VOT), the evolution of the $StO_2$ would reflect the reactive hyperemia. Recently, it has been shown that the $StO_2$ recovery slope may have a prognostic value in septic patients. However, this value may depend on the model of NIRS probe and the way to perform the VOT. The goal of our study was to confirm the prognostic value of the $StO_2$ recovery slope with the currently commercialised NIRS probe.

**METHODS.** We enrolled patients who have been admitted for septic shock since less than 24 h and once that they have been resuscitated (fluid, norepinephrine) with the goal to correct hypovolemia and to achieve a mean arterial pressure (MAP) > 65 mmHg. In each subject, we performed a VOT using the InSpectra $StO_2$ 650 monitor (Hutchinson, MN). A brachial pneumatic cuff was inflated to 220 mmHg once the $StO_2$ was stabilised. it. Brachial occlusion was maintained until $StO_2$ reached 40%; then the pneumatic cuff was rapidly deflated. NIRS data were calculated off-line by InSpectra Analysis Program V4.00.

**RESULTS.** We included 94 patients (63 ± 13 years). The SAPS 2 was 55 ± 17; MAP was 77 ± 8 mmHg and mortality was 40%. The tables present the data in the subgroup of patients who will survive compared to patients who will die.

GLOBAL CHARACTERISTICS OF THE 2 SUBGROUPS

| | Survivors (n = 56) | Non survivors (n = 38) | P |
|---|---|---|---|
| Age (year) | 65 ± 14 | 62 ± 13 | 0.2 |
| SOFA | 10 ± 3 | 13 ± 4 | 0.0003 |
| SAPS II | 53 ± 16 | 56 ± 17 | 0.3 |
| MAP (mmHg) | 79 ± 10 | 76 ± 13 | 0.13 |
| Lactate (mmol/L) | 2.4 ± 1.8 | 4.1 ± 3.1 | 0.007 |
| $ScvO_2$ (%) | 73 ± 9 | 77 ± 8 | 0.18 |
| Cardiac Index (L/min/m$^2$) | 3.3 ± 1.2 | 3.2 ± 1.0 | 0.99 |
| | Survivors (n = 56) | Non survivors (n = 38) | p |
| Baseline $StO_2$ (%) | 79 ± 8 | 79 ± 8 | 0.89 |
| Desaturation slope (%/min) | −9.8 ± 8.0 | −8.5 ± 3.5 | 0.59 |
| Duration of occlusion (min) | 6 ± 3 | 7 ± 3 | 0.35 |
| Recovery slope (%/s) | **2.9 ± 1.5** | **1.8 ± 1.1** | **0.0008** |
| Maximal $StO_2$ (%) | 89 ± 8 | 87 ± 7 | 0.35 |

Systemic haemodynamic variables after resuscitation did not differ between survivors and nonsurvivors. Among NIRS data, only the $StO_2$ recovery slope was different between these 2 populations.

**CONCLUSIONS.** Our study confirms that $StO_2$ recovery slope is the only NIRS parameter that has a prognostic value in patients with septic shock studied after the initial resuscitation.

## 0631

### MICROCIRCULATORY EFFECTS OF CHANGES IN ARTERIAL PRESSURE DURING SEPTIC SHOCK

A. Thooft[1], R. Favory[2], D.R. Salgado[2], J. Creteur[2], D. De Backer[2], J.-L. Vincent[2]

[1]Erasme University Hospital, Intensive Care Medicine, Brussels, Belgium, [2]Erasme University Hospital, Brussels, Belgium

**INTRODUCTION.** Septic shock is characterized by an impaired tissue perfusion associated with microcirculatory alterations. The evaluation of systemic hemodynamic variables can be insufficient to appreciate this, and the optimal level of arterial pressure is hard to define. Sidestream dark field (SDF—Microscan, Microvision Medical, Amsterdam, The Netherlands) can be used to evaluate the microcirculation state.

**OBJECTIVES.** The aim of this trial was to evaluate the effect of increasing mean arterial pressure by norepinephrine on the sub-lingual microcirculation using SDF.

**METHODS.** After Local Ethical Committee approval and informed consent, we studied 6 patients with septic shock for less than 48 h. All patients required a NE infusion for arterial hypotension resistant to fluid therapy, and were monitored with a pulmonary artery catheter. We measured hemodynamic variables, cardiac output, mixed venous oxygen saturation ($SvO_2$), and blood lactate concentration, together with the evaluation of the sub-lingual microcirculation with SDF (Microscan, Microvision Medical, Amsterdam, The Netherlands). Five sets of data were obtained: two at baseline with a MAP of 65 mmHg, once after increasing MAP to 75 and 85 mmHg by increasing the NE dose, and finally with MAP back to baseline. We obtained 20 s video clips of 5 different sites by a device with a × 5 objective lens. The data were analyzed blindly and randomly. We based our data analysis on previously established criteria of microcirculatory perfusion [1]. We separated the vessels in small and large with a cut-off for the diameter of 20 μm. We determined two perfusion indexes, the microvascular flow index (MFI) and the vessel density. We reported the data corresponding to the mean and SD of the first two baseline measures versus MAP 85 mmHg analyzed by repeated measures analysis of variance (at 5% level) with Bonferroni adjustment to account for multiple comparisons.

**RESULTS.** Cardiac output increased from 6.1 (5.4–6.8) to 6.7 (5.9–7.6) l/min ($p < 0.05$), without significant changes in heart rate. Systemic vascular resistance also increased. $SvO_2$ increased from 70.6 (67.9–73.2) to 75.9 (71.7–80.1)% ($p < 0.05$), so that oxygen consumption remained stable. Blood lactate concentrations decreased from 2.3 (1.5–3.1) to 2.1 (1.4–2.8) mEq/l ($p < 0.05$). The density of small vessels increased from 9.6 (8.8–10.4) to 11.1 (9.8–12.3) n/mm ($p < 0.05$). Small perfused vessel density also increased from 7.9 (7.2–8.3) to 9.8 (9.1–10.8) n/mm ($p < 0.05$). The microvascular flow index increased from 2.4 (2.1–2.7) to 2.9 (2.8–2.9) ($p < 0.05$).

**CONCLUSIONS.** In patients with septic shock, increasing MAP above 65 mmHg with NE can increase cardiac output, and improve the microcirculation as evaluated by SDF techniques.

**REFERENCE(S).**

1. De Backer D et al. How to evaluate the microcirculation: report of a round table conference. Critical Care. 2007;11:R101.

# Antimicrobial treatment: 0632–0645

## 0632

### A YEAR OF EXPERIENCE WITH TIGECICLIN FOR THE TREATMENT OF MULTIDRUG RESISTANT GERMS IN ICU

A.M. Poullet Brea[1], E. Curiel Balsera[1], E. Banderas Bravo[1], R. Olalla Sánchez[1], L. Chimali Cobano[1], G. Quesada García[1]

[1]Carlos Haya Regional Universitary Hospital, Intensive Care Unit, Málaga, Spain

**INTRODUCTION.** Tigecicline's use is limited in our country to the indications endorsed by the clinical studies. However in clinical practice, indication is enlarged for the treatment of MDR germs because of acquired resistance to common antibiotics.

**OBJECTIVES.** Analysis of indications and results of the treatment with tigecicline in an adult multidisciplinary ICU.

**METHODS.** Observational retrospective study of patients treated in ICU with tigecicline during 2009. Demographic, clinical data and prognosis are analyzed. Quantitative data are expressed as mean and standard deviation or median and interquartilic range for skewed data. Qualitative variables are expressed as percentages. Positive clinical outcome is defined as a partial or total improvement of signs and symptoms, negative when there isn't improvement or there's clinical deterioration, uncertain when there aren't enough data to allow us to know it. Microbiological response was considered positive if the organism couldn't be isolated in repeat samples during or after the course of tigecicline therapy (at least 5 days of treatment). It was considered negative when the microorganism persists 5 days after treatment initiation and not documented when we lack control cultures.Status at discharge from ICU was defined as alive, deceased with atributable death to the infection, deceased with non attributable death to the infection.

**RESULTS.** We included 44 patients treated more than 1 week with tigeciline. Mean age was 48.1 (SD 15.5) years and 81.8% was male. Medium APACHE was 22 (16–28). Admission in ICU was for medical reason in 43.2%, trauma in 29.5%, surgical in 27.3%. 82% didn't have important comorbidities. Most frequent localization of infection was respiratory tract 51.2% (27.3% VAP, 20.4% tracheobronquitis and 2.3% CAP). Other locations were skin and surgical wound 13.6%, intra-abdominal 13.6%, primary bacteraemia 9.1%, catheter related bacteraemia 4.5%.Clinical use were only according to approved indications in 27.9%. It was used in an empiric way in 9.3%. Most frecuent germs was: *Acinetobacter baumanii* 81.4%, *Klebsiella pneumoniae* 4.7%, *Enterococcus faecalis* 4.7%. Susceptibility to tigecicline was 84.1%. It was associated another antibiotic in 74.4%: intravenous colistin 25.6%, aerosolized colistin 32.6%, amikacin in 14%. Positive clinical outcome was observed in 67.4%, negative in 30.2%. Negative Microbiological response was 37.2%, positive in 34.9% and we lack data in 27.9%. In no cases of negative microbiological response, were observed appearance of tigecicline resistance. 61.4% of patients were discharged from ICU alive, 20.5% deceased attributed to the infection and 18.2% died for other causes.

**CONCLUSIONS.** Tigecicline is used frequently outside of indications approved at the moment, as treatment against MDR germs with few antibiotic options. Positive clinical outcomes has a high rate without appearance of resistances although it has been often used associated to another antibiotic.

## 0633

### ANTIBIOTIC RESISTANCE BETWEEN A SOUTH AFRICAN AND BRITISH INTENSIVE CARE UNIT. EDENDALE HOSPITAL, PIETERMARITZBURG, SOUTH AFRICA AND ROYAL BERKSHIRE HOSPITAL, READING, UK

B. Greatorex[1], I. Rechner[1]

[1]Royal Berkshire NHS Foundation Trust, Intensive Care, Reading, UK

**INTRODUCTION.** Invasive infections are common in intensive care units and mortality from severe sepsis in the critical care setting ranges from 28–50%. Inappropriate use of antibiotics can result in the development of antibiotic resistance among bactaraemic pathogens. It is also well known that resistance among pathogens is increasing internationally.

**OBJECTIVES.** Our objective was to establish if there was a difference between the bacteria cultured and the resistance patterns of these bacteria in a South African (SA) (700 admissions per year) and a British (UK) (650 admissions per year) ICU. We explored whether any differences could be explained in terms of antibiotic prescribing practices.

**METHODS.** A 6 month retrospective study was carried out in the SA unit from February to August 2008 and then in the UK ICU from February to August 2009. A record was made of all positive bacterial cultures in these periods including screening samples. The specturm of antibiotic resistance that existed for these positive cultures was recorded. The SA ICU did not have regular clinical microbiology input, with no definitive screening programme, but the UK had both of these.

**RESULTS.** There were 288 and 198 positive cultures in the SA and UK samples, respectively. The most prevelant organisms seen in the South African ICU were *Klebsiella pneumonia* (n = 34), *Escherichia coli* (n = 28), *Acinetobacter baumannii* (n = 22) and Klebsiella spp (n = 18). In the UK Coliforms (n = 39), mixed coagulase negative Staphylococcus (n = 32), coagulase negative Staphylococcus (n = 30) and Staphylococcus aureus (n = 17) were the most prevalent. The highest resistance was with ampicillin (85%) in both units and the lowest was with amikacin (8%) and colistin (12%). Ampicillin, amikacin, co-amoxiclav, cefuroxime, colistin and gentamicin showed the same level of resistance in both units. The resistance to the other antibiotics tested in both units was higher in the SA ICU. In the SA unit trimethoprim (77%), followed by cefpodoxime (62%) had the highest levels of resistance. Vancomycin resistance was 10 times higher in the SA ICU.

**CONCLUSIONS.** The vast majority of microorganisms cultured in the SA ICU were gram-negative, whilst the majority in the UK unit were gram-positive. In addition, it was noted that there was a higher amount of antibiotic resistance in SA. These differences might be explained by several factors including the amount of clinical microbiology input, the presence of screening, the duration of antibiotics given and the infection control methods used. Population demographics will influence these results too with a high prevalence of trauma and HIV patients in SA. The high rates of gram positive cultures in the UK ICU may be a consequence of the screening program that is in place. Areas of future research would be to look at the effect of the introduction of infection control measures and the input of a Microbiologist. These would be relatively cost neutral.

## 0634

### ANTIBIOTIC DIVERSITY MAY PREVENT RESISTANCE IN VENTILATOR ASSOCIATED PNEUMONIA CAUSED BY ESKAPE

A. Sandiumenge[1], T. Lisboa[2], F. Gomez[3], P. Hernandez[4], L. Canadell[5], J. Rello[6]

[1]Unversiy Hospital Joan XXIII, IISPV, Intensive Care Department, Tarragona, Spain, [2]Hospital do Clinicas, Intensive Care Department, Porto Alegre, Brazil, [3]University Hospita Joan XXIII, Microbiology Department, CIBERES, Tarragona, Spain, [4]Insitut Investigacion Sanitaria Pere Virgili (IISPV), Epidemiology Department, Tarragona, Spain, [5]Universi Hospital Joan XXIII, Pharmacy Department, Tarragona, Spain, [6]Vall d'Hebron University Hospital, Institut de Recerca Vall d'Hebron-UAB, CIBERES, Intensive Care Department, Barcelona, Spain

**OBJECTIVES.** To test in the clinical ground, what mathematical models have predicted in theoretical scenarios [1]: that antimicrobial diversity prevents from resistance.

**METHODS.** Four differentiated antimicrobial strategies were consecutively implemented in an ICU for the empirical treatment of ventilator-associated pneumonia (VAP) (Patient-specific: 10 months; Priorization: 12 months; Restriction: 12 months and Mixing 10 months). Periods were grouped into heterogeneous or homogeneous according to the degree of antimicrobial diversity attained with each antibiotic strategy as measured by the antimicrobial heterogeneity index (AHI) [2]. Incidence of VAP caused by ESKAPE pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella spp*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa and Enterobacter spp*) was compared among periods. Statistical significance level $p < 0.05$.

**RESULTS.** Treatment of VAP supposed a 72% of global antimicrobial usage. VAP empirical antimicrobial patterns were more heterogeneous during Patient-specific (0.80) and Mixing (0.84) periods than during Priorization (0.36) and Restriction (0.30) periods either individually or grouped as a Scheduling group (0.33). A total of 135 episodes of VAP were observed in 124 patients (12.9 VAP/1,000 MV days) with no significant differences among study periods. Incidence of ESKAPE resistant pathogens isolated in VAP episodes was significantly higher during Scheduling period than during Patient-specific (RR 2.62; 95% CI:1.05 to 6.04) and Mixing (RR 5.91; 95% CI:1.85 to 18.9) periods. This was mostly due to a significant increase of the percentage of Carbapenem resistant strains of Acinetobacter baumannii occurring during Scheduling period (15%) as compared with Patient-specific (2.4%) and Mixing (0%) $p < 0.05$. VAP due to ESKAPE pathogens had higher mortality than those caused by non-ESKAPE pathogens (RR 2.92; 95% CI: 1.11–7.66) although no statistical differences were noted among study periods.

**CONCLUSIONS.** Antimicrobial strategies promoting diversity prevent against resistance in VAP due to ESKAPE pathogens.

**REFERENCE(S).** 1. Bergstrom C, Lo M, Lipsitch M. Ecological theory suggests that antimicrobial cycling will not reduce antimicrobial resistance in hospitals. PNAS. 2004;36:13285–90.
2. Sandiumenge A, Diaz E, Rodriguez A et al. Impact of diversity of antibiotic use on development ofantimicrobial resistance. J.Antimicrob Chemother. 2006;57:1197–203.

## 0635

### NEBULIZED COLISTIN TREATMENT OF MULTI-RESISTANT ACINETOBACTER BAUMANNI PULMONARY INFECTION IN CRITICAL ILL PATIENTS

M.J. Pérez-Pedrero[1], M. Sánchez Casado[1], S. Rodriguez Villar[1]

[1]Hospital Virgen de la Salud, Intensive Care Unit, Toledo, Spain

**OBJECTIVE.** To analyse the treatment of pulmonary infection by multi-resistant acinetobacter baumannii (MAB) with nebulized colistin in comparison with intravenous administration or a combination of both.

**METHOD.** Retrospective study of patients admitted to this Intensive Care Unit on invasive mechanical ventilation and with positive MAB cultures of the airway. All received treatment with colistin (CL). Nosocomial pneumonia (NP) or Tracheobronchitis (TB) was determined according to routine criteria and colonization (CO) was determined in the case of a positive culture in the absence of infection criteria. 3 groups of patients were defined: treated with nebulized CL, treated with IV CL and treated with IV CL plus nebulized CL. Microbiological eradication and clinical recovery were evaluated according to routine criteria.

**RESULTS.** 83 patients were studied. 54 were treated, with the following diagnoses: 15 (27.8%) with NP, 16 (29.6%) with TB and 23 patients (42.6%) with CO. Nebulized CL was used in 36 patients (66.7%): 66.7% of which for CO, 33.3% in treatment for TB and in no case of NP. In 61.1% of the patients IV CL was used: 22.2% of which for CO, 38.9% for TB and 38.9% in NP. The combination of IV CL and nebulized CL was used in 15 patients (27.8%): 5 patients (33.3%) CO, 2 patients (13.3%) TB and 8 patients (53.3%) NP.

RESULTS OF SOME OF THE VARIABLES ANALYZED

| | IV colistin | Nebulized colistin | IV and nebulized colistin | |
|---|---|---|---|---|
| Age | 60.1 ± 17.4 | 55.5 ± 19.8 | 55.6 ± 14.8 | ENS |
| APACHE II* | 12.8 ± 5.7 | 11.2 ± 4.3 | 14.1 ± 5.7 | ENS |
| SOFA | 4.6 ± 2.0 | 3.7 ± 2.0 | 4.9 ± 2.4 | ENS |
| CPIS | 6.0 ± 1.9 | 3.5 ± 1.0 | 5.2 ± 2.5 | $p < 0.001$ |
| Days admitted to ICU | 45.5 ± 36.5 | 49.0 ± 40.2 | 45.3 ± 22.7 | ENS |
| Days admitted to hospital | 64.1 ± 63.0 | 70.9 ± 59.0 | 61.9 ± 35 | ENS |
| Nephrotoxicity | 2 (11.1%) | 1 (4.8%) | 1 (6.7%) | ENS |
| Bronchospasm | 0 | 0 | 0 | ENS |
| Mortality | 5 (27.8%) | 4 (19.0%) | 2 (20%) | ENS |

Microbiological eradication was achieved in 32 patients (59.3%), with the following distribution: 8 (47.1%) with IV CL, 15 (83.3%) with nebulized CL and 9 patients (69.2%) with a combination of IV CL and nebulized CL. Clinical recovery was achieved in 42 patients (77.8%): 12 (80.0%) with IV CL, 18 (94.7%) with nebulized CL and 12 (85.7%) with a combination of nebulized and IV CL. These differences were not significant.

In the group of patients with infection due to TB and NP (31 patients, 57.4%), microbiological eradication was achieved in 5 patients (100%) treated with nebulized CL and in 6 of the 9 patients (42.9%) treated with IV CL, the difference being significant ($p < 0.05$). Clinical recovery in this group was 100% (6 patients) treated with nebulized CL and 75% (9 of the 12 patients) in the IV CL group. This difference was not significant.

**CONCLUSIONS.** The study suggests that treatment with colistin in patients with pulmonary infection with multi-resistant acinetobacter baumannii could be more efficient if it were to be administrated solely nebulized or in combination with IV colistin rather than administered solely intravenously.

## 0636

### AN ANTIMICROBIAL STEWARDSHIP PROGRAM IMPROVES THE QUALITY OF ANTIMICROBIAL PRESCRIBING IN AN INTENSIVE CARE UNIT

C.M. Katsios[1], L. Burry[2], S. Howie[2], T. Khory[3], S. Lapinski[4], R. Wax[4], M. Christian[4], C. Bell[5], S. Mehta[4], T. Stewart[4], A. Morris[6]

[1]McMaster University, Department of Medicine, Hamilton, Canada, [2]Mount Sinai Hospital, Department of Pharmacy, Toronto, Canada, [3]Mount Sinai Hospital, Toronto, Canada, [4]Mount Sinai Hospital, University of Toronto, Department of Medicine, Toronto, Canada, [5]St. Michaels Hospital, University of Toronto, Department of Medicine, Toronto, Canada, [6]Mount Sinai Hospital, University of Toronto, Department of Medicine, Department. of Infectious Diseases, Toronto, Canada

**INTRODUCTION:** Antimicrobial stewardship programs (ASP) can improve antimicrobial use in an intensive care unit (ICU). Positive microbial cultures in ICU patients often prompt the initiation of antimicrobial therapy, regardless of the sampling site or the contamination potential. Discontinuing empiric therapy based on clinical criteria or negative cultures reduces hospital stay and impacts mortality in the ICU.

**OBJECTIVE.** We sought to determine if the introduction of an ASP altered decisions to treat sterile site cultures (SSC) versus non-sterile culture sites (non-SSC), and subsequently, if regimens were tailored following microbiologic results.

**METHODS.** We retrospectively analyzed patients admitted to our medical-surgical ICU during a period pre-ASP and post-ASP introduction (April–May 2008 and 2009, respectively). Parameters collected included demographic data, antimicrobial regimens, culture results, ICU chart documentation of antimicrobial therapy, mortality, antimicrobial costs and defined daily doses (DDD) per 100 patient days. Culture results were separated into SSC and non-SSC specified a priori. Regimens were analyzed using Chi Square tests. Documentation practices were analyzed for inclusion of treatment dates, de-escalation, and details on clinical decision-making.

**RESULTS.** There was no significant difference in age distribution, sex, APACHE II score, or types of ICU admissions between the pre-ASP ($n = 139$) and post-ASP groups ($n = 139$). 82.7% of pre-ASP patients versus 77.7% of post-ASP patients received antibiotics during their ICU stay. There were 215 positive cultures (42.3%) pre-ASP versus 179 positive cultures (40.2%) post-ASP. Post-ASP, there was a statistically significant trend to treat more SSC and less non-SSC. Pre-ASP 65 SSC and 88 non-SSC were treated ($\chi^2 = 0.005$, $p = 0.941$) versus 60 SSC and 58 non-SSC post-ASP ($\chi^2 = 25.47$, $p < 0.05$). The decision to treat positive non-SSC dropped significantly post-ASP ($\chi^2 = 4.026$, $p = 0.045$). A higher proportion of detailed antibiotic regimen documentation in the ICU chart was noted post-ASP (70.5 vs. 26.4%), with a 19% (72 vs. 53%) increase post-ASP in the number of regimens with documented stop dates, and a 8% (23 vs. 15%) increase in treatment de-escalation.There was a 3.0% decrease in overall ICU mortality post-ASP. There was a 35% reduction in antibiotic cost per ICU bed-day ($44.03 vs. $28.45), resulting in a reduction in total antibiotic costs of $14 898. Furthermore, there was a 9.2% reduction in mean antibacterial DDD/100 patient days (142.26 vs. 129.2).

**CONCLUSIONS.** The collaborative ASP team minimized unnecessary use, tailored spectrum of activity, decreased cost, and promoted better patient care practices. The ASP implementation was associated with a statistically significant reduction in treated non-SSC, an increase in treated SSC, and more transparent chart documentation practices. Appropriate and judicious antimicrobial use guided by an ASP is associated with significant benefit in ICU patients.

## 0637

### CRITICAL CARE ANTIMICROBIAL STEWARDSHIP AND POLICY PROMOTE APPROPRIATE CHANGES TO ANTIBIOTIC PRESCRIBING

T. Leary[1], R. Rajpurohit[2], H. Williams[2]

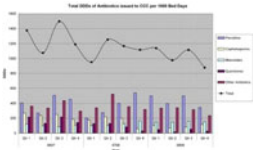
[1]Norfolk and Norwich University NHS Foundation Trust, Critical Care, Norwich, UK, [2]Norfolk and Norwich University NHS Foundation Trust, Microbiology, Norwich, UK

**INTRODUCTION.** As part of a Critical Care antimicrobial stewardship program, a new antibiotic policy was introduced in 2008. The policy focussed on the restriction of cephalosporin and quinolone use.

**OBJECTIVES.** To review antibiotic administration over the 18 months before and after policy introduction to establish adherence to policy. To review whether the recommendations in the policy and use of antibiotics were appropriate for the antibiotic sensitivity patterns in critical care.

**METHODS.** Defined daily doses (DDDs) for antibiotics were obtained for the period 2006 to 2009. For 2008, results from blood culture and respiratory isolates, with their antibiotic sensitivity pattern, were obtained from the microbiology department. Antibiotic sensitivities were compared with DDDs graphs to ensure that recommendations were appropriate.

**RESULTS.** Following the introduction of the policy in quarter 3 of 2008, there was a reduction in cephalosporin and quinolone prescription. There was an expected increase in penicillin prescription.



Antibiotic prescribing 2006–2009

There was an overall reduction in antibiotic use. According to the sensitivities of the common pathogens, these changes would appear to be appropriate.

BLOOD CULTURE AND RESPIRTORY ISOLATES: SENSITIVITY AND RESISTANCE

| Gram positive isolates | | Antibiotics | | | | | |
|---|---|---|---|---|---|---|---|
| | | Flucloxacillin | | Vancomycin | | Amoxicillin | |
| | | S | R | S | R | S | R |
| Blood culture (35) | Coagulase negative *Staphylococcus* (16) | 6 | 10 | 16 | | | |
| | *St. aureus* | 2 | 2 | 4 | | | |
| | Enterococcus sp.(2) | | | 2 | | 2 | |
| Respiatory (198) | St. aureus (27) | 25 | 1 | 27 | | | |
| | Streptococcus pneumoniae (8) | | | 8 | | 7 | 1 |
| | Other Streotococcus(3) | | | 3 | | 3 | |
| | Enterecoccus sp. (1) | | | 1 | | 1 | |

| Gram Negative isolates | | Antibiotics | | | | | |
|---|---|---|---|---|---|---|---|
| | | Co-amoxiclav | | Tazocin | | Gentamicin | |
| | | S | R | S | R | S | R |
| Blood culture (35) | *E.coli* (11) | 6 | 5 | 10 | 1 | 10 | 1 |
| | *Pseudomonas aeriginosa (1)* | | | 1 | | 1 | |
| | *Gram negative* | | | | | | |
| Respiratory (198) | *E.coli* (93) | 66 | 27 | 85 | 8 | 90 | 3 |
| | *Pseudomonas aeriginosa* (46) | | | 44 | 2 | 45 | 1 |
| | *Haemphilus influenzae* (15) | 15 | | | | | |

Isolates: sensitivity and resistance

**CONCLUSIONS.** Production of a local policy as part of an antimicrobial stewardship scheme has brought about an appropriate change in clinical practice.

**REFERENCE(S).** George P, Morris AM. Pro/Con debate: Should antimicrobial stewardship programs be adopted universally in the intensive care unit? Critical Care. 2010;14:205.

## 0638

### ORIGINAL IN-SILICO APPROACH IDENTIFIES NEW BROAD-SPECTRUM INFLUENZA A ANTIVIRALS

J. Textoris[1], L. Josset[2,3], B. Loriod[4], O. Ferraris[2], B. Lina[3], C. Nguyen[4], J.-J. Diaz[5], M. Rosa-Calatrava[2]

[1]Assistance Publique Hôpitaux de Marseille. Université de la Méditerranée, Service d'anesthésie et de réanimation, Marseille cedex 20, France, [2]Université Claude Bernard Lyon 1, VirPath CNRS FRE 3011, Lyon, France, [3]Hospices Civils de Lyon, laboratoire de Virologie, Centre de biologie et de pathologie est, Bron cedex, France, [4]Université de la Méditerranée, TAGC U928 INSERM, Marseille Cedex, France, [5]Université Claude Bernard Lyon 1, CGMC, CNRS UMR5534, Villeurbanne, France

**INTRODUCTION.** Classical antiviral therapy inhibits viral proteins and are subject to resistance. An alternative strategy which target cellular factors has been developed to counteract this resistance emergence. We hypothesized that such approach may identify broad spectrum antivirals. Influenza A virus was used as a model for viral diversity and need for therapy against unpredictable viruses as recently underlined by the H1N1 pandemic.

**OBJECTIVES.** We proposed to identify a gene-expression signature associated with infection with different influenza A virus subtypes which could help to identify potential antiviral drugs with broad spectrum.

**METHODS.** This experimental study was divided into three parts. First, cellular gene expression response to infection with five different human and avian influenza virus strains was analyzed using a cDNA nylon microarray (HuSG9 k—TAGC Marseille, France). Lung epithelial cell line A549 were infected with avian (H5N1, H5N2 and H7N1) or human (H3N2 and H1N1) strains. Thirty independent samples were analyzed (5 replicates for each condition). Supervised analysis was performed using Significance Analysis of Microarray (SAM) algorithm. In the second part, the identified transcriptional signature (TS) was compared to the Connectivity Map (CMAP) database, in order to identified potential antivirals drugs. Then, the antiviral activity of the identified drugs was tested on A549 infected cells using a neuraminidase assay.

**RESULTS.** Using SAM algorithm, 300 genes were determined as differentially expressed between infected and non-infected samples (FDR = 10%). Strikingly, only a few genes (n = 16) were induced by infection and related to immune response. Most of them (95%) were down-regulated. A concise list was used to screen CMAP, a database of drug-associated gene expression profiles, for molecules with inverse profiles than the signature of infection. We hypothesized that such compounds would induce an unfavorable cellular environment for influenza virus replication. Eight potential antivirals including a known antiviral were identified, and five inhibited influenza viral growth in vitro. The new pandemic H1N1 virus (SOI-V), which was not used to define the gene expression signature of infection, was inhibited by five of the eight identified molecules.

**CONCLUSIONS.** This is the first study showing that a gene expression based-screening can be used to identify antivirals. This original in-silico approach has a very high hit-rate (5/8) compared to classical high-throughput drug screenings. The efficacy of the selected drugs on the new H1N1 (SOI-V) strain highlight the ability of the approach to identify broad spectrum drugs. Such approaches could accelerate the drug discovery progress and could be extended to other pathogens.

## 0639

### APPROPRIATENESS OF EMPIRIC ANTIBIOTIC THERAPY AND EFFICACY OF DE-ESCALATION THERAPY IN A LEVEL: 111 MULTIDISCIPLINARY ICU

D. Vijayan[1], A. Warrier[1], S. Kumar[1], M. Thomas[1], J.S. Bina[1]

[1]KIMS, Critical Care, Trivandrum, India

**AIM.** To study the appropriateness of empiric antibiotic therapy as per Hospital Antibiotic Policy and to compare the mortality among the de-escalation group with the rest.

**METHODS.** Retrospective analysis of empiric antibiotic therapy, antibiotic sensitivity of subsequently isolated organism and the final outcome (mortality adjusted for illness severity score—SOFA and age) among 70 bacteremic patients admitted in our multi-disciplinary ICU during 1 year (2009).

**RESULTS.** The empiric therapy was appropriate in 90% (63/70) of the cases when chosen as per the hospital antibiotic policy. De-escalation was possible in 54% (38/70), in 35.7% (25/70) the initial antibiotic was continued and in only 10% (7/70) escalation was needed. The crude mortality among de-escalation group was only 26.3% compared to overall crude mortality of 34.3%. Severity and age adjusted mortality was comparable.

**CONCLUSIONS.** A local antibiogram guided hospital antibiotic policy ensures appropriate empiric therapy in 90% of the cases, thus improving the outcome. De-escalation as per the hospital policy is a safe option as demonstrated by severity adjusted mortality which is comparable.

## 0640

### ADVERSE EVENTS RELATED TO THE USE OF LINEZOLID: RESULTS OF THE MESLIN STUDY

A. Socias[1], R. Poyo-Guerrero[1], P. Luque[2], M.J. López Pueyo[3], R. Zaragoza[4], M. Nieto[5], B. Balsera[6], V. Gómez Tello[7], P. Ramírez[8], Á. Menvia[9], P. Ugarte[10], M. Borges[1], MESLIN Study Group

[1]Hospital Son Llàtzer, Palma de Mallorca, Spain, [2]Hospital Clínico Universitario Lozano Blesa, Zaragoza, Spain, [3]Hospital General Yagüe, Burgos, Spain, [4]Hospital Dr Peset, Valencia, Spain, [5]Hospital Clinico San Carlos, Madrid, Spain, [6]Hospital Arnau Vilanova, Lleida, Spain, [7]Clínica Moncloa, Madrid, Spain, [8]Hospital Universitari La Fe, Valencia, Spain, [9]Hospital Donostia, San Sebastián, Spain, [10]Hospital Marqués de Valdecilla, Santander, Spain

**INTRODUCTION.** The use of linezolid has been associated with the appearance of some adverse effects, but there is little information about its open label use in critically ill patients [1].

**OBJECTIVES.** To monitor the appearance of adverse events related to the use of linezolid in a real scenario.

**METHODS.** MESLIN is a multi-centric, retrospective, observational study conducted at 13 Spanish hospital from January 06 to April 09. Demographic data, severity, infection type, linezolid use and adverse effects were recorded. Statistics: Chi-square, Fisher test, Mann–Whitney test, Kruskal–Wallis test.

**RESULTS.** Four-hundred and eighteen patients were included, 294 (70.7%) were male. Mean age was 60.66 (16.16) years. Mean SOFA score was 7.18 (3.76). Mean APACHE II score was 19.97 (7.19). Mean duration of linezolid treatment was 9.66 (6.54) days. There were 16 (3.8%) patients with adverse events related to linezolid use, the most frequent was thrombopenia (11 (2.6%)), followed by anemia 3 (0.7%) and leukopenia (2 (0.5%). Treatment duration was not related to the appearance of adverse events (p 0.421). They were more frequent in patients with acute renal failure (RR 2.97 (1.05–8.39)) and liver failure (p 0.001) (Table 1). Patients with adverse events had higher crude mortality (p 0.049) but the attributable mortality was not changed (p 0.805).

**TABLE 1** LIVER FAILURE AND RISK OF ADVERSE EVENTS

| Child -Pugh | RR | 95% CI |
|---|---|---|
| A | 3.13 | 0.89–11.039 |
| B | 3.48 | 0.80–15.10 |
| C | 10.44 | 2.74–83.38 |

**CONCLUSIONS.** The rate of adverse events is low and their appearance is not related to treatment duration, probably because of treatments are short. The presence of adverse events was not related to outcome.

**REFERENCE(S).** 1. Metaxas EI, Falagas ME.Update on the safety of linezolid. Expert Opin Drug Saf. 2009;8(4):485–91.

**GRANT ACKNOWLEDGMENT.** Study partially financed by Pfizer.

## 0641

### LONG-TERM USE OF SELECTIVE DIGESTIVE DECONTAMINATION: IMPACT ON ANTIBIOTIC RESISTANCE ACQUISITION AND INFECTION RATES CAUSED BY MULTIRRESISTANT MICROORGANISMS

M.E. Ochoa-Ardila[1], A. García-Cañas[2], K. Mediavilla[2], A. González -Torralba[2], P. García-Hierro[2], I. Alía[2], M.Á. de la Cal[2]

[1]Fundación Valle del Lilli, Cali, Colombia, [2]Hospital Universitario de Getafe, Getafe, Spain

**INTRODUCTION.** SDD is a preventative measure that reduces mortality (20%), the incidence o ventilator associated pneumonia (65%) and Gram-negative bloodstream infections (60%) in ICU. Some authors claim against SDD use because concerns about its potential impact in antibiotic resistance acquisition.

**OBJECTIVES.** 1. To assess the impact of continuous long-term use of SDD on antibiotic resistance acquisition in ICU; 2. To evaluate the impact of this practice in the development of ventilator associated pneumonia (VAP) and bloodstream infection (BI) caused by ICU acquired MMO

**METHODS.** Type of study: Cohort prospective study: Setting : 18-bed medical/surgical ICU. Period of study: 5 consecutive years. Patients: All consecutive patients with expected mechanical ventilation $\geq$ 72 h. Interventions: 1. SDD (tobramycin, colistin, amphotericin in oropahryngeal paste and digestive solution, plus 4 days i.v. cefotaxime); oral and digestive vancomycin was added to patients coming from other hospitals or other wards. 2. Surveillance samples (oropharynx, rectum) were taken on admission and once a week. Diagnostic samples were taken according to clinical prescription. Definitions: A new case was considered a patient with MMO in surveillance or diagnostic samples who was not known as a previous carrier. ICU acquired MMO was considered when the first sample with MMO growth was obtained after a negative sample on admission. Statistical analysis: time-trend was estimated by Spearman coefficient. Frequency of sampling and incidences were reported per 1,000 patient-days.

**RESULTS.** 1,588 patients were included. The frequency of sampling was 1,1087. During the study period there was an increase in the consumption of ceztadime and imipenem. The prevalence of patients with multi-resistant MMO at ICU admission was 22%. The incidence of MMO acquired in ICU was kept stable, 18.91. The acquired resistance of Enterobacteriaceae was kept stable. There has been an increase of acquired P. aeruginosa resistant to ceftazidime (3.3–6.5)and imipenem (6.1–9.5). The incidence of non-fermenter Gram negative bacilli and MRSA acquisition was $<$ 3 The incidence of VAP and BI caused by acquired MMO was $\leq$ 1.

**CONCLUSIONS.** Long term use of SDD is not associated to an increase in acquired resistance carriage. The incidence of severe infections caused by ICU acquired MMO is very low in patients treated with SDD.

**GRANT ACKNOWLEDGMENT.** CIBERES.

## 0642

### PREDICTOR FACTORS OF INADEQUATE CONCENTRATIONS OF CONTINUOUS INFUSION OF VANCOMYCIN IN SEPTIC PATIENTS

F.S. Taccone[1], E. Ocampos-Martinez[1], L. Penaccini[1], A. Abdelhadii[1], F. Jacobs[1], J.-L. Vincent[1]

[1]Erasme University Hospital, Brussels, Belgium

**INTRODUCTION.** Continuous infusion (CI) of vancomycin is frequently used in critically ill patients to treat severe infections caused by Gram-positive bacteria. However, sepsis can alter drug pharmacokinetics (PKs), resulting in insufficient drug concentrations. Inadequate antimicrobial concentrations, especially during the first days of treatment, may have potential deleterious effects on morbidity and mortality of septic patients. Recent recommendations suggest a loading dose of 15 mg/kg followed by a CI of 30 mg/kg of vancomycin, but data on the efficacy of this strategy in sepsis are scarce.

**OBJECTIVES.** The aim of this study was to identify the predictor factors of inadequate vancomycin concentrations in septic patients.

**METHODS.** Retrospective analysis of all patients admitted in the ICU from January 2008 to December 2009 in whom a vancomycin was given as a CI. Patients were included if they (a) were $> 18$ years old, (b) had sepsis according to standard criteria, (c) received at least 28 mg/kg daily for the first 48 h. Demographics, microbiological and treatment data were collected. Creatinine clearance (CrCl) was calculated from 24-h urine collection and normalized to body surface area (BSA). Concentrations below 20 mcg/mL were considered as inadequate. Multivariate logistic regression analysis was performed using all variables showing a significant association ($p < 0.2$) with inadequate vancomycin concentrations at day 1 or day 2 of therapy in univariate analysis.

**RESULTS.** During the study period, 114 patients met the inclusion criteria. 57 (50%) and 40 (35%) patients had inadequate vancomycin concentrations at day 1 and 2 of therapy, respectively. Univariate analysis showed that male sex ($p = 0.13$), vasopressor therapy ($p = 0.08$), high body weight ($p = 0.13$), low loading vancomycin dose ($p = 0.12$) and daily vancomycin dose ($p = 0.1$), high CrCl ($p < 0.001$) were associated with inadequate vancomycin concentrations at day 1 of therapy; male sex ($p = 0.01$), vasopressor therapy ($p = 0.16$), inadequate concentrations at day 1 ($p < 0.001$), SOFA score at day 2 ($p = 0.31$), low daily vancomycin dose ($p = 0.09$) and high CrCl ($p < 0.001$) were associated with inadequate vancomycin concentrations at day 2 of therapy. Multivariate regression analysis showed that high CrCl was the only variable that indipendently predicted inadequate vancomycin concentrations at day 1 and 2 of therapy. Hence, CrCl $> 120$ ml/min $m^2$ had a sensitivity of 91%, a specificity of 40%, a positive predictive value of 82% and a negative predictive value of 60% for inadequate vancomycin concentrations at day 1. Receiver operating characteristic curve analysis for CrCl showed an area under the curve of 0.76 (95% CI: 0.67–0.85).

**CONCLUSIONS.** In ICU septic patients treated with a CI of vancomycin, drug concentrations were found insufficient in nearly half of cases, even when standard recommended regimen was applied. CrCl was the strongest variable to predict inadequate drug concentrations.

## 0643

### ANTIBIOTIC PRESCRIBING IN A MIXED GENERAL INTENSIVE CARE UNIT: A SEVEN YEAR AUDIT OF PRACTICE

S.J. Austin[1]

[1]Mater Hospital, Belfast Trust, Critical Care, Belfast, UK

**INTRODUCTION.** Timing of antibiotic therapy is crucial to treatment success. However duration of antibiotic therapy is also important with shorter treatment regimens increasing the likelihood of treatment failure and longer regimens increasing drug costs in the intensive care unit. Therefore it is important to investigate the length of antibiotic prescriptions in everyday practice in a busy intensive care unit outside strict study protocols.

**OBJECTIVES.** To assess antibiotic prescription in everyday medical practice in a mixed general intensive care unit in the UK.

**METHODS.** A Microsoft Access database was created in September 2002 for computerised drug chart creation in a six bedded general intensive care unit. All drug prescriptions from September 2002 until April 2010 were stored for audit purposes in the database. Data from 2002 and 2010 were excluded as these years did not include data from full calendar years. Duration of antibiotic treatment was calculated from the start and finish dates of the drug prescriptions and rounded up to a whole number of days of treatment. Data were analysed by antibiotic class and duration of therapy.

**RESULTS.** A total of 3818 antibiotic prescriptions were made during the period 2003–2009. The duration of antibiotic prescription ranged from 1 day to a maximum of 48 days with an mean duration of antibiotic administration of 4.3 days (mode 2 days). Of note, just over half (52.5%) of all antibiotic prescriptions were for a duration of less than 3 days, 73% for 5 days and 86.4% for up to 7 days. The most commonly prescribed antibiotics were beta-lactam antibiotics (25%), cephalosporins (19.2%), nitroimidazoles (17.8%—metronidazole), aminoglycosides (7.3%), macrolides (5.9%—clarithromycin). Second line antibiotics were more rarely prescribed : antistaphylococcal agents (5.8%—mainly teicoplanin and vancomycin) and carbapenems (4.7%—mainly meropenem). Antifungal agents (5.4%) and antiviral agents (1.9%) were not commonly prescribed. Antibiotic prescribing policy was changed in our unit in 2007 to restrict the use of cephalosporins and quinolone antibiotics in an attempt to reduce the incidence of Clostridium difficile. This can be seen in our study in that cephalosporins were commonly prescribed prior to 2007 with 20–30% of prescriptions being cephalosporins. After 2007, incidence of cephalosporin prescription dropped below 10% being only 3% of prescriptions in 2009.

**CONCLUSIONS.** Administration of antibiotics for the correct duration of prescription is vital for both therapeutic success and cost effectiveness. In this study,73–86% of antibiotics were prescribing for 5–7 days which is the commonly believed duration of antibiotic therapy required for effective treatment.

## 0644

### RAPID ASSESSMENT OF ANTIBIOTIC SUSCEPTIBILITY IN POSITIVE BLOOD CULTURE

C. Olivieri[1], R. Vaschetto[1], V. Kroumova[2], E. Gobbato[2], S. Guido[1], F. Della Corte[1], P. Navalesi[1], G. Fortina[2]

[1]Università del Piemonte Orientale 'Amedeo Avogadro' Alessandria-Novara-Vercelli, Department of Anesthesia and Intensive Care, Novara, Italy, [2]Azienda Ospedaliera 'Maggiore della Carità', Clinical Microbiology and Virology, Novara, Italy

**INTRODUCTION.** Sepsis is a leading cause of admittance and mortality in Intensive Care Unit. Failure to administer an appropriate therapy for the pathogen responsible of the infection is associated with increased morbidity and mortality. Initial empirical broad spectrum approach can be modified after assessment of antibiotic susceptibility or identification of the causative agent. Early assessment of antibiotic susceptibility, leading to administration of the correct antimicrobial agents, can reduce morbidity and mortality and can also lower toxicity, costs and microbial resistance related to inappropriate maintenance of broad spectrum therapy.

To assess antibiotic susceptibility, positive blood cultures (BC) are currently treated in solid medium for 16–24 h.

The HB&L® system, an automated instrument formerly used for urine screening, allows antibiotic susceptibility identification in 6 h, giving results 1 day in advance compared to standard disk-diffusion methods.

**OBJECTIVES.** The aim of this study is to compare the results on antibiotic susceptibilities of BC in septic patients admitted in high dependency and intensive care units using the HB&L system, the standard method used in the clinical microbiology laboratory of the institution (VITEK-2®) and a gold standard technique (Etest®).

**METHODS.** The study was performed from April 1st, 2009 to December31st, 2009 at the "Maggiore della Carità" Hospital in Novara, Italy. A total of 167 positive BC specimens were included, 91 Gram-positive and 66 Gram-negative. Antimicrobial susceptibility of each sample was tested with the HB&L system (Alifax, Padova, Italy), the VITEK-2 system (BioMerièux, Marcy l'Etoile, France) and the Etest (BioMerièux, Marcy l'Etoile, France). Antimicrobial susceptibility was tested on growth-positive samples for Vancomycin, Teicoplanin and Cefoxitin on Gram-positive bacteria specimens and for Piperacyllin/Tazobactam, Levofloxacin and Amikacin on Gram-negative bacteria specimens. Results of HB&L and VITEK-2 systems were compared to the gold standard Etest. HB&L system, based on a light-scattering technique, detects microbial growth in fluid samples and provides real-time growth curves and bacterial counts (cfu/ml). Results are obtained in 180–240 min after sample preparation. VITEK®2 system and Etest® need the inoculum of positive blood culture sample in solid media plates with agar and overnight incubation before test reading.

**RESULTS.** For Gram-positive bacteria the concordance between HB&L and Etest was 87.9% and between VITEK-2 and Etest was 80.2%. For Gram-negative bacteria the concordance between HB&L and Etest was 83.3% and between VITEK-2 and Etest was 80.4%.

**CONCLUSIONS.** The HB&L system demonstrates a very good concordance with standard laboratory methods in the assessment of antimicrobial susceptibility in positive BC, giving results 1 day in advance as opposed to standard methods.

## 0645

### NEPHROTOXICITY DURING CONTINUOUS INFUSION OF VANCOMYCIN IN SEPTIC PATIENT

S. Cianferroni[1], A. Devigili[1], J.-M. Hougardy[1], L. Penaccini[1], E. Ocampos-Martinez[1], A. Abdelhadii[1], F. Jacobs[1], J.-L. Vincent[1], F.S. Taccone[1]

[1]Erasme University Hospital, Brussels, Belgium

**INTRODUCTION.** Clinical studies suggested that high dose and concentrations of vancomycin are associated with nephrotoxicity in hospitalized patients. However, patients with high severity and septic shock were excluded from these analyses. Also, in these patients, vancomycin is often given as continuous infusion (CI).

**OBJECTIVES.** The aim of this study was to evaluate the incidence of nephrotoxicity among ICU septic patients requiring CI of vancomycin and to identify the risk factors of development of renal dysfunction in this population.

**METHODS.** Retrospective analysis of all patients admitted in the ICU from January 2008 to December 2009 in whom a vancomycin was given as a CI. Patients were included if they (a) were $> 18$ years old, (b) had sepsis according to standard criteria, (c) were treated for more than 48 h, (d) were not on continuous renal replacement therapy (CRRT). Demographics, comorbid conditions and treatment data were collected. Vancomycin loading dose, mean daily and total dose, as well as vancomycin concentrations at day 1, mean concentrations of the first 3 days of therapy and the highest concentration observed during the therapy were also recorded. Nephrotoxicity was defined as an increase in serum creatinine of $\geq 0.3$ mg/dL compared to baseline levels during therapy and within 72 h from vancomycin discontinuation. Concomitant renal toxics were also recorded. Creatinine clearance (CrCl) was calculated from 24-h urine collection and normalized to body surface area (BSA) for day 1 of therapy. Multivariate logistic regression analysis was performed using all variables showing a significant association ($p < 0.2$) with nephrotoxicity during therapy in univariate analysis.

**RESULTS.** During the study period, 207 patients met the inclusion criteria. 49 (24%) patients developed nephrotoxicity during vancomycin therapy. Patients developing nephrotoxicity were more frequently exposed to other concomitant nephrotoxics ($p = 0.001$), had higher APACHE II and SOFA score at admission ($p = 0.02$ and $p = 0.03$, respectively), longer duration of therapy ($p = 0.09$), higher concentrations of vancomycin at day 1 and during the first 3 days of therapy ($p = 0.007$ and $p < 0.001$, respectively) and lower CrCl at admission ($p = 0.002$). However, the mean vancomycin concentration during the first 3 days of therapy ($p < 0.001$, 95% CI $= 1.045$–$1.153$) and the duration of therapy ($p = 0.043$, 95% CI $= 1.003$–$1.233$) were the only variables associated with nephrotoxicity in the multivariate logistic regression analysis.

**CONCLUSIONS.** In ICU septic patients treated with a CI of vancomycin, nephrotoxicity was found in almost 25% of cases. Vancomycin concentrations and duration of therapy were the strongest variables to predict nephrotoxicity during therapy.

# Perioperative infections: 0646–0655

## 0646

### USE OF TOPICAL NEGATIVE PRESSURE WITH A VAC© ABDOMINAL DRESSING SYSTEM IN CRITICALLY ILL PATIENTS WITH PERITONITIS IS ASSOCIATED WITH IMPROVED OUTCOMES

L.A. Hogg[1], G.D. Simpson[2], A.I. Amin[3]

[1]NHS Lothian, Department of Anaesthesia, Livingston, UK, [2]NHS Fife, Department of Intensive Care, Dunfermline, UK, [3]NHS Fife, Department of Surgery, Dunfermline, UK

**INTRODUCTION.** Peritonitis is a common cause of critical illness requiring admission to the intensive care unit (ICU) and is associated with high mortality [1, 2]. Multiple laparotomies are frequently required during treatment [3].
**OBJECTIVES.** To determine whether use of topical negative pressure (TNP) with a VACADS, facilitating a second look laparotomy, was associated with a reduction in mortality.
**METHODS.** Patients admitted to ICU with peritonitis between 1/1/02 to 31/12/09 were identified using the Scottish national database of ICU admissions (Ward Watcher). A locally held surgical database was then used to identify a subgroup of patients where the abdomen was left open for a 'second look' laparotomy. The decision to leave the abdomen open was made independently by the surgeon at the time of surgery. Patients with peritonitis secondary to biliary sepsis or appendicitis were excluded. Patient demographics including age, sex, APACHE II score, unit stay, ventilator days and hospital stay were collated. The patients were divided into those who had received TNP and those who had not. Standardised mortality ratios (SMR) were calculated for both groups and hospital mortality outcomes were compared
**RESULTS.** 244 patients were admitted to the ICU with peritonitis during the study period. 11 with biliary sepsis and 12 with appendicitis were excluded. 26 patients were treated with a VACADS (TNP group). Of this group 13 had a perforated viscus, 9 anastamotic leaks, 2 iatrogenic bowel injury and 2 had pelvic sepsis. (33% female, mean age 62.46 years, mean APACHE II score 17.27). 195 patients had standard treatment without TNP (non TNP group). Of this group 144 had a perforated viscus, 22 anastamotic leaks, 20 iatrogenic bowel injury and 9 had pelvic sepsis. (57.9% female, mean age 67.41 years, mean APACHE II score 17.93). The unit mortality rate in the TNP group was 3.8% compared with 15.9% in the non TNP group. The SMR was 0.41 in the TNP group compared with 0.66 in the non TNP group. The TNP group had more ventilated days (mean 8.96 vs. 4.46) and longer hospital stays (mean 11.3 vs. 5.84) but a shorter ICU to discharge time (mean 23.8 vs. 28.16). The hospital mortality in the TNP group was 15.4% compared with 27.2% in the non TNP group.
**CONCLUSIONS.** The use of TNP with a VACADS in critically ill patients with peritonitis could be associated with improved outcomes. There was a risk reduction in the TNP group but this was not statistically significant. Ongoing data collection should be continued and this trend would have to persist in order to show significance.
**REFERENCE(S).** 1. Adkins AL et al. Open Abdomen Management of Intra abdominal Sepsis. Am Surg. 2004;70(2):137–40.

2. Marshall JC, Innes M. Intensive care unit management of intra-abdominal infection. Crit Care Med. 2003;31(8):2228–37.

3. Buijk SE, Bruining. Future directions in the management of tertiary peritonitis. Intensive Care Med. 2002;28:1024–9.

## 0647

### INTRA-ABDOMINAL INFECTION DUE TO ANASTOMOTIC LEAKAGE: COMPARATIVE OUTCOME OF PATIENTS TREATED WITH VAC SYSTEM AND SIMPLE RELAPAROTOMY

C. Lopez[1], C. Alonso[2], L. Pérez[2], A. Rodriguez[2], L. Mouriz[2], A. Pastor[3]

[1]Complexo Hospitalario de Ourense, Anaesthesiology and Reanimation, Ourense, Spain, [2]Complexo Hospitalario de Ourense, Ourense, Spain, [3]Complexo Hospitalario de Ourense, Neurosurgery, Ourense, Spain

**INTRODUCTION.** The rate of post surgical infections following abdominal surgery have increased in critical care patients due to long lasting and aggressive surgery in patients with high morbidity.Early diagnosis of such infections and the use of perioperative antibiotic prophylactix are considered essentials to improve the outcome of these patients. Surgical techniques are continuously improving and,at present, he use of vacuum-assisted closure (VAC®) are the devices of choice used in our centre in the management of complicated post surgical abdominal surgery.
**OBJECTIVES.** The aim of the present study is to evaluate the medical conditions of patients diagnosed of peritonitis due to anastomotic dehiscence and their outcome,depending on the use of the surgical techniques applied.
**METHODS.** We carried out a retrospective study from January 2009 up to September 2009 going through the medical notes of patients admitted to our critical care unit with the diagnosis of intra-abdominal infection or peritonitis(36 patients).We selected the cases due to anastomotic leakage (14 patients) 0.14 of the 15 medical notes were reviewed.The variables were:age,APACHEII,Candida Score,lactate,procalcitonine,gener,number of surgeries,haemodynamic,respiratory or renal failure,leukocytosis/leukopenia,lenght of staying and clinical outcome.We divided the patients in two groups:those who were treated with a relaparotomy to treat the cause of the intra-abdominal infection and in the other group we included the patients treated by laparostomy and VAC devices.
**RESULTS.** The cause of peritonitis was anastomotic dehiscense in 41.67% of the patients.All of them underwent relaparotomy,and in 5 cases (35.71%),VAC devices were applied following relaparotomy during an average of 5 days.The results are observed in Tables 1, 2, and 3.

**TABLE 1** ANALITICAL AND CLINICAL DATA AT ENTRY

| | VAC Treatment | Relaparotomy | p* |
|---|---|---|---|
| Renal failure | 60% | 33.3% | >0.05 |
| Respiratory failure | 100% | 88.9% | >0.05 |
| Coagulation failure | 40% | 44.4% | >0.05 |
| Leukocytosis > 12,000 | 60% | 88.89% | >0.05 |
| Leukopenia < 4,000 | 20% | 11.11% | >0.05 |
| Lactate | 1.82 ± 0.66 | 2.14 ± 1.54 | >0.05 |
| Procalcitonin | 5.92 ± 8.14 | 1.4 ± 1.81 | >0.05 |
| Fiebre > 38° | 40% | 55.56% | >0.05 |
| Hipotermia < 36° | 40% | 22.22% | >0.05 |

**TABLE 2** DEMOGRAPHIC AND EPIDEMIOLOGIC DATA

| | VAC treatment | Relaparotomy | p* |
|---|---|---|---|
| Age | 68.20 ± 11.58 | 74.44 ± 13.15 | >0.05 |
| Male, Female | 40%, 60% | 44.4%, 55.6% | >0.05 |
| APACHE II | 12 ± 3.81 | 17 ± 4.97 | >0.05 |
| Candida Score | 3.2 ± 1.30 | 2.44 ± 1.13 | >0.05 |
| Number of surgeries | 4 ± 2.34 | 1.44 ± 1.04 | >0.05 |
| Lenght of staying | 22.4 ± 11.96 | 16 ± 15.07 | >0.05 |
| Clinical outcome, Discharged Exitus | 80%, 20% | 77.8%, 22.2% | >0.05 |

**TABLE 3** INITIAL SURGERY

| | VAC treatment(%) | Relaparotomy (%) |
|---|---|---|
| Colonic surgery | 80 | 44.44 |
| Stomachal surgery | 20 | 11.11 |
| Intestinal obstruction | | 11.11 |
| Abdomino-peritoneal amputation | | 11.11 |
| Hernia Littré | | 11.11 |
| Anterior rectal resection | | 11.11 |

**CONCLUSIONS.** Bacterial peritonitis due to anastomotic leackage has been the most frequent cause of peritonitis in our critical care unit during this period.The use of VAC devices to treat such infections is a good alternative treatment although we cannot prove, in the present study,that those devices are a better option due to the small sample of our study.

**REFERENCE(S).** 1. Guirao X, Arias J, Badía JM et al.Recomendaciones en el tratamiento antibiótico empírico de la infección intraabdominal.Documento de consenso.Rev Esp Quimioter. 2009;22(3):151–72.

2. Muñoz Calero A, Landa García JI.VAC Therapy: Aplicación en Cirugía General.Documento de consenso Asociación Española de Cirujanos/KCI Clínic Spain. Reunión abril 2007.

3. Solomkin J, Mazuski JE, Bradley J et al. Diagnosis and management of complicated intra-abdominal infection in adults and children:guidelines by the Surgical Infection Society and the Infectious Diseases Society of America.CID 2010;50:133–64.

**GRANT ACKNOWLEDGMENT.** Drs. M. Cid and L. Mouriz for their support.

## 0648

### EFFECTIVENESS OF THE PERIOPERATIVE PREVENTIVE ANTIBACTERIAL THERAPY IN NEUROSURGICAL PATIENTS

A. Kondratiev[1], L. Gegraeva[2], R. Nazarov[3]

[1]Russian Neurosurgical Institute of Prof. A. L. Polenov, Anaesthesiology and Intensive Care Unit, St. Petersburg, Russian Federation, [2]Russian Neurosurgical Institute of Prof. A. L. Polenov, St. Petersburg, Russian Federation, [3]Russian Neurosurgical Institute, S-Petersburg, Russian Federation

**INTRODUCTION.** The frequency of infectious complications after neurosurgical operations according to different data is about 1–11%.

**OBJECTIVES.** Among the development risk factors of infectious complications the most significant are duration of operation, extensiveness of surgical trauma and perioperative hemorrhage. Introduction of microsurgical techniques in the operations on intracranial tumors and brain vessels on the one hand reduced surgical trauma and intraoperative hemorrhage, but at the same time increased the duration of neurosurgical operation. The study of publications about the efficiency of perioperative preventive antibiotics showed, that there were different opinions about its benefits.

**METHODS.** We have analyzed the case histories of 3805 neurosurgical patients, who had undergone the operation in our hospital in 1998–2004 years. In 3,038 cases there were preventive intraoperative antibiotics by using of cephalosporins of the third generation, and in 767 cases there were no preventive treatment. In our research we estimated the quantity of local (meningitis, ventriculitis, wound suppuration) and systemic (postoperative pneumonia, sepsis) infectious complications.

**RESULTS.** In the group of patients with preventive antibacterial treatment we observed infectious complications in 1.77% cases which was less then in group without preventive antibiotics where infectious complications occurred in 4.69% cases. The difference was statistically authentic ($p < 0.05$). Thus, it is a certain fact, that preventive antibiotics decrease the number of suppurative and inflammatory complications in patients, undergoing neurosurgical operations for about 2, 92%. The most effective antibiotics are cephalosporins of the third and the fourth generations and fthorhynolones.

**CONCLUSIONS.** In our hospital preventive antibacterial treatment resulted in decreasing of the quantity of infectious complications, lethality and reduced the duration of hospitalization.

## 0649

### INVASIVE DEVICES-RELATED INFECTIONS AFTER CARDIAC SURGERY

F. Alvarez Lerma[1], M. Carrasco[2], J.J. Otal[3], A. Martinez-Pellus[4], A. Arenzana[5], L. Iglesias[6], J.C. Ballesteros[7], ENFERMEDADES INFECCIOSAS (SEMICYUC)

[1]Hospital del Mar, ICU, Barcelona, Spain, [2]Hospital Vall d'Hebron, Unidad Postoperatoria Cirugía Cardica, Barcelona, Spain, [3]Hospital Vall d'Hebron, Servicio de Medicina Preventiva y Epidemiología, Barcelona, Spain, [4]Hospital de Arrixaca, Murcia, Spain, [5]Hospital Virgen de la Macarena, Servicio de Medicina Intensiva, Sevilla, Spain, [6]Hospital Central de Asturias, Servicio de Medicina Intensiva, Oviedo, Spain, [7]Hospital Clínico, Servicio de Medicina Intensiva, Salamanca, Spain

**OBJECTIVE.** To analyze the rates, types of infection and etiology of invasive devices-related infections that occurred during the patients' stay in the intensive care unit (ICU) in cardiac surgery patients as compared with the remaining surgical patients.

**MATERIAL AND METHODS.** Observational, prospective and multicenter study in which patients participated voluntarily. Patients included in the ENVIN-HELICS registry between 2005 and 2008 (both years included) were assessed, and the subgroups of cardiac surgery patients and the remaining surgical patients were selected. Mechanical ventilation-related pneumonia (MVP), urinary catheter-related infection (UC-I), primary bacteremia (PB), and PB related to vascular catheters (PB-VC) were assessed. Frequencies are expressed as incidence density.

**RESULTS.** A total of 46,930 patients were included in the study. There were 4,348 (9.3%) patients in the cardiac surgery group and 10,012 (21.3%) in the general surgical group. Infections occurred in 206 (4.7%) cardiac surgery patients and in 355 (6.3%) general surgical patients ($p = 0.0013$). Incidence density by type of infection were lower among cardiac surgery patients (MVP: 12.5 vs. 13.5 episodes per 1,000 days of mechanical ventilation, $p = 0.467$; UC-I: 2.9 vs. 4.4 episodes per 1,000 days of urinary catheter inserted, $p = 0.0033$; and PB-VC: 3.5 vs. 4.6 episodes per 1,000 days of vascular catheter inserted, $p = 0.0418$). Differences in the etiology of infections were not found. The mortality rate in cardiac surgery patients with one or more infections was 24.4% as compared with 2.8% in non-infected patients ($p < 0.001$). ICU stay increased from 4.7 to 21.4 days ($p < 0.001$).

**CONCLUSIONS.** Cardiac surgery patients accounted for 9.3% of patients admitted to the ICU for more the 24 h. In this group, invasive devices-related infections were lower than in the remaining surgical patients. Mortality and ICU length of stay in cardiac surgery patients with one or more infections increased significantly. Prevention of such infections should be a priority objective in ICUs taking care for cardiac surgery patients.

## 0650

### USE OF A SELECTIVE DECONTAMINATION OF THE DIGESTIVE TRACT (SDD) PROTOCOL IN A POLYVALENT INTENSIVE CARE UNIT (ICU): PROSPECTIVE OBSERVATIONAL STUDY

A. Abella-Álvarez[1], T. Mozo-Martín[1], I. Torrejón-Pérez[1], C. Hermosa-Gelbard[1], V. Enciso-Calderón[1], E. Calvo-Herranz[1], I. Salinas-Gabiña[1], M.A. Campos-Fernández de Sevilla[2], E. Aznar-Cano[3], M.A. García-Ureña[4], F. Gordo-Vidal[1]

[1]Hospital del Henares, Intensive Care Unit, Madrid, Spain, [2]Hospital del Henares, Pharmacy, Madrid, Spain, [3]Laboratorio Brsalud, Microbiology, Madrid, Spain, [4]Horpital del Henares, Surgery, Madrid, Spain

**OBJECTIVE:** To describe the incidence of nosocomial infection and outcome, in a polyvalent ICU of recent opening, with de use of a SDD protocol associated to a conventional prevention measures of infection control.

**SETTING:** Polyvalent ICU with 8 beds, 478 patients treated in 2009. 1 year study period from January to December 2009.

**METHOD.** Prospective cohort study. The SDD protocol was administrated to all patients with an estimated mechanical ventilation needed for more than 48 h, and to nonintubated patients with risk factors (Glasgow Coma Score $\leq$ 11; severe acute Pancreatitis or Neutropenic patients). It was used a combination of Cefotaxime iv (4 days) with oropharyngeal and digestive Polimixin solution, Tobramycin and Nystatin. We analyze the ICU and hospital outcome and the infections associated with devices in ICU and nosocomial infections to ICU's discharge. The information is described as average (range) or as percentages.

**RESULTS.** 81 patients were included in SDD protocol during the study period: women 38%, age 61 (26–89), SAPS III 61.6 (36–100), predicted survival 61%, survival to UCI 84%, survival hospital 79%, time of SDD employment 10 days (1–49). The reason for using SDD were: in 91.4% of the patients mechanical ventilation, tracheostomy 4.9%, pancreatitis 2.5% and neutropenic 1.2%. The infections associated to ICU devices in all the patients were: Pneumonia associated to mechanical ventilation (0 for 1,000 mechanical ventilation days); Bacteriemia associated to catheter or primary (1.45 for 1,000 days of venous central catheter) and urinary infection (2.09 for 1,000 days of urinary catheter). From the group of patients who received DDS and were trasladated to conventional guard, just 7 were diagnosed with nosocomial infection, 2 of them suffered non condensative respiratory infection, 1 was diagnosed with pneumonia, 1 was diagnosed with surgical injury infection and 3 were diagnosed with urinary tract infections. The time from the discharge of the UCI to the appearance of nosocomial infections was 11 days (3–19).

**CONCLUSIONS.** This population had a higher survival probability than the predicted by the SAPS III score. The rate of infection associated with devices in ICU is better than the published standards (ENVIN-ICU), emphasizing a 0 incidence density of pneumonia associated with mechanical ventilation. We have not seen an increased risk of hospital infection after SDD employment.

## 0651

### PREOPERATIVE STATINS AND COMPLICATIONS FOLLOWING CARDIAC SURGERY

M.N. Parias Ángel[1], P. Font Ugalde[2], R. Guerrero Pabón[1]

[1]Hospital Univesitario Reina Sofía, Intensive Care Unit, Córdoba, Spain, [2]Universidad de Córdoba, Departamento Medicina, Córdoba, Spain

**INTRODUCTION.** Recent studies have suggested that preoperative statins use is associated with a reduction in infectious complications after cardiac surgery.

**OBJECTIVES.** To assess the effect on morbidity of preoperative statins use in cardiac surgery.

**METHODS.** Prospective and observational cohort study. We evaluated all of 124 consecutive patients who underwent coronary artery bypass graft (CABG) and/or valve surgery at our hospital between November 30, 2007 and, February 28, 2008. We described general characteristics and comorbidities (age, gender, weight, height, hypertension, diabetes, dyslipemia, chronic kidney failure), pharmacological treatments (betablockers, ACE, statins), type of cardiac surgery (CABG and/or valve replacement) and postoperative complications (pneumonia, bacteriemia, sternal wound, leg vein harvest site infection, urinary tract infection, stress ulcer, acute cardiac failure and length of stay at hospital). The time of monitoring was 90 days. Differences in categorical variables were calculated using two-sided likelihood ratio Chi-square test or Fisher's exact test, and the Mann–Withney U or Student t test was used for continuous variables, when appropriate. Cox proportional-hazards regression analysis was used to assess the impact of statins use on infectious complications across the time. Data analysis was done using SPSS for Windows 15.0.0 (SPSS, Chicago, IL, USA).

**RESULTS.** A total of 124 patients were included. The 48.4% (60) were women, the mean age was 65 $\pm$ 11 years. The frequency of preoperative statins use were 40% (50 patients). In total, 61 (48%) patients developed an infectious complication. In our study, preoperative use of statins was not associated with a statistically reduction in any individual infection on its own ($p > 0.05$ for all).

**CONCLUSIONS.** In our patients, preoperative statin use was not associated with a reduction in the rate of postoperative infections within 90 days after surgery. May be useful to performance a randomized study (preoperative statins use versus no preoperative statins).

**REFERENCE(S).** 1. Liakopoulos OJ, Choi YH, Haldenwang PL et al. Impact of preoperative statin therapy on adverse postoperative outcomes in patients undergoing cardiac surgery: a meta-analysis of over 30,000 patients. Eur Heart J. 2008;12:1548–59.

2. Mohamed R, McAlister FA et al. Preoperative statin and infection after cardiac surgery: a cohor study. Clin Infect Dis. 2009;48:66–72.

## 0652

### EFFECTS OF THE IMPLEMENTATION OF THE VASCULAR CATHETER BUNDLE IN A CARDIAC SURGERY POSTOPERATIVE UNIT IN RIO DE JANEIRO, BRAZIL, YEARS 2007–2009

A. Rouge[1], I. Espinola[2], C.T. Paixão[1], L. Prado[1], G.K.S. Nascimento[1], K.M. Senna[1], M.R. Vasques[1], M.B. Freitas[1], S.A. Olival[1], R.V. Gomes[1], C.C. Lamas[1,2]

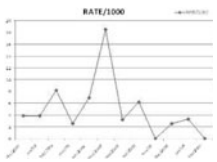
[1]Instituto Nacional de Cardiologia/MS, Rio de Janeiro, Brazil, [2]UNIGRANRIO, Rio de Janeiro, Brazil

**INTRODUCTION.** Catheter-related blood stream infection (CR-BSI) presents severe morbidity and potential mortality in intensive care units. We have recognized a high rate of this adverse event in our unit and implemented the catheter bundle in the year 2007.

**OBJECTIVE.** To evaluate the effect of systematic implementation of the catheter bundle protocol on the rates of CR-BSI in a busy cardiac surgery post-operative unit.

**METHODS.** The catheter bundle implemented included: (1) choice of catheter site insertion, using preferably the subclavian or jugular vein approach (2) use of topical chlorexidine in the site of insertion (3) full paramentation of the involved physician, including a large sheet to place on the patient (4) early removal of the catheter. This was a prospective cohort study, of consecutive patients. Two periods were evaluated: period I—6 months prior to intervention (December 2007 to May 2008); period II—from September 2008 until February 2009. Months of June, July and August were excluded from analysis, since this was considered the implementation period. CR-BSI was considered, when positive blood cultures, with no other focus of infection, was detected in a patient with a central venous catheter. Rate was per 1,000 catheter days. Statistical analysis was performed with Epi info (STATCALC) program, using the Chi-square test for comparison of proportions between periods I and II. Yates correction was used.

**RESULTS.** There was a total of 4,239 catheter-days in the unit during the study periods. Period I included 2,095, and 2,139 in period II. CR-BSI rates were 16 cases pre implementation, and 5 post implementation. Odds ratio was 3.27 (confidence interval 1.12–10.20) with $p = 0.026$ ($p < 0.05$). Number of CR-BSI per month is presented in graph 1. Microorganisms identified are shown in Table 1.




BSI-RATE/1000

**CONCLUSION.** A systematic, bedside approach to reduce CR-BSI proved effectiveness in the scenario of a postoperative cardiac surgery unit in Rio de Janeiro, Brazil. A statistically significant decrease in CR-BSI was observed in a relatively short period of intervention, improving health care quality.

**ACKNOWLEDGMENT**: Nursing and Physitians staff of the Surgical Intensive Care Unit.

**REFERENCE.** N Engl J Med. 2006;355:2725–32.

## 0653

### CLINICAL SEVERITY OF BACTERIAL SEPSIS IN CRITICALLY ILL, SURGICAL PATIENTS

C. Chelazzi[1], G. Villa[1], L. Salamova[1], A.R. De Gaudio[1]

[1]Università degli Studi di Firenze, Florence, Italy

**INTRODUCTION.** Bacterial sepsis is common among critically ill, surgical patients (1). Clinical picture may include leukocytosis, fever and increased serum procalcitonin. Although clinical severity varies depending on host immunologic status and pathogen virulence, data are lacking about clinical differences between Gram positive (G +) and Gram negative sepsis (G −).

**OBJECTIVES.** to assess for differences in terms of SAPS II score, white blood cell count (WBCC), body temperature (BT), serum procalcitonin (PCT) and ICU-mortality between microbiologically confirmed G + and G − sepsis.

**METHODS.** Data were retrospectively collected from charts of critically ill patients admitted to a surgical ICU from the 1/1/09 to 31/12/09. Inclusion criteria were clinical evidence of sepsis (2) and microbiologically proven infection from G + or G − bacteria. Incomplete charts and fungal co-infections were considered as exclusion criteria. Microbiological diagnosis and infections sites were noted. Patients were divided in two groups, G + and G − sepsis and differences in SAPS II score, WBCC, BD and serum PCT at the time of the first positive culture and ICU mortality were sorted and tested for statistical significance ($p < 0.05$).

**RESULTS.** On a total of 39 septic patients, 28 had a G + infection and 11 a G − infection. Table A shows microbiological diagnosis and infections sites. SAPS II scores were higher in G − than G + infected patients ($p < 0.05$). WBCCs were significantly higher in patients with G − sepsis than in those with G + sepsis ($p < 0.05$, Table B). Patients with G − sepsis shows, also, higher ICU-mortality rate than those with G + sepsis ($p < 0.05$, Table B).

**TABLE A** INFECTIONS SITES

| | Gram + (n 28) | Gram − (n 11) |
|---|---|---|
| Blood stream infection | 7 (25%) | 0 |
| Pneumonia | 12 (43%) | 5 (45%) |
| Intra-abdominal infection | 4 (14%) | 3 (27%) |
| Urinary tract infection | 2 (7%) | 2 (18%) |
| Surgical site infection | 1 (4%) | 1 (9%) |

**TABLE B** CLINICAL FEATURES OF INFECTIONS

| | Gram + (n 28) | Gram − (n 11) | p |
|---|---|---|---|
| SAPS II | 41.3 | 51.5 | 0.03 |
| BT | 36.8 $\pm$ 1.4 | 37 $\pm$ 1.8 | n.s. |
| WBCC | 13,535 $\pm$ 6477 | 19,779 $\pm$ 9853 | 0.02 |
| PCT | 3.24 $\pm$ 6.7 | 3.98 $\pm$ 5.77 | n.s. |
| ICU-mortality | 7(25%) | 7(63.6%) | 0.03 |

**CONCLUSIONS.** In critically ill, surgical patients with Gram negative infections, clinical sepsis was more severe than those with Gram positive sepsis. This difference is already evident at clinical presentation, in particular SAPS II score, white blood cell count and ICU-mortality were higher in Gram negative infective patients.

**REFERENCE(S).** 1.Cheng B, Xie G et al. Epidemiology of severe sepsis in critically ill surgical patients in ten university hospitals in China. Crit Care Med. 2007;35(11):2538–46.

2. Vincent JL. Clinical sepsis and septic shock–definition, diagnosis and management principles. Langenbecks Arch Surg. 2008;393(6):817–24.

### 0654

**INFECTIONS AND USE OF ANTIBIOTICS IN PATIENTS ADMITTED FOR SEVERE ACUTE PANCREATITIS: DATA FROM THE EPIC2 STUDY**

J. De Waele[1], R. Moreno[2], A. Anzueto[3], J. Lipman[4], J. Rello[5], Y. Sakr[6], J.L. Vincent[7]

[1]Ghent University Hospital, Critical Care Medicine, Ghent, Belgium, [2]Hospital de Santo António dos Cacuchos, Lisbon, Portugal, [3]University of Texas Health Science Center, San Antonio, USA, [4]University of Queensland, Brisbane, Australia, [5]Joan XXIII University Hospital, Tarragona, Spain, [6]Friedrich Schiller University, Jena, Germany, [7]Erasme University Hospital, Brussels, Belgium

**INTRODUCTION.** Severe acute pancreatitis (SAP) is often complicated by infectious complications—both pancreatic and extra-pancreatic. Infected pancreatic necrosis in particular is an important source of morbidity and mortality. Multicenter data on the use of antibiotics, the frequency of infectious complications, and the microbiology in patients with SAP are desirable.

**OBJECTIVE.** The objective of this study was to analyze the characteristics of the infectious complications (location of infection, antibiotics used, microbiology, use of prophylactic antibiotics) in this setting.

**METHODS.** The EPIC2 study was a 1-day point prevalence study performed on May 8, 2007. A total of 1,265 ICUs from 76 countries participated and included data on 14,141 patients present on the study day. Demographic, physiologic, bacteriological, and therapeutic data were collected, along with outcome data at ICU and hospital discharge. From this database, we extracted data from patients who were admitted to the ICU because of SAP.

**RESULTS.** Of the 14,141 patients, 159 (1.12%) were admitted to the ICU for SAP (65% male, mean age 57 ± 15 years, SAPS2 score 33.4 ± 14.2). SAP patients stayed in the ICU for a median of 25 (10–53) days; ICU mortality was 22.7%. Of these, 116 patients (73%) were considered to be infected: 50 (31.4%) patients had intra-abdominal infections (IAI), 25 (15.7%) extra-abdominal infections, and 41 (25.8%) a combination of the two. For antibiotic treatment, penicillins and other beta-lactams were used most frequently (31.1 and 44.4%, respectively). In patients treated for IAI, 28 different microorganisms were recovered. Gram-negative bacteria (n = 14), were more prevalent than Gram-positive organisms (n = 9), anaerobes (n = 1), and fungi (n = 4). Pseudomonas was isolated most frequently (n = 7). Prophylactic antibiotics were administered to 38 of the 159 patients (23.9%), most often in patients who were admitted for 1 week or less; in this latter patient subgroup of 72 patients, 22 (30.6%) were treated with prophylactic antibiotics (most frequently beta-lactams). Twelve patients (7.5%) received prophylactic antifungals.

**CONCLUSION.** Despite being uncommon, SAP is still associated with a high ICU mortality (22.7%). Infections continue to be a major problem in this population, with a significant proportion presenting with non-abdominal sites of infection. Most patients are treated with antibiotics (1/3 prophylaxis and 2/3 for treatment). Gram-negative organisms were isolated most frequently, whereas yeasts were less common.

### 0655

**COMPLIANCE WITH SURGICAL ANTIBIOTIC PROPHYLAXIS POLICY FOR ELECTIVE SURGICAL PROCEDURES**

M.G. Ritesh[1]

[1]Darent Valley Hospital, Anaesthetics, Dartford, UK

**BACKGROUND.** NPSA issued an alert tittled "WHO Surgical Safety Checklist "in January 26th, 2009—one of the components in the checklist is the administration of prophylactic antibiotics at a sufficient interval (1 h) before the start of the surgical intervention. Hospital protocol for antibiotic surgical prophylaxis was already in place, which recommended, in a majority of specialities and cases, for administration of antibiotics at least 30 min before start of surgical procedure. With this background, we wanted to examine to what extent hospital policy guidelines were being implemented and whether best practice was being followed.

**AIM AND OBJECTIVE.** To determine if patients were receiving their antibiotic prophylaxis. To determine if patients receiving their prophylactic antibiotics, were within 30 min of the commencement of procedure. To determine compliance with protocol and establish best practice.

**METHOD.** A form was filled in by the Operating Theatre Practitioner, to log the name of the operation, time of administration and name of antibiotic given by the anaesthetist and the time of start of operation i.e. knife to skin time. These forms were filled in, without the anaesthetist being aware, to exclude any form of performance or operating bias. All data was collected prospectively. A total of 100 patients were selected. It was equally divided between all the specialities in the Main Operating Theatres. They were Orthopaedics—20 cases, General Surgery—20 cases, Laparoscopic Surgery—20 cases, Urology—20 cases, and Gyneacology—20 cases.

**RESULTS.** Overall: Percentage of patients receiving antibiotics after start of surgery—25%. Percentage of patients receiving antibiotics less than 30 min before start of operation—70%. Percentage of patients receiving antibiotics more than 30 min before start of operation—5%. Percentage of patients receiving antibiotics—100%.

**CONCLUSION.** The Surgical prophylaxis policy formulated by the Microbiology department states that antibiotics be administered between 30 min and 2 h before start of surgery. The objective of this audit has been realised. The compliance rate, as per the hospital protocol is a mere 5%, with 95% of patients receiving antibiotics less than 30 min before the start of surgery or after the start of surgery. Numerous studies have clearly shown a reduction in surgical site infection rates with antibiotic prophylaxis and better outcomes.

## Infections in the immunosuppressed host: 0656–0667

### 0656

**SECULAR TRENDS IN OUTCOMES ASSOCIATED WITH SEVERE SEPSIS AND SEPTIC SHOCK IN NEUTROPENIC PATIENTS**

M. Legrand[1], A. Max[1], V. Peigne[1], V. Lemiale[1], E. Canet[1], M. Darmon[2], B. Schlemmer[1], E. Azoulay[1]

[1]Saint-Louis University Hospital, Medical ICU, Paris, France, [2]Saint-Etienne University Hospital, Medical ICU, Paris, France

**INTRODUCTION.** Survival improves in critically ill cancer patients. Whether these benefits translate to neutropenic patients with severe sepsis and septic shock remains unclear.

**OBJECTIVES.** We conducted this study to report outcomes in neutropenic patients admitted to the intensive care unit (ICU) with severe sepsis and septic shock.

**METHODS.** Observational longitudinal cohort study over a 10-year study period in a 12-bed medical ICU.

**RESULTS.** 428 neutropenic patients with severe sepsis or septic shock. The underlying diseases were mostly acute leukemia (35.7%), lymphoma (31.7%) or solid tumors (16.5%). Vasopressors were needed in 292 (68.7%) patients, mechanical ventilation in 232 (54%) and dialysis in 76 (17.8%). Infection was microbiologically documented in 237 (55.5%) patients, clinically documented in 141 (32.9%) patients while 50 (11.9%) patients had a fever of unknown origin (FUO). An acute non-infectious condition was diagnosed in 175 (40.9%) patients, and was more frequent in FUO patients or those with clinically documented infection (52 and 47%, respectively) than in patients with microbiologically documented infection (35%). ICU and hospital mortality rates were, respectively, of 40.1 and 49.8%. Six months and 1-year mortality rates were 59.5 and 63.3%, respectively. Hospital mortality rate ranged from 58.7% between 1998 and 2003 to 43% between 2004 and 2008 (p = 0.006). By multivariate analysis, nine independent predictors of hospital mortality were identified. Six were associated with mortality, namely, increased age, need for vasopressors, neurologic, respiratory or hepatic dysfunctions and presence of acute non-infectious condition. Three factors were associated with reduced mortality, namely, ICU-admission after 2003, initial antibiotic combination using aminoglycosides and early removal of the indwelling catheter.

**CONCLUSIONS.** In neutropenic patients with severe sepsis and septic shock, survival improves over time. This study identifies two potential targets for improvement that are aminoglycosides administration in combination with betalactam antibiotics and early catheter removal. Acute non-infectious conditions are associated with increased mortality underlining the need for complete clinical assessment allowing identification of infectious and non-infectious aetiologies of newly developed organ dysfunction.

### 0657

**INVASIVE ASPERGILLOSIS IN INTENSIVE CARE UNITS: UNDERLYING CONDITIONS, CLINICAL PRESENTATION, MEDICAL IMAGING, AND MORTALITY**

N. Brusselaers[1], F.S. Taccone[2], P. Bulpa[3], A.-M. Van den Abeele[4], G. Dimopoulos[5], J. Rello[6], B. Misset[7], J.A. Paiva[8], K. Vandewoude[1], D. Vogelaers[1], S. Blot[1]

[1]Ghent University Hospital, General Internal Medicine, Ghent, Belgium, [2]Erasmus Hospital Brussels, Brussels, Belgium, [3]Mont-Godinne University Hospital, Intensive Care Unit, Yvoir, Belgium, [4]General Hospital Sint Lucas, Ghent, Belgium, [5]Athens University Hospital, Intensive Care Unit, Athens, Greece, [6]Joan XXIII University Hospital, Intensive Care Unit, Tarragona, Spain, [7]Hôpital Saint-Joseph, Paris, France, [8]Hospital de São João, Porto, Portugal

**INTRODUCTION.** Invasive aspergillosis (IA) is a fungal infection particularly affecting immunocompromised hosts. In the past decade, however, several reports indicate an important occurrence rate of IA in apparently immunocompetent ICU patients. Little is known about the specific risk profile of ICU patients to develop IA.

**OBJECTIVES.** To describe characteristics and outcome in ICU patients with IA.

**METHODS.** We report an interim analysis of the *Asp*ICU project (http://www.aspicu.org), a multicenter (n = 24) observational survey (November 2006–November 2009) of all ICU patients with a positive *Aspergillus* culture. IA was defined according to an algorithm that discriminates Aspergillus colonization from probable or proven IA [1].

**RESULTS.** At time of interim analysis 390 patients were included in the AspICU project. Of these, 183 cases (46.9%) were classified as IA (of which 44 proven and 139 probable IA). The lung was the most frequent site of infection (97.8%) and *A. fumigatus* the most common isolated species (93.0%). The median APACHE II score at admission was 26 (IQR 18–30) and the median SOFA score at time of diagnosis of IA was 9 (IQR 6–13). IA was generally diagnosed in medical ICUs (82.0%). The most frequently observed co-morbid conditions or underlying diseases were COPD (37.2%), ARDS (19.0%), diabetes mellitus (13.7%), and chronic heart failure (8.7%). There were 26 patients (14.2%) with solid organ transplantation (12 liver, 7 kidney, 5 lung, and 2 heart transplants). Only 35.0% of patients had classical host factors as defined by the EORTC/MSG, such as neutropenia (6.6%), hemato-oncological malignancy treated with cytotoxic agents (8.7%), bone marrow transplantation (2.7%), or chronic use of corticosteroids (15.3%). Clinical signs suggestive for IA were dyspnea (63%), worsening respiratory insufficiency in spite of antibiotic therapy and ventilator support (56%), and fever refractory to at least 3 days of antibiotic therapy (34%). Medical imaging (either by CT or on Chest X-ray) showed non-specific infiltrates (72%), pleural fluid (26%), diffuse "ARDS-like" infiltrates (20%), nodules (21%), wedge-shaped infiltrates (5%), cavitation (4%), Halo sign (3%), and air crescent sign (2%). Mortality at 12 weeks after diagnosis was 69.8% in proven IA and 67.2% in probable IA.

**CONCLUSIONS.** IA in ICUs is associated with high mortality. Classical host factors and medical imaging suggestive for IA were rather rare. COPD is the most frequent underlying condition.

**REFERENCE(S).** 1. Vandewoude K, Blot S, Depuydt P, Benoit D, Temmerman W, Colardyn F, Vogelaers D. Clinical relevance of Aspergillus isolation from respiratory tract samples in critically ill patients. Crit Care 2006;10:R31.

**GRANT ACKNOWLEDGMENT.** (1) Unrestricted educational grant from Pfizer Belgium, (2) Research grant from Ghent University, (3) S. Blot is supported by a grant from ESICM and the iMDSoft Patient Safety Award 2008, (4) The *Asp*ICU project is endorsed by the ECCRN of the ESICM.

## 0658

### DAPSONE-ASSOCIATED METHAEMOGLOBINAEMIA IN PATIENTS WITH HAEMATOLOGIC MALIGNANCIES

A. Subramaniam[1], R. Nagappan[2], C. Corallo[3]

[1]Box Hill Hospital, Eastern Health, Intensive Care, Melbourne, Australia, [2]Box Hill Hospital, Eastern Health, Monash University, Intensive Care, Melbourne, Australia, [3]Alfred Hospital, Department of Pharmacy, Melbourne, Australia

**INTRODUCTION.** Methaemoglobinaemia is a rare problem that can significantly impact on oxygen carriage and may require ICU management. Dapsone is the recommended second-line agent used for *Pneumocystis jiroveci* pneumonia prophylaxis in immunocompromised patients and has been used with increased frequency. Three leukaemic patients on dapsone developed symptomatic acquired methaemoglobinaemia (methaemoglobin level > 1.5%) [1]. This prompted a retrospective review of all patients admitted to our institution with haematological malignancies who received dapsone over a 12-month period.

**OBJECTIVES.** To determine the true incidence of dapsone-associated methaemoglobinaemia and other contributing factors.

**METHODS.** Retrospective study over a 12-month period. Co-oximetry data was employed to identify patients with methaemoglobinaemia.

**RESULTS.** Thirty-four patients with haematologic malignancies received dapsone between January and December 2008, of whom 53% (N = 18) had co-oximetry studies done. Raised methaemoglobin levels was seen in thirteen patients, 4 of them symptomatic; with mean peak levels of 7.84% (range 1.9–26.8%). 61.5% (N = 8) of these patients required intensive care support. Mean onset of methaemoglobinaemia was 11.8 days (range 4–18 days) following dapsone commencement. All patients were anaemic with an average Hb of 85.5 g/L (range 59–111 g/L). All 13 were prescribed either fluconazole or voriconazole and 5 patients were also on high-dose steroids, both agents known to induce cytochrome P450 enzymes and hence potentiating dapsone toxicity.

**CONCLUSIONS.** Our experience suggests that dapsone should be used with caution in patients with haematological malignancies as they are particularly at risk of developing symptomatic methaemoglobinaemia due to underlying anaemia, immunosuppression and potential drug interactions. The current recommendation for dapsone for PJP prophylaxis in this group of patients needs to be reviewed. When methaemoglobinaemia does occur, early recognition is possible with routine co-oximetry testing and correct treatment may lessen the need for or duration of ICU supports.

**REFERENCE(S).**

1. Ash-Bernal R, Wise R, Wright SM. Acquired methemoglobinemia: a retrospective series of 138 cases at 2 teaching hospitals. Medicine (Baltimore), 2004;83(5):265–73.

## 0659

### MANAGEMENT OF FUNGAL INFECTIONS IN THE INTENSIVE CARE UNIT: A SURVEY OF UK PRACTICE

C.M. Chalmers[1], A.M. Bal[2]

[1]Crosshouse Hospital, Department of Anaesthesia, Kilmarnock, UK, [2]Crosshouse Hospital, Department of Microbiology, Kilmarnock, UK

**INTRODUCTION.** *Candida* species are the fourth most common cause of nosocomial bloodstream infection [1]. Such infections commonly affect patients in the intensive care unit (ICU) [1] and carry a high mortality of up to 42% [2]. There are published guidelines for the management of fungal infections [3, 4] but to date there is no literature documenting their usual management in ICUs in the UK.

**OBJECTIVES.** To document usual management of fungal infections in general and candidaemia in particular in UK ICUs. To compare this management to published guidelines.

**METHODS.** An electronic survey was sent to 212 ICUs across the UK (approximately 90% of all UK units). Questions related to empirical treatment of fungal infections, the management of proven candidaemia and more general management practices.

**RESULTS.** A total of 72 responses were received (30.6% response rate). 57.7% of units have no local policy on the use of antifungal agents. Microbiology advice is usually sought before commencing antifungal therapy. 85.9% of units use antifungal agents empirically, usually only for certain groups of patients perceived to be at high risk. These include patients with gastrointestinal perforations, abdominal surgery, immunosuppression and liver failure. Risk factors contributing to a decision to commence empirical therapy include fever unresponsive to antibiotics and rising inflammatory markers. 76.4% of those who use empirical therapy perceive this to be beneficial. Fluconazole is the antifungal agent of choice in most units for both empirical therapy (81.4%) and proven candidaemia (64.1%). Duration of therapy is 14 days in 47% of units and dependent on clinical response or advice in 23.3%. Central venous catheters (CVC) are removed within 48 h frequently or always in 73.9% of units and ophthalmological examination arranged frequently or always in 15.1%.

**CONCLUSIONS.** Few units have a local policy on the management of fungal infections but close liaison with microbiologists is usual. Empirical therapy is often employed for patients deemed to be at high risk, although evidence for this approach is lacking [5]. Adherence to published guidelines could be improved, potentially reducing morbidity and mortality from these common infections.

**REFERENCES.**

1. Wisplinghoff H et al. Nosocomial bloodstream infections in US hospitals: analysis of 24,179 cases from a prospective nationwide surveillance study. Clin Infect Dis. 2004;39:309–17.
2. Aliyu SH et al. Candidaemia in a large teaching hospital: a clinical audit. Q J Med. 2006;99:655–63.
3. Pappas PG et al. Clinical practice guidelines for the management of candidiasis: 2009 update by the Infectious Diseases Society of America. Clin Infect Dis. 2009;48:503–35.
4. Denning DW et al. British Society for Medical Mycology proposed standards of care for patients with invasive fungal infections. Lancet Infect Dis. 2003;3:230–40.
5. Zilberberg MD et al. Fungal Infections in the ICU. Infect Dis Clin N Am. 2009;23:625–42.

## 0660

### HIGH FREQUENCY OF RESPIRATORY VIRUSES DETECTED BY MULTIPLEX POLYMERASE CHAIN REACTION IN THE IMMUNOCOMPROMISED WITH ACUTE RESPIRATORY FAILURE

D. Schnell[1], J. Legoff[1], B. Schlemmer[1], É. Azoulay[1]

[1]Hôpital Saint-Louis, Paris Diderot University, Paris, France

**INTRODUCTION.** RT-PCR is more sensitive than standard methods for respiratory viruses (RV) detection. However, this has not been evaluated in immunocompromised patients with acute respiratory failure (ARF). Moreover, the exact clinical significance of a positive PCR assay remains unknown.

**OBJECTIVES.** To evaluate the sensitivity of RT-PCR in immunocompromised patients with acute respiratory failure (ARF).

**METHODS.** Prospective single-center study in immunocompromised patients with ARF. Multiplex RT-PCR sensitivity was compared to immunofluorescence.

**RESULTS.** Hundred immunocompromised patients (65 hematologic malignancies including 14 hematopoietic stem cell transplantations, 22 iatrogenic immunosuppression, and 13 with solid tumours) were included in the study. A RV was detected in 47 (47%) patients with multiplex RT–PCR compared to 8 (8%) with immunofluorescence ($P = 0.006$). Patients with and without a positive PCR assay had similar clinical and radiographic presentations. The need for ventilatory support (57 vs. 75%, $P = 0.09$), the occurrence of shock (43 vs. 53%, $P = 0.41$), the need for renal replacement therapy (26 vs. 23%, $P = 0.92$), time spend in the ICU (6 vs. 7 days, $P = 0.35$), and ICU mortality (17 vs. 28%, $P = 0.27$) were comparable between groups. The PCR assay results according to diagnostic categories of acute respiratory failure are displayed in Fig. 1.

PCR assay results according to diagnosis

**CONCLUSIONS.** In our immunocompromised patients with ARF, multiplex RT-PCR was far more sensitive than immunofluorescence for the detection of RV. However, further investigations are needed to clarify the exact clinical significance of a positive PCR assay.

## 0661

### ASSESSMENT OF CANDIDA SCORE TOGETHER WITH SERUM PROCALCITONIN IN ICU PATIENTS: PREDICTOR OF INVASIVE CANDIDIASIS?

X. Li[1], R. Wu[1], J. Chen[1], X. Guan[1], S. Huang[1]

[1]The First Affiliated Hospital of Sun Yat-Sen University, Department of Critical Care Medicine, Guangzhou, China

**INTRODUCTION.** Invasive candidiasis (IC) was associated with significantly increased morbidity and mortality among patients admitted to the intensive care unit (ICU). Thus, how to effectively predict IC has become a challenge in clinical practice. Given the conventional microbiological, histological and radiological methods are insensitive, time-consuming and not generally accessible, rapid, specific and culture-independent predictive method of IC is needed.

**OBJECTIVES.** This study was performed to assess the implementation of Candida Score (CS) together with serum procalcitonin (PCT) as predictor of IC in ICU patients.

**METHODS.** Retrospectively analyze clinical data and laboratory examination from 2008–2006 to 2009–2012. Using CS together with PCT/G test as predictor in succession.

**RESULTS.** Overall 155 patients were included and invasive candidiasis group (IC) was confirmed in 54 cases. Average PCT and G test were significantly higher in IC group compared to non-IC group ($p < 0.05$). The AUROC of 48-h PCT and 48-h G test were 0.960 and 0.859, respectively. The cutoff of 48-h PCT was 0.55 ng/ml. There was significant difference of 48-h PCT between survival group and death group ($p < 0.05$).

**CONCLUSIONS.** CS together with PCT can be used to predict IC in ICU patients. The predictive value of CS together with PCT is better than that of CS together with G test.

**REFERENCE(S).**

1. Pierre Emmanuel Charles, Caemen Castro, Sergio Ruiz-Santana et al. Serum procaltonin levels in critically ill patients colonized with Candida spp.: new clues for the early recognition of invasive candidiasis? Intensive Care Med. 2009;35:2146–50.
2. Christ-Crain M, Muller B. Procalcitonin in bacterial infections-hype, hope, more or less? Swiss Med Wkly. 2005;135:451–60.
3. Christofilopoulou S, Charvalos E, Petrikkos G. Could procalcitonin be a predictive biological marker in systemic fungal infections? Study of 14 cases. Eur J Intern Med. 2002;13:493–5.
4. CristÓbal LeÓn, Sergio Ruiz-Santana, Pedro Saavedra et al. A bedside scoring system (Candida score) for early antifungal treatment in nonneutropenic critically ill patients with Candida spp. colonization. Crit Care Med. 2006;34(3):730–7.
5. Engelmann P, Garbino J, Pittet D. Epidemiology of Candida species infections in critically ill non-immunosuppressed patients. Lancet Infect Dis. 2003;3:685–702.
6. Pittet D, Monod M, Suter PM et al. Candida colonization and subsequent infections in critically ill surgical patients. Ann Surg. 1994;220:751–8.
7. Gauzit R, Cohen Y, Dupont H et al. Infections by Candida spp. in intensive care. Survey of French practices. Presse Med. 2003;32:440–9.
8. Ruhnke MA, Bohme A, Buchheidt D et al. Diagnosis of invasive fungal infections in hematology and oncology. Ann Hematol. 2003;82 suppl 2:s141–8.

## 0662

### A MULTIPLEX PCR FACILITATES THE DIAGNOSIS OF INVASIVE ASPERGILLOSIS IN CRITICALLY ILL PATIENTS

A. Santos Bouza[1], E. Varela Ledo[2], L. Martínez Lamas[2], A. Peraza Torres[1], C. Martín López[1], C. Domínguez Antelo[1], M. Robelo Pardo[1], B. Regueiro García[2]

[1]Complexo Hospitalario Universitario de Santiago, Intensive Care Unit, Santiago de Compostela, Spain, [2]Complexo Hospitalario Universitario de Santiago, Microbiology, Santiago de Compostela, Spain

**INTRODUCTION.** Invasive Aspergillosis (IA) has very high mortality in Critically Ill Patients (CIP) and requires early treatment. The frequent isolation of *Aspegillus fumigatus* (AF) in patients without IA and the slowness of its cultivation make diagnosis difficult. Proven IA requires histopathological documentation, and probable IA requires microbiological evidence, risk factors and clinical and radiological manifestations. Blood culture has no diagnostic value for IA by current methodology. SeptiFast is a multiplex PCR to identify AF from 25 bacterial and fungal microorganisms common in CIP.

**OBJECTIVES.** We assess SeptiFast in the diagnosis of aspergillosis in severe sepsis.

**METHODS.** We prospectively studied patients admitted to ICU between March 2008 and April 2010 who met criteria for severe sepsis or septic shock according to consensus definitions through conventional microbiological culture (CMC) of bronchial aspirate and occasionally other specimens. During sepsis, patient blood was processed for SeptiFast one or more times using the previously described technique.

**RESULTS.** At the end of period 378 patients met the inclusion sepsis criteria. In 359 of these CIP we have not identified AF by CMC, and SeptiFast only was positive for AF in two CIP of this group. In the remaining 19 septic CIP we have identified AF through CMC, of whom 9 had risk factors and met clinical, radiological and/or pathological criteria of IA (Invasive Aspergillosis Patients, IAP group), while in other 10 patients AF also was identified in bronchial aspirate without criteria of IA (Bronchial-aspirate Aspergillus Patients, BAP group). There were no significant differences between IAP and BAP group in mean age (73 vs. 74), invasive mechanical ventilation (9/9 vs. 9/10), APACHEII (27 vs. 29) or SOFA (9 vs. 7) on admission, but in mortality (100 vs. 30%). They were treated with Voriconazole, occasionally associated with other antifungals. Septifast was positive for AF in 7 of the 9 patients in the IAP group and in 3 of 10 patients in the BAP group. To identify IA among septic CIP with CMC identification of AF, SeptiFast obtained sensitivity of 77.77% (0.40–0.96), specificity of 70% (0.35–0.92), predictive positive 70% and negative 77.77% value, likelihood ratio positive 2.59 and negative 0.32, with prevalence of 47.36% among 19 patients.

SEPTIFAST IN SEPTIC CIP WITH AF BY CMC

| SeptiFast | IA | BA | Total |
|---|---|---|---|
| AF+ | 7 | 3 | 10 |
| AF− | 2 | 7 | 9 |
| Total | 9 | 10 | 19 |

**DISCUSSION.** IA is extremely serious in CIP and requires early specific therapy, but accurate diagnosis is difficult and slow. SeptiFast was processed in our laboratory in 5 h helping the early detection of AF among all septic CIP, and differentiation between noninvasive and invasive aspergillosis. It allows the identification of 24 other microorganisms that cause sepsis, then is not an additional burden.

**CONCLUSIONS.** A multiplex PCR which includes among its target Aspergillus Fumigatus has helped the rapid diagnosis and identification of the most severe forms of Aspergillosis in critically ill patients.

## 0663

### A FIVE YEAR STUDY OF ALL CANDIDEMIA EPISODES IN A MEDICAL: SURGICAL ICU

E. Paramythiotou[1], F. Frantzeskaki[1], A. Antoniadou[2], H. Giamarellou[2], D. Plachouras[2], T. Panagea[2], L. Zerva[3], A. Armaganidis[1]

[1]Athens University, ICU, Athens, Greece, [2]Athens University, 4th Department of Internal Medicine, Athens, Greece, [3]Athens University, Microbiology Laboratory, Athens, Greece

**INTRODUCTION.** Invasive candidiasis and candidemia are frequently encountered in the nosocomial setting, particularly in the Intensive Care Unit (ICU) causing considerable morbidity and mortality. The increasing incidence of non-albicans Candida species could also be important.

**BACKGROUND.** The aim of the present study was to record the epidemiology, risk factors, mortality, strains susceptibility to antifungal drugs, and to evaluate Ostrosky rule's capability to predict invasive candidiasis in patients with candidemia in the ICU.

**METHODS.** This is a retrospective study of all candidemia episodes which were registered in our medical—surgical ICU in a 5 year period. The records of the research laboratory of the fourth Internal Medicine Department and the Microbiology Laboratory of Attikon University hospital were used in order to identify patients. Medical records were then retrieved. Only the first candidemia episode was evaluated. Special forms were completed for each patient including demographic information, concomitant conditions, severity scores on the day of ICU admission, risk factors, data of colonization and candidemia—related information.

**RESULTS.** Our hospital is a 640-bed teaching tertiary care hospital with a 25-bed medical and surgical ICU. During the study period a total of 1,098 patients were hospitalized in the ICU. Among them 39 patients developed fungemia, i.e. (3.55 per 1,000 admissions). The population study consisted of 23 men and 16 women. Mean patients' age was 69 years while median ICU length of stay was 36 days (range 1–240). Medical cause of admission was present in 22 cases and surgical in 17 cases. Species isolated were *C. albicans* (25.6%), The majority of the non-albicans cases were caused by *C. parapsilosis* (20.5%).The rest were equally divided between *C. tropicalis*, *C. krusei* and *C. glabrata.* Three candidemias were "imported". Median time between ICU admission and candidemia was 25 days (3–75). Mean Apache II score was 16, 4 (range 12–20) on the day of admission and overall mortality was 66.6%. Attributable mortality was 35%. Ostrosky prediction rule was positive in 20 patients. Urine or lung colonization was present in 20.5%, and multiple site colonization in 29%. Seven (18%) patients were submitted to an intraabdominal operation. Twelve patients (31%) received TPN prior to candidemia episode. Seven patients were receiving steroid therapy for several reasons. Risk factors analysis between Candida and non-Candida showed that corticosteroid use was associated with non-Candida species. Caspofungin was the most commonly introduced treatment.

**CONCLUSIONS.** Compared to other blood infections fungemias are not common among ICU patients but they are often lethal. A high Apache II score at admission, multiple site colonization and abdominal surgery should raise a high suspicion index and a prophylactic therapy should start. Non Albicans species are on the rise and they may be associated with corticosteroid use.

## 0664

### CONTROL OF A NOSOCOMIAL OUTBREAK DUE TO *ASPERGILLUS FUMIGATUS* AT A INTENSIVE CARE UNIT

J.V. Hernández-Rodriguez[1], J. del Diego-Salas[1], M. Nieto-González[1], M.V. De la Torre-Prados[1], F. Hidalgo-Gómez[1], A. Infante-Urrios[1]

[1]Hospital Clinico Virgen de la Victoria, Málaga, Spain

**INTRODUCTION.** *Aspergillus fumigatus* (AF) is one of the most frequent causes of nosocomial pneumonia, and the mortality from infection by this pathogen is 80%. This fungus is commonly isolated from the environment (soil, organic debris, decaying vegetation, and water), and it releases conidia which can be inhaled by immunocompromised hosts. It has several pathogenic mechanisms that differentiate it from other species: the capacity to grow at 37°C, spores are very resistant to environmental etc.

**OBJECTIVES.** To describe the epidemiological conditions of our ward and clinical characteristics of patients who suffer these infections.

**METHODS.** A retrospective study of cases admitted to ICU with this type of infection. Patients were included due to their positive result to alveolar broncoaspiration, given by the department of microbiology. Environmental controls were taken by the department of preventive medicine.

**RESULTS.** We had 4 cases, 2 male and 2 female, with a range age of 46–69 years. 3 of them died because of this invasive aspergillosis [one of them with *A. niger* (AN) also], 2 have been confirmed by necropsia and we are still waiting one result. The female patient alive suffered, besides the pulmonary aspergillosis, neuroaspergillosis. One case was attended in our ward due to cardiovascular problems, the reason for the rest was the H1N1v flu. None had surgery, transplanted or had any severe immunosuppression due to any cause prior admission. All of them were treated with corticosteroids (2 of them with 60 mg/day, and the other two with 160 mg/day and 240 mg/day. All dosis have been pondered to metilprednisolon). All of them suffered other inside-ICU infections: one was co-infected with *meticilin-resistant Staphylococcus aureus*, other one with *klebsiella* and *non albicans Candida (na C.), pseudomona aeruginosa* co-infected other patient, and finally, the only patient no overinfected with bacteria, who was also infected with na C. Environmental controls carried out with Merck® Microbiological Air Sampler MAS-100 demonstrated the presence of *AF* and *AN* in every area of our ward.

**CONCLUSIONS.** Our patients do not match the typical profile of patients with aspergillosis (patients who develop profound or prolonged neutropenia, AIDS, leukemia or lymphoma…), despite immunosuppression provoked the H1N1v flu in two of them, so we needed to find a common source of contamination. This was the environmental pollution caused by a remodeling of the hospital, bordering our area, and discovered by the department of preventive medicine. Once aware of this situation, we proceeded to the gradual closure of modules affected by this pollution, and repositioning of patients in other areas of care for patients at high risk. This, together with the works undertaken in the remodeling of the unit (HEPA filter replacement…) led us not to have more infected patients and after more environmental controls demonstrated the effectiveness of our measures.

## 0665

### TUBERCULOSIS IN THE INTENSIVE CARE UNIT IN PARIS AREA IN THE XXI CENTURY

S. Valade[1], B. Mégarbane[1], L. Raskine[2], N. Deye[1], F.J. Baud[1]

[1]Hôpital Lariboisière, Réanimation Médicale et Toxicologique, Paris, France, [2]Hôpital Lariboisière, Laboratoire de Bactériologie, Paris, France

**INTRODUCTION.** Tuberculosis remains a major concern worldwide in the XXI century.

**OBJECTIVES.** We aimed to know the circumstances of admission and outcome of patients for whom a diagnosis of tuberculosis was assessed in the intensive care unit (ICU).

**METHODS.** Retrospective one-centre study including all patients with a microbiological diagnosis of tuberculosis in the ICU during 2000–2009; results were expressed as median [25-75% percentiles]; univariate comparisons using Chi-square and Mann–Whitney tests; multivariate analysis using ascendant logistic regression with determination of Odds ratio (OR) and 95%-confidence intervals.

**RESULTS.** Forty-eight patients (35 M/13 F, 41 years [31–52], body mass index: 20.6 kg/m$^2$ [17.0–24.2], HIV+: 29%, homeless: 33%, SAPS2: 31 [22–50]) were included. Patients were originated from Africa (42%), Asia (19%), and Europe (39%). The reasons for ICU admission were respiratory (63%), neurological (33%), and cardiovascular (8%) failure. Features included significant weight loss (84%), fever (80%), conscious loss (54%), meningeal syndrome (19%), and hemoptysis (9%). Chest X-rays were abnormal (89%), showing alveolar condensations (52%), miliary (18%), pleurisy (28%), caverna (26%), and mediastinal lymph nodes (26%). Meningeal localization (21%, leucocytes: 336/mm$^3$ [216–372], lymphocytes: 91% [86–97], glucose: 1.6 mM [1.3–2.1], protein: 3.0 g/l [2.3–3.3], and positive Mycobacterium tuberculosis Polymerase Chain Reaction (50%) in the CSF) was accompanied by hydrocephalus in third of the cases. Diagnosis was based on direct examination (59%) and culture (100%) with a delay of 19 days [11–30]. Two strains were rifampicin-resistant. Supportive treatments included intubation (52%, duration: 8 days [3–21]), non-invasive ventilation (14%), and vaopressor infusion (norepinephrine, 33% and epinephrine, 25%). Mycobacterium tuberculosis quadritherapy was started in the ICU in only 70% of the patients, while diagnosis was assessed after ICU discharge in 30% of the cases. In these cases, patients were diagnosed with a community pneumonia (8/14), pleurisy (3/14), pneumocystis infection (1/14), acute pulmonary edema (1/14) and renal failure (1/14). Seventeen patients (35%) died in the ICU in relation to refractory hypoxemia (35%) and shock (65%). In a multivariate analysis, two independent variables were associated with tuberculosis-related death in the ICU ($p < 0.001$): vasopressor administration during 24 h (OR: 20.7 [3.7–116.7]) and increased respiratory rate ≥40/min on ICU admission (OR: 5.8 [1.2–28.0]).

**CONCLUSIONS.** Tuberculosis may still require ICU admission in the XXI Century in France leading to an elevated mortality rate (35%). Patient histories and clinical features are variable. Diagnosis is difficult and may only be assessed after ICU discharge (30%). On ICU admission, increased respiratory rate and cardiovascular failure requiring catecholamines are predictive of death.

## 0666

### SOURCES AND PATHOGENS INVOLVED IN SEVERE SEPSIS AND SEPTIC SHOCK AMONG NEUTROPENIC PATIENTS

A. Max[1], M. Legrand[1], J.-L. Donay[1], V. Peigne[1], V. Lemiale[1], M. Darmon[1], B. Schlemmer[1], É. Azoulay[1]

[1]Hôpital Saint-Louis, Paris Diderot University, Paris, France

**INTRODUCTION.** Severe sepsis and septic shock are frequent among neutropenic patients. Identifying the leading microorganisms identified in septic neutropenic patients is of paramount importance when considering the first line empirical antibiotic therapy.

**METHODS.** Observational cohort study over a 10-year study period.

**RESULTS.** 428 patients (51 years old [40–60], 40% female sex) were included. The underlying hematological/cancer conditions were acute leukemia (35.7%), lymphoma (31.7%) and solid tumors (16.5%). The hospital mortality rate was 49.8%. Duration of neutropenia before admission was 6 days [2–10] with an overall duration of 11 [8–16] days. The main clinical sites of infection were lungs (44%), abdomen (11%), catheters (7%) and the urinary tract (4%). Infections were microbiologically documented in 45% of the patients, clinically documented in 141 (32.9%) patients. Only 12% of the patients had a fever of unknown origin. Sources of bacteria in patients with microbiologically documented infections were blood cultures (81%), followed by respiratory tract (19%). Urine and catheters' tip cultures were less frequently contributive (7 and 6%, respectively). Gram-positive bacteria represented 23% of the documented infections. The 3 most commonly isolated bacteria were *Pseudomonas aeruginosa* (23%), *Escherichia coli* (23%) and *Staphylococcus aureus* (8%). Patients with multi-resistant bacteria (MRB, 22%) more often received inadequate antibiotic therapy (30 vs. 7%, p = 0.009). An invasive fungal infection was documented in 48 (11%) patients, including 27 invasive pulmonary aspergillosis and 11 candidemia. Only 3 (4.3%) of the 70 patients with solid tumors were found to have a fungal infection (3 candidemias). Virus were identified in 24 (5.6%) patients. During the 10 years study period, incidence of bacteraemia and MRB increased significantly whereas fungus and gram-positive bacteria-related infections decreased. Appropriate empirical antibiotic therapy increased from 87 (1998–2002) to 95% (2003–2008), (p 0.005).

**CONCLUSIONS.** In neutropenic patients with severe sepsis and septic shock, microbiological documentation occurs in 45% of the cases, chiefly with gram-negative bacteria. Blood stream infections are the leading cause of documented infections. The incidence of fungal infections was high in this cohort with predominant hematological patients. Studies are needed to refine risk factors for Pseudomonas aeruginosa or MRB as to increase likelihood of early adequate antibiotic therapy.

## 0667

### A POSITIVE REAL-TIME PCR PNEUMOCYSTIS JIROVECI ASSAY'S IN INTENSIVE CARE UNIT (ICU) PATIENTS: WHAT'S ELSE?

O. Guisset[1], M. D'almeida[2], X. Goux[2], F. Gabriel[2], D. Gruson[1], I. Accoceberry[2]

[1]University Hospital, Medical Intensive Care Unit, Bordeaux, France, [2]University Hospital, Mycology-parasitology Laboratory, Bordeaux, France

**INTRODUCTION.** *Pneumocystis jiroveci* (PJ) polymerase chain reaction (PCR) is now a quasi-systematic exam to explore ICU patients with pulmonary infiltrates [1], but cannot distinguish colonization from infection.

**OBJECTIVES.** To analyse and compare patients with negative conventional staining methods and real-time PCR positive assay for the detection of PJ, in ICU or not.

**METHODS.** We retrospectively reviewed patients with respiratory symptoms and/or pulmonary infiltrates and respiratory samples at Bordeaux University Hospital (CHU) between 2006 and 2009, i.e 3,231 analysis from 2,414 patients, looking for patients with negative conventional staining methods and real-time PCR positive assay for the detection of PJ [2]. Clinical, radiological and microbiological data of all patients with PCR positive PJ detection were analysed.

**RESULTS.** During a 4 years period, 36 patients were identified in ICU and 65 patients in general CHU population. In both groups, 90% were non HIV patients (55% with haematological malignancies, 20% solid tumors, 25% chronic respiratory pathologies), and 70% of them immunosupressed by medication (immunomodulators or long-term corticosteroids). The CD4+ lymphocytes count was lower in ICU population (105 vs. 162/mm$^3$). A PJ chemoprophylaxis existed only in 15%. The detection of PJ was realised on bronchoalveolar lavage (BAL) (64%) or bronchial sputum (38%) samples with the same efficiency and the same median cycle threshold (Ct) number (33 Ct) in ICU. Specific PJ treatment was engaged in 67% of ICU patients vs. 80% (80% trimethoprim-sulfamethoxazole) but bacterial pneumonia was concomitant for 15% of them versus 5% in general CHU population. There was a 50% day 28-mortality in ICU patients (with or without specific PJ treatment) versus 21%. Ct number was higher in dead ICU group (34 Ct) than in dead general CHU population (31 Ct).

**CONCLUSIONS.** In this retrospective study, we confirm the interest of PCR PJ assays in non-HIV immunocompromised patients, the equal sensibility of PCR on bronchial sputum or BAL in ICU for the detection of PJ [1]. The systematic research of PJ in all respiratory samples from ICU patients did not show PJ circulation in these patients. More than everywhere else, in ICU, it seems to be dangerous arguing colonization and not treating these patients with high mortality.

**REFERENCES.** 1. Azoulay E et al. Polymerase chain reaction for diagnosing Pneumocystis pneumonia in non-HIV immunocomised patients with pulmonary infiltrates. Chest. 2009;135:655–61.

2. Filliaux J et al. Accuracy of a routine real-time PCR assay for the diagnosis of Pneumocystis jiroveci pneumonia. J Microbiol Methods. 2008;75:258–61.

# Nosocomial infections: 0668–0681

## 0668

### OUTCOMES OF ACENETOBACTER INFECTIONS IN A TERTIARY CARE INDIAN ICU

M. Sircar[1], R. Gupta[1], R. Kaur[2], A. Gupta[1], S. Sengupta[2], N. Jain[1], S. Kumar[1], N. Chavhan[1], H. Vohra[1], V. Taneja[1], D. Nagar[1]

[1]Fortis Hospital, Pulmonology and Critical Care, Noida, India, [2]Fortis Hospital, Microbiology, Noida, India

**INTRODUCTION.** Multi drug resistant (MDR) Acinetobactor is a challenge to patient outcomes in intensive care units (ICU).

**OBJECTIVES.** Retrospective evaluation of outcome of MDR Acinetobactor infections in a tertiary care Indian ICU.

**METHODS.** Acinetobactor isolations for patients admitted to Medical-surgical ICU of Fortis Hospital, NOIDA, India from 1.1.2009 to 31.3.2010 were identified from laboratory records and clinical details were then obtained retrospectively from their case records.

**RESULTS.** During this period 1,477 patients were admitted and 1,247 cultures were sent. Acinetobacter baumanii was grown in 145 specimens from 77 patients (blood 24, central venous line tip (CVP) 4, respiratory tract specimens (RTS) 72, Urine 8 and wound swab 17). They were all resistant to amikacin, gentamicin, tobramicin, cefotaxime, ceftazidime, cefepime, imipenem, meropenem, piperacillin-tazobactum, ticarcillin–clavulanate, cotrimoxazole and ciprofloxacin. The confirmation of isolates (identification and susceptibility) was done by fully automated Microscan WalkAway 40 system (Siemens).

In 36 patients [male 30, mean ± SD (range) age 53.97 ± 21.7 (8–71) years, APACHE IV scores 53.97 ± 19.31 (18–112) and predicted mortality 15.45 ± 16.15 (1.28–70.42) %] with 64 positive cultures (blood 4, CVP 2, RTS 47, Urine 5 and wound swab 6) the isolation was considered as colonization and no change in antibiotics was contemplated. Of this 8 (22.2%) patients died, 2 self discharged and the remaining 26 were discharge alive. Based on National Healthcare Safety Network/CDC guidelines, diagnosis of infection was made in 41 patients [males 33, mean ± SD (range) age 56.34 ± 19.58 (16–93) years, APACHE IV scores 63.47 ± 21.86 (14–113) and predicted mortality 23.23 ± 17.07 (1.28–64.7) %] with 81 positive cultures (blood 20, CVP 2, RTS 45, Urine 3, swab 11). Based on in vitro susceptibility 29 patients (31 episodes) were treated with Tigecycline, Colistin or Polymyxin B. Despite treatment initiation at mean ± SD 3.51 ± 2.29 days after cultures were sent, 16 of 29 (55.17%) died. Another 10 patients died and 2 self discharged before culture reports were available. In all 26 of 41(63.4%) patients died in this group. The infected group was older (t test, p = 0.028), sicker (t test, p= 0.029) and had higher predicted (t test, p= 0.033) and actual mortality (63.4 vs. 22.2%) as compared to the colonized group.

**CONCLUSIONS.** All our isolates were MDR Acinetobactor baumanii that was similar to earlier Indian reports [1]. Mortality was 63.4% in our infected patients despite early initiation of appropriate antibiotics and this was more than the predicted mortality based on APACHE IV scores [2]. MDR forms of Acinetobactor are a known independent risk factor for mortality [3]. Newer early diagnostic techniques and treatments are needed.

**REFERENCES.** 1. Indian J Med Res. 2008;128:178.

2. Expert Opin Pharmacother. 2010;11:779.

3. Indian J Med Microbiol. 2006;24:39.

## 0669

### ANTIMICROBIAL POLICY ON INTENSIVE CARE UNIT AND CLOSTRIDIUM DIFFICILE INFECTION

S. Gupta[1], K. Ellis[2], M. Hawkins[1]

[1]Stirling Royal Infirmary, Anaesthetics, Stirling, UK, [2]Stirling Royal Infirmary, Infection Control, Stirling, UK

**INTRODUCTION.** Clostridium difficile infection (CDI) has gained a high profile in Scotland. To reduce CDI, a reduction in the use of ceftriaxone was advocated. However, this has been the first line antimicrobial for many patients with severe sepsis admitted to our ICU. Hence, there is pressure to change our antimicrobial policy despite conflicting studies regarding the risk of CDI in relation to specific antimicrobials[1]. The ICU is a nine-bedded, adult, mixed surgical/medical unit in a district general hospital. Our practice is to use broad spectrum drugs, then de-escalate after microbiological results and avoid prolonged courses of antimicrobials.

**OBJECTIVES.** To investigate whether recent antimicrobial prescribing in ICU was associated with *C. difficile* infection.

**METHODS.** Patients admitted to ICU for 48 h or more, between September 2005 and March 2009, were identified from the HELICS (Hospitals in Europe Links for Infection Control through Surveillance) database. All antimicrobials administered to these patients were recorded. The local infection control department's surveillance programme provided information on patients who subsequently had a stool sample positive for *C. difficile* toxin. Categorical data was analysed using Chi-squared or Fisher exact test.

**RESULTS.** We identified 913 patients, of which 18 (2%) subsequently had a *C. difficile* toxin positive stool sample (180 days post-ICU discharge in one case). Many patients received multiple antimicrobials, whilst 131 had none during their ICU stay (see Table 1).

**TABLE 1** IMPACT OF ANTIMICROBIALS ON CDI

| | Patient numbers | Toxin +ve (%) | Odds ratio | 95% Confidence interval | P value |
|---|---|---|---|---|---|
| No antimicrobials | 131 | 3 (2.3) | 1.19 | 0.34–4.19 | 0.7 |
| Ceftriaxone | 441 | 10 (2.3) | 1.34 | 0.52–3.44 | 0.6 |
| Piperacillin/Tazo | 194 | 7 (3.6) | 2.40 | 0.92–6.30 | 0.07 |
| Clarithromycin | 193 | 7 (3.6) | 2.31 | 0.88–6.05 | 0.08 |
| Metronidazole | 340 | 7 (2.1) | 1.07 | 0.41–2.79 | 0.88 |
| Vancomycin | 86 | 4 (4.7) | 2.83 | 0.91–6.80 | 0.08 |

**CONCLUSIONS.** In this cohort, the incidence of subsequent *C. difficile* toxin positive stool samples was low. Consistent with other studies [2], we have not found an association with administration of a specific antimicrobial. A care bundle approach with formal antimicrobial stewardship may have most impact on reducing CDI rates [3].

**REFERENCE(S).** 1. Thomas C et al. Antibiotics and hospital-acquired Clostridium difficile-associated diarrhoea: a systematic review. J Antimicrob Chemother. 2003;51:1339–50.

2. Manian FA et al. Is it Clostridium difficile infection or something else? A case control study of 352 hospitalized patients with new-onset diarrhoea. Southern Med J. 2007;100 (8):782–6.

3. Owens RC, Valenti AJ. Clostridium difficile-Associated Disease in the New Millenium. Inf Dis Clin Pract. 2007;15:299–315.

## 0670

### COLISTIN (POLYMYXIN E) IN THE TREATMENT OF MULTIDRUG-RESISTANT *PSEUDOMONA AERUGINOSA* IN THE ICU

C. Salinas-Martinez[1], A. Hernandez-Luna[1], C. Magana-Macias[1], C.I. Olvera[1], M. Poblano-Morales[1], J. Aguirre-Sanchez[1], J. Franco-Granillo[1].

[1]The American British Cowdray Medical Center, Intensive Care Unit, Mexico City, Mexico

**INTRODUCTION.** The prevalence of infection by Multidrug-Resistant *Pseudomona aeruginosa* (MDRP) increases mortality in critically ill patients. Colistin (Polymyxin E) is a peptide with bactericide activity against *P. aeruginosa*. Recommended dose for adults without renal impairment is 5 mg/kg/day; main adverse effect is nephrotoxicity in 14–25% [1].

**OBJECTIVES.** To evaluate the efficacy of Colistin in the treatment of MDRP.

**METHODS.** Observational retrospective study of patients files admitted to the ICU from January 2008 to July 2009 with positive cultures to MDRP who received Colistin. Following data was obtained: demographics, site of infection, site of positive cultures, time of cultures to become negative, data of inflammatory response (laboratory and clinical parameters) as well as antibiotics previously used.

**RESULTS.** We included 15 patients with MDRP: 54% female, with mean age of 57 ± 20 (16–77), APACHE II score 18 ± 8 (6–28) and SOFA score 10 ± 3 (4–14). Site of positive cultures were: lung (53%), abdomen (40%) and urinary tract (30%). Antibiotics previously used were meropenem (73%), vancomycin (73%), aminoglucosides (67%), linezolid (60%), cephalosporins (40%) and quinolones (33%). Colistin was started on day 5 after diagnosis and it was used for 17 ± 7 (6–30) days. There was a clinical improvement in 80% of the patients, with 53% of negative cultures (previously positive) within 48 h, 73% negative after 96 h and 87% after 244. Leukocytes diminished from 17,830 ± 7,084 (10,000–32,000) to 11,946 ± 4,533 (4,000–27,000) p = 0.01 on day 7. Procalcitonin diminished from 4.7 ± 7.8 (1–30) to 2.1 ± 3.9 (0.3–17) without statistical significance. Creatinin clearance was affected after treatment in 12% and mean initial value of 76.5 ± 15.7 (50–100) ml/min lowered to a final value of 63.4 ± 23.1 (13–95) ml/min (p value non-significant).

**CONCLUSIONS.** Colistin was an efficient treatment for MDRP as demonstrated by clinical and bacteriologic improvement, being renal impairment the main adverse effect.

**REFERENCES.** 1. Jian Li, Roger N. Colistin: the re-emerging antibiotic for multidrug resistant Gram Negative bacterial infections. Lancet Infect Dis. 2006;6:589–601.

## 0671

### IMPACT OF INFECTION/COLONIZATION BY ACINETOBACTER BAUMANNII IN HOSPITAL MORTALITY

S.G. Chaves[1], M. Câmara[2], J. Nóbrega[2], S. Freitas[3], R. Rodrigues[1], L. Brazão[1], R. Maul[2]

[1]Hospital Central do Funchal, Serviço de Medicina Interna, Funchal, Portugal, [2]Hospital Central do Funchal, Serviço de Medicina Intensiva, Funchal, Portugal, [3]Hospital Central do Funchal, Unidade de Investigação, Funchal, Portugal

**INTRODUCTION.** Acinetobacter is a gram negative coco-bacillus that in the past three decades has emerged as an important hospital pathogen worldwide. Several risk factors related to the host and to treatment, have been identified as predisposing to infection/colonization by this agent.

**OBJECTIVES.** To assess whether infection/colonization by Acinetobacter baumannii has an influence on hospital mortality and what is the impact of the different demographic and clinical variables on hospital mortality.

**METHODS.** Retrospective observational study. All patients admitted in a Central Hospital from January 2007 to December 2008 with the isolation of Acinetobacter baumannii (n = 89) were included. Clinical and demographic data analysed were age, gender, comorbidities, cause of admission, department of hospitalization, length of stay, length of stay until isolation of Acinetobacter, site and season of isolation, multidrug resistance (resistance to three or more classes of antibiotics), invasive procedures, antibiotic treatment and mortality. Patients were classified into two groups: Group A (GA)—Infected patients with clinical and analytical infection related to the site of isolation and to cultures in which the only microorganism was Acinetobacter (n = 29). Group B (GB)—Colonized patients without signs or symptoms of infection in whom Acinetobacter was isolated (n = 60). Statistical analysis was performed using the Chi square, Student t test, logistic regression, Spearman correlation and Cox regression curves. A $p$ value $< 0.05$ was considered significant. The data was analysed with SPSS 14.0.

**RESULTS.** The results for Groups A and B were respectively as follows: Age 63.7 ± 17.7 and 67.5 ± 17.5 years, $p = 0.342$; Gender (male/female) 62.1/37.9% and 56.7/41.6%, $p = 0.628$; Mortality 69 and 46.7%, $p = 0.048$; Comorbidities 82.8 and 78.3%, $p = 0.626$; Invasive procedures 48.2 and 36.7%, $p = 0.296$; Hospital length of stay 54.2 ± 62.4 and 44.7 ± 51.3 days, $p = 0.449$ and Hospital length of stay until isolation 23.8 ± 23.7 and 22.9 ± 36.7 days, $p = 0.911$. Multivariate analysis showed that only age and infection have an impact on hospital mortality (OR 1.072 CI 95% (1.032–1.114) $p < 0.00001$ and OR 4.683 CI 95% (1,431–15,326) $p = 0.011$, respectively). The $p$ value for survival between Groups according to Kaplan–Meier curves was 0.048.

**CONCLUSIONS.** Mortality difference between infected and colonized patients was statistically significant. Regarding independent variables, age and infection were associated with an increased risk of mortality. There was no difference in survival between colonized and infected patients (p = 0.05).

**REFERENCE(S).** Munoz-Price; Weinstein; Acinetobacter Infection, NEJM. 2008;358: 1271–1281. Villers D, Espaze et al. Nosocomial *Acinetobacter baumannii* infection: microbiological and clinical epidemiology. Ann Intern Med. 1998;129:182–9

## 0672

### CONTINUING REDUCTION IN ICU ACQUIRED MULTIRESISTANT ACINETOBACTER WITHOUT INCREASE IN OTHER MULTIRESISTANT BACTERIA WITH USE OF SELECTIVE DIGESTIVE DECONTAMINATION INCLUDING VANCOMYCIN FOR INTUBATED CRITICALLY ILL PATIENTS

D.T. Doberenz[1], S. Konda[1], N. Farzam[1], R. Meacher[1]

[1]Charing Cross Hospital, Intensive Care Unit, London, UK

**INTRODUCTION.** Selective Digestive Decontamination (SDD) can reduce colonization with multiresistant bacteria in critically ill patients [1, 2]. SDD including colistin, tobramycin, vancomycin and nystatin to the mouth and by gastric tube has been administered to patients intubated and ventilated >48 h in our Intensive Care Unit (ICU) from January 2007, together with expanded microbiological screening for cephalosporin resistant gram-negative bacteria (RGNB), *Methicillin Resistant Staphylococcus Aureus* (MRSA) and *Vancomycin Resistant Enterococcus* (VRE) (mainly MRSA screening before 2007). We previously reported significant reduction in acquisition of multi-resistant *Acinetobacter baumannii* (*MRAB*) and non significant trends to less RGNB, MRSA and VRE acquisition in the first 6 months of SDD.

**OBJECTIVES.** Extended analysis of ICU-acquisition of multi-resistant bacteria before and after introduction of SDD.

**METHODS.** Retrospective observational study of all patients intubated and ventilated >48 h in our ICU in the first 6 months of 2005 (without SDD) and 2009 (with SDD). Data were obtained from ICU and hospital databases. The numbers of patients with ≥1 diagnostic or screening sample positive for MRAB, RGNB, MRSA or VRE from ≥48 h after ICU admission to ≤48 h after ICU discharge were analyzed as proportions of all patients intubated and ventilated >48 h in each 6 months' period and compared to existing data from 2006 and 2007.

**RESULTS.**

COMPARISON OF ACQUIRED MICROBIOLOGY

| | Before introduction of SDD | | After introduction of SDD | |
|---|---|---|---|---|
| | 1 January–30 June 2005 | 1 January–30 June 2006 | 1 January–30 June 2007 | 1 January–30 June 2009 |
| Total patients intubated and ventilated >48 h | 114 | 114 | 125 | 147 |
| Patients with ICU acquired MRAB | 30 (26.3%) | 25 (21.9%) | 5 (4.0%)* p <0.001 vs 2005/06 | 1 (0.7%)* p <0.001 vs 2005/06 |
| Patients with ICU acquired RGNB | 18 (15.8%) | 9 (7.9%) | 9 (7.2%) | 15 (10.2%) |
| Patients with ICU acquired MRSA | 7 (6.1%) | 6 (5.3%) | 1 (0.8%) | 1 (0.7%) |
| Patients with ICU acquired VRE | 9 (7.9%) | 10 (8.8%) | 5 (4.0%) | 15 (10.2%) |

**CONCLUSIONS.** In our ICU the use of SDD has been associated with a highly significant reduction in acquisition of previously endemic MRAB and a trend to reduced acquisition of MRSA. The slight rise in ICU acquired RGNB and VRE in the first 6 months of 2009 may be partly due to increasing compliance with microbiological surveillance. Longer term observation of the effect of SDD on patients' microbiological colonization during and after a stay on our ICU is necessary and on-going.

**REFERENCE(S).** 1. De Smet A et al. Decontamination of the digestive tract and oropharynx in ICU patients. NEJM. 2009;360:20–31

2. Agusti C et al. Short-term effect of the application of selective decontamination of the digestive tract on different body site reservoir ICU patients colonized by multi-resistant *Acinetobacter baumannii*. J Antimicrob Chemother. 2002;49:205–8.

3. Doberenz D et al. Reduction of ICU acquired multiresistant Acinetobacter without increase in other multiresistant microbial pathogens with introduction of SDD. Int Care Med. 2008;34 (S1):S184.

## 0673

### RISK FACTORS AND OUTCOME OF *ACINETOBACTER BAUMANNII* INFECTION IN PATIENTS WITH HEMATOLOGICAL MALIGNANCIES ADMITTED TO INTENSIVE CARE UNIT

M. Turkoglu[1], E. Isıktas[1], O. Guzel Tunccan[2], G.U. Erdem[1], M. Dizbay[2], G. Aygencel Bıkmaz[1], M. Yagci[3], G. Sucak[3]

[1]Gazi University School of Medicine, Department of Internal Medicine, Medical Intensive Care Unit, Ankara, Turkey, [2]Gazi University School of Medicine, Department of Clinical Microbiology and Infectious Diseases, Ankara, Turkey, [3]Gazi University School of Medicine, Department of Internal Medicine and Hematology, Ankara, Turkey

**INTRODUCTION.** Multi drug resistant *Acinetobacter baumannii* is a growing concern in intensive care units (ICU). In many studies it has been shown to be related with increased mortality [1]. However it is still controversial whether this mortality is due to *A. baumanii* infection per se or to the underlying diseases. Hematological malignancy is one of the most important underling disease that makes ICU patients susceptible to infections. So we designed a study in this spesific group of ICU patients to analyze the clinical course of *A. baumanii* infection in this group.

**OBJECTIVES.** To investigate incidence, risk factors and mortality of *A. baumannii* infection in patients with hematological malignancies admitted to ICU.

**METHODS.** We did a retrospective analysis of prospectively collected data of all patients with hematological malignancies admitted to a medical ICU of a university hospital from April 2007 to April 2010.

**RESULTS.** One hundred thirty one patients with hematological malignancies were included in the study. The most common hematological malignancy was leukemia (51%) and 25 (19%) patients had undergone haematopoietic stem cell transplantation before ICU admission. Thirty-seven patients (28%) developed 41 *A. baumannii* infections during ICU stay. The most common seen infection due to *A. baumannii* was pneumonia (66%) followed by bloodstream infection (24%), urinary tract infection (5%) and skin-soft tissue infection (5%). The type of hematological malignancy and the severity of neutropenia were not associated with nosocomial *A. baumannii* infections. Increased age, prolonged ICU stay, presence of nasogastric tube and prior use of imipenem antibiotic were found to be independent risk factors for the acquisition of *A. baumannii* infection in multivariate analysis (p = 0.017, p = 0.000, p = 0.007, p = 0.008 respectively).The mortality rate was found to be higher in patients with *A. baumannii* infection (81%), then the others (57%) (p = 0.015). Invasive mechanical ventilation (p = 0.000) and sepsis occured in the ICU (p = 0.007) but not *A. baumannii* infection were independently correlated with mortality.

**CONCLUSIONS.** In ICU patients with heamatological malignancies increased age, prolonged ICU stay, presence of nasogastric tube and prior use of imipenem antibiotic were major risks for *A. baumannii* infection. Although the mortality rate was very high in these patients, presence of this infection was not correlated with mortality.

**REFERENCE** 1. García-Garmendia L, Ortiz-Leyba C, Garnacho-Montero J, Jiménez-Jiménez FJ, Monterrubio-Villar J, Gili-Miner M. (1999) Mortality and the increase in length of stay attributable to the acquisition of Acinetobacter in critically ill patients. Crit Care Med 27:1794–9.

## 0674

### HIGH BED OCCUPANCY IN INTENSIVE CARE DOES NOT LEAD TO AN INCREASE IN METHICILLIN-RESISTANT STAPHYLOCOCCAL AUREUS ACQUISITION

S.C. Boyle[1], K. Ellis[2], A. Morgan[3], A. Longmate[4], M. Hawkins[4]

[1]Forth Valley NHS Trust, Department of Anaesthesia and Critical Care, Stirling, UK, [2]Forth Valley NHS Trust, Department of Aneasthesia and Critical Care, Stirling, UK, [3]Forth Valley NHS Trust, Department of Anaesthetics and Critical Care, Stirling, UK, [4]NHS Forth Valley, Department of Anaesthesia and Critical Care, Stirling, UK

**INTRODUCTION.** In the UK, methicillin-resistant *Staphylococcal aureus* (MRSA) is a high profile infection that can affect patients in the intensive care unit (ICU). Concern exists about the impact of high rates of bed occupancy on the incidence of MRSA acquisition [1].

**OBJECTIVES.** To determine whether MRSA acquisition was related to high bed occupancy in a 9 bedded, adult, mixed medical/surgical ICU in a district general hospital in Scotland.

**METHODS.** We reviewed all patients admitted to our ICU from September 2005 to October 2008 inclusive. Information was retrieved on bed occupancy and MRSA acquistion. Patients with known MRSA prior to ICU admission and those with a positive test within the first 48 h were excluded. Patients who became MRSA-positive 48 h after admission were included as new acquisitions. Bed occupancy was based upon the number of hours patients were nursed on ICU each day, and was summed and expressed as a percentage of the maximum available (i.e. 24 × 9 = hours per day × maximum number of beds). Bed availability changed during the study period and is accounted for in the analysis. High occupancy was defined as greater than 87.5% as used in a previous study [1]. When occupancy exceeded 100%, patients were nursed elsewhere in the hospital until an ICU bed was available. The ICU layout remained the same throughout the study period, with no reduction in bed spacing when occupancy was high.

**RESULTS.** There were 1,157 study days, of which 415 were high occupancy (>87.5%) and 742 were low occupancy days (<87.5%). Of the 1,447 patients admitted, 102 had known MRSA prior to, or within 48 h of admission. Another 38 patients acquired MRSA during their ICU stay, with 19 on high occupancy and 19 on low occupancy days. The frequency of MRSA acquisition was 0.00594 per patient day during high occupancy and 0.00425 during low occupancy. The incidence rate difference was 0.001689 (95% confidence interval −0.0016 to 0.0050), producing a non-significant p value of 0.154.

**CONCLUSIONS.** From our data, there is no evidence to suggest that MRSA acquisition is more likely to occur on days when ICU bed occupancy is high.

**REFERENCE(S).** 1. Howie AJ, Ridley SA. Bed occupancy and incidence of Methicillin-resistant *Staphylococcal aureus* infection in an intensive care unit. Anaesthesia 2008;**63**:1070–3.

**ACKNOWLEDGMENT**. We would also like to thank Suzanne Lloyd for her statistical input.

## 0675

### IN VITRO ACTIVITY OF TIGECYCLINE IN CARBAPENEMASE-POSITIVE *KLEBSIELLA PNEUMONIAE* CLINICAL STRAINS IN ICU PATIENTS

A. Kyriakaki[1], A. Xanthaki[1], E. Papagrigoriou[1], A. Tsiringa[1], V. Skandami[1], M. Balla[2], M. Papanikolaou[2], M. Toutouza[1]

[1]Ippokratio General Hospital Athens, Department of Microbiology, Athens, Greece, [2]Ippokratio General Hospital Athens, Intensive Care Unit, Athens, Greece

**INTRODUCTION–OBJECTIVES.** Resistant microorganisms are of a major concern in hospitalized patients. Our purpose was to determine the susceptibility of tigecycline against serine-carbapenemase (KPC) and metallo-b-lactamase (MBL) positive *Klebsiella pneumoniae* clinical strains.

**METHODS.** A total of 61 carbapenemase-positive *K. pneumoniae* strains (40 KPC-postive and 21 MBL-positive) were isolated from ICU patients in our hospital between November 2008 and October 2009. Isolates originated from blood (8/61), bronchial secretions and bronchoalveolar lavage (19/61), drainage fluids and wounds (24/61) endovascular catheter tips 5/61 and urine (5/61). Species identification was performed by VITEK II method and susceptibility testing to antimicrobial agents by Kirby–Bauer according to CLSI instructions. Carbapenemase production was identified by the Hodge-Test and E-test MBL method. Susceptibility to tigecycline was determined by disk diffusion method (Kirby–Bauer) and E-test method (AB-BIODISK,SOLNA,SWEDEN). Zone sizes and MIC interpretive criteria followed published guidelines established by US Food and Drug Administration (FDA) for tigecycline.

**RESULTS.** Fifty-five out of sixty-one (90.1%) *K. pneumoniae* isolates (MBL or KPC producers) were susceptible to tigecycline with MICs ranging from 0.5 to 2 g/ml. Among the other isolates, 4/61 (6.7%) showed intermediate susceptibility to tigecycline with MICs 3 and 4 g/ml and 2/61 (3.3%) were resistant to tigecycline with MICs ranging from 8–12 g/ml. Results of both methods (K.B., E-test) were in concordance.

**CONCLUSIONS.** Our results show that tigecycline has very good activity against multidrug resistant *K. pneumoniae* strains with carbapenemase production and seems to be promising for the treatment of serious nosocomial infections in ICU patients.

## 0676

### CLINICAL AND ENVIRONMENTAL SAMPLING OF AN ADULT INTENSIVE CARE UNIT IN GREECE

A. Xanthaki[1], A. Kyriakaki[1], A. Paraskeva[2], A. Karaferi[1], V. Skandami[1], M. Balla[2], M. Papanikolaou[2], M. Toutouza[1]

[1]Ippokratio General Hospital Athens, Department of Microbiology, Athens, Greece, [2]Ippokratio General Hospital Athens, Intensive Care Unit, Athens, Greece

**INTRODUCTION–OBJECTIVES.** Epidemiologic control in an ICU environment is a key-component leading to a more successful prevention of nosocomial infections. We conducted this study in order to identify (1) bacterial contamination on inanimate surfaces and hands of healthcare workers (2) colonization or infection in patients.

**METHODS.** At a given day ICU surfaces were screened and included ventilator tube surfaces, bedrails, bedside monitors, cardiograms, dressing trolleys, sinks, telephones, wall oxygen humidifiers etc. Environmental sites were cultured by using sterile cotton swabs inoculated into thioglucolate broth and were incubated aerobically at 37°C for 48 h. At the same day, hand impressions were taken from all ICU staff and also blood, bronchial secretions and urine were cultured from all patients. Microorganism identification was performed by the VITEK-II method and susceptibility testing by the disk diffusion testing according CLSI. Some were further evaluated by E-test. Production of extended spectrum beta-lactamases was determined by the double disk synergy test and metallo-beta-lactamase production by the EDTA-synergy test.

**RESULTS.** A colistin-resistant, MBL positive *Klebsiella pneumoniae* strain with an identical resistant phenotype was isolated lated from blood and ventilator tube surface of the same patient. A multiresistant *K. pneumoniae* strain with the same phenotype and also production of ESBLs and MBLs was isolated from bedrails and bedside monitor of another patient. A multiresistant, carbapenem resistant *Pseudomonas aeruginosa* of an identical phenotype was cultured from the bronchial secretions and ventilator tube of a patient, the ventilator tube of another and the bronchial secretions of a third patient. Environmental sampling also revealed the presence of 11 Enterococcus strains 3 of which were vancomycin resistant, a multiresistant *Pseudomonas putida* and also *Candida parapsilosis* from a dressing trolley shelf. A multiresistant *Acinetobacter baumanii* was also cultured from the hands of a healthcare worker.

**CONCLUSIONS.** The bacteriological profile of the ICU revealed the presence of highly resistant microorganisms exhibiting multiple and complicated resistance mechanisms. The fact that identical phenotypes were observed, is an indication of a possible genetic relation among some of these strains. These isolates will further be analysed by PCR and PFGE methodology. After survey, hand antisepsis and infection control measures were encouraged.

## 0677

### NASAL AND CUTANEOUS COLONIZATION AMONG INTENSIVE CARE UNIT PATIENTS: A 3-MONTH PERIOD STUDY

A. Kyriakaki[1], A. Xanthaki[1], M. Balla[2], M. Papanikolaou[2], E. Drimousis[2], E. Zampeta[1], A. Tsiringa[1], E. Fragkoulis[2], M. Toutouza[2]

[1]Ippokratio General Hospital Athens, Department of Microbiology, Athens, Greece, [2]Ippokratio General Hospital Athens, Intensive Care Unit, Athens, Greece

**INTRODUCTION–OBJECTIVES.** To determine the frequency of bacterial colonization (nasal and cutaneous) of patients in the intensive care unit and also the risks of infection.

**METHODS.** During a 3-month period 21 adults admitted to ICU were screened for nasal and skin (inguinal area and armpit) colonization. The ICU has 2 boxes and 5 beds on the open ward. Swabs were obtained from each patient once weekly. Microorganism identification was performed by the VITEK II system. Antibiotic susceptibility was determined by disk diffusion method according to CLSI guidelines, by E-test, E-test MBL and Hodge-test for carbapenemase production and double disk synergy test for the production of extended spectrum beta-lactamases.

**RESULTS.** 1. Colonization by Gram-negative bacteria was found in 16/21(76%) of the patients: We identified cutaneous colonization with *Klebsiella pneumoniae* with carbapenemase activity (MBL or KPC-positive) colistin sensitive or resistant in 6/21 (28.5%)of the patients, multi-drug resistant *Pseudomonas aeruginosa* 3/21 (14.3%), *Acinetobacter baumannii* 5/21(23.8%), *Stenotrophomonas maltophilia* 1/21 (4.8%) and Proteus mirabilis with extended spectrum b-lactamase production 1/21(4.8%). Heavy and mixed colonization correlated with prolonged ICU stay and patients were usually colonized at examined body sites simultaneously. Clinical cultures at the study period revealed colonization or infection of the lower airways in half of the patients with nasal colonization. 2. MRSA nasal colonization was found in 3/21 (14.2%) patients. In one case MRSA colonization preceded MRSA VAP pneumonia. 3. Candida colonization occurred in 13/21 (62%) patients.

**CONCLUSIONS.** Nosocomial infection surveillance is crucial for infection control. Prolonged ICU stay correlated with a high risk of colonization with multiresistant strains.

## 0678

### FIRST OUTBREAK OF MULTIDRUG-RESISTANT *KLEBSIELLA PNEUMONIAE* IN AN ICU OF A GREEK UNIVERSITY HOSPITAL

I. Soultati[1], E. Anastasiou[1], M. Zouka[1], P. Partala[1], E. Geka[1], E. Euthimiou[1], E. Protonotariou[2], M. Giannakou[1]

[1]AHEPA Hospital, ICU, Thessaloniki, Greece, [2]AHEPA Hospital, Microbiology, Thessaloniki, Greece

**INTRODUCTION.** The emergence of plasmid-mediated carbapenem-hydrolysing $\beta$-lactamases and their spread among Gram-negative species, mainly in *Klebsiella pneumoniae* is a threat for the ICU.

**OBJECTIVES.** The characteristics of an outbreak caused by a *K. pneumoniae* strain, resistant to carbapenem (imipenem and meropenem) in a university hospital ICU are described.

**METHODS.** Bacterial identification and initial antimicrobial susceptibility testing were performed by the VITEK 2-automated system (bioMérieux, France). All isolates were initially screened for the presence of metallo-$\beta$-lactamases (MBLs) and *K. pneumoniae* cabapenemases (KPCs) using phenotypic tests. MBL production was tested with the combined synergy test between imipenem and EDTA and the presence of KPC was performed with the double disc synergy test between boronic acid and meropenem. The presence of KPC strains was selectively performed using PCR. Unpaired t test was used for statistical analysis.

**RESULTS.** The outbreak involved 22 patients urgently admitted in the ICU from February 2009 till March 2010. Overall reasons for admission were: ARF (22.7%, n = 5), coma (40.9%, n = 9), trauma (13.6%, n = 3) and MOFS (22.7% n = 5). *K. pneumoniae* strains were isolated from the urinary tract (31.8%, n = 7), respiratory tract (31.8%, n = 7), blood (22.7%, n = 5) and other (13.6%, n = 3) after the second week of ICU stay. All patients had prolonged hospitalization and antibiotic administration prior to *K. pneumoniae* appearance. The antibiotics mainly used were beta lactamases and cephalosporins. The patients' data according to isolated strains are referred to in Table 1.

**TABLE 1**

| *K. pneumoniae* | Age (years)* | APACHE II* | GCS* | SOFA* | Mortality |
|---|---|---|---|---|---|
| MBL (n = 13) | 58.2 ± 18.5 | 16.2 ± 7.3 | 11.5 ± 4 | 4.7 ± 2.6 | 38.5% (n = 5) |
| KPC (n = 9) | 63.7 ± 13.2 | 16.4 ± 5.4 | 11.8 ± 3.4 | 5.6 ± 2.6 | 44.4% (n = 4) |

* Mean ± SD

Multidrug resistance characterized the studied isolates, with colistin and gentamycin being the most active agents. All KPC isolates carried $bla_{KPC-2}$ genes.

**CONCLUSIONS.** The outbreak of *K. pneumoniae* infections was associated with a significant mortality. The prevalence of $bla_{KPC-2}$ genes producing *K. pneumoniae* did not coincide with a decreasing prevalence of MBL producing isolates. The presence of $bla_{KPC-2}$ genes poses major therapeutic as well as infection control problems. Our efforts should focus on rational use of available antibiotics and enhancement of infection control measures.

**REFERENCE** Pournaras S et al. Clonal spread of KPC-2 carbapenemase-producing *Klebsiella pneumoniae* starins in Greece. J Antimicrob Chemother. 2009;64(2):348–52

**GRANT ACKNOWLEDGMENT.**

## 0679

### NOSOCOMIAL OUTBREAK DUE TO CLONAL ESBL KLEBSIELLA STRAIN AT A INTENSIVE CARE UNIT

M. Nieto-González[1], J. del Diego-Salas[1], J.V. Hernández-Rodriguez[1], M.V. De la Torre-Prados[1], F. Hidalgo-Gómez[1], M. Ortega[1]

[1]Hospital Clinico Virgen de la Victoria, Málaga, Spain

**INTRODUCTION.** *Klebsiella pneumoniae* (KP) is an important cause of nosocomial infection because of the microorganism's extraordinary capacity for multiple antibiotic resistance. KP easily acquire extended-spectrum b-lactamases (ESBLs). Several studies suggest some ways that can decrease the prevalence of ESBL KP strains: reduce the use of cephalosporins, better hand hygiene etc. However, the successful management of these outbreaks remains controversial.

**OBJECTIVES.** To describe the epidemiological and clinical characteristics of patients who suffered these infections/colonizations. To describe the antibiogram characteristics of the ESBL KP.

**METHODS.** A retrospective study of cases admitted to ICU with this type of infection and/or colonization. We included all patients admitted in our ward during the outbreak. All colonization samples were taken by the department of preventive medicine and the results analysed by the department of microbiology. We evaluated the risk factors found in the systematic revision for this topic made by the Agency for Health Technology Assessment (AETSA) of Andalucía.

**RESULTS.** We found 7 infected patients and 6 colonized since October 2009 and March 2010. 9 (69.2%) were male and 4 female (30.8%). Average age was 55 (median 53.0). 8 (61.5%) presented chronic disease, mainly diabetes (23.1%) and hypertension (15.4%). According to APACHE scale, 5 of these patients had a predicted probability of death higher than 60%, only 1 (7.7%) died inside our ward. Main infection was pneumonia (42.8%). Average stay were 34.85 days (median 13.0). 12 (92.3%) needed mechanical ventilation, and in 10 cases (77.9%) it was for 5 days or more (maximum 56 days). 8 patients required parenteral nutrition, in 5 of them (62.5%) it took, at least, 11 days since the beginning of it to acquire the germ. All the patients had a central catheter placed in the moment of ESBL KP isolation. All of them were treated with empiric antibiotic treatment; 7 (53.9%) of them with cephalosporins (cefuroxim etc.), 2 (15.4%) with carbapenems, 2(15.4%) with quinolons, 1 (7.7%) with aminoglucosids and 1 with piperacillin/tazobactam. No one was treated with vancomicin. Up to 9 even with 4 different antibiotics. The outbreak was caused by a single type of clone of ESBL KP. It was resistent to all quinolons and cephalosporines except cefoxitin. In two patients it was also found resistance to all carbapenems.

**CONCLUSIONS.** According to AETSA, our patients match the typical profile of patients with ESBL KP (males, high antibiotic pressure, invasive procedures etc.). And despite not being clear death rates for ESBL KP, ours is low, 1 patient (7.7%). Measures such as cohorts isolation, hand washing protocols and routine sampling colonization helped to minimize the consequences. We have designed a database for further and deeper analysis, which will help us to carry out more effective actions in similar situations.

## 0680

### INFECTIONS WITH METALLO-B-LACTAMASE (MBL)-PRODUCING *KLEBSIELLA PNEUMONIAE*: CLINICAL FEATURES OF A NOSOCOMIAL OUBREAK IN A SPANISH INTENSIVE CARE UNIT

B. Balandin Moreno[1], B. Isidoro Fernández[2], G. Vazquez Grande[1], M.Á. Romera Ortega[1], S. Alcántara Carmona[1], L. Álvarez Martínez[1]

[1]Puerta de Hierro Majadahonda, Intensive Care Unit, Madrid, Spain, [2]Puerta de Hierro Majadahonda, Preventive Medicine, Madrid, Spain

**INTRODUCTION.** Carbapenem resistant *Klebsiella pneumonie* (KP) is an emerging pathogen and with high mortality. The limited therapies options is a concern in ICU.

**OBJECTIVES.** We describe the clinical features of a nosocomial outbreak of MBL-producing KP in a ICU in Madrid, Spain.

**METHODS.** From July 2009 to April 2010, 21 patients were infected and/or colonized with MBL-producing KP. The clinical and epidemiological features, and outcome were prospectively analysed.

**RESULTS.** Among the 21 pts, 8 were infected and 13 were colonized with MBL-producing KP. The Metallo-B-LactamasE (MBL) VIM-1 (integron 1) were isolated in all cases. It showed resistance to cefotaxime (100%), ciprofloxacin (100%), imipenem (100%), meropenem 100%) and amikacin (95%); most isolates were susceptible to colistin (95%) and tigecycline (100%).

Among the 21 pts, 13 were men and the mean age was 56.9 years. All of them were hospitalised in a medical ICU. Mean APACHE II score was 19.6. The mean length of stay to the first isolation of MBL-producing KP was 26.5 days (4–90). All patients have been previously treated with broad-spectrum antibiotics such as carbapenems (66%), third generation cephalosporin (66%), quinolones (62%), piperacillin/tazobactam (43%) or aminoglycosides (14%).There were 10 infections in 8 patients: pneumonia (4), UTI (3), catheter-related bacteremia (2), and ventriculitis (1). 7 patients received antibiotic directed therapy with tigecycline and colistin (6) or tygecicline (1). One patient with UTI received no treatment. Among infected patients the overall mortality was 25% (2/8), and was due to the MBL-producing KP in 2 patients with pneumonia. Among the 13 colonizated patients the most frequent sites of isolement were rectal swab (7), urine (6) and tracheal aspirate (5). The mortality among colonizated patients was 30.7% (4/13).

**CONCLUSIONS.** MLB-producing KP are emerging in Spain. This bacteria can produce severe nosocomial infections associated with a high mortality. We have also observed a higher proportion of colonizated asymptomatic patients. Antibiotic multiresistance is of concern because of the limited therapeutic options for treatment of these infections.

## 0681

### HEPATIC DYSFUNCTION OR FAILURE FAVOURS ICU-ACQUIRED INFECTION

P. Massion[1], D. Ledoux[1], P. Damas[1]

[1]University Hospital Centre Liege, General Intensive Care, Liège, Belgium

**INTRODUCTION.** It is well known that hepatic dysfunction may be provoked by septic shock which occurs in 30–50% of ICU-acquired infection.

**OBJECTIVES.** The present study was to look for the time dependant relationship between hepatic dysfunction or failure as assessed by the hepatic SOFA score (score 1–2 for dysfunction; score 3–4 for failure) and the severity of ICU-acquired infection.

**METHODS.** During 4 years (2003–2007), 2,422 patients hospitalized for more than 2 days in the ICU of CHU Sart-Tilman were studied.

**RESULTS.** They were 67 year-old (53–76), mean SAPS II score was 38.7 ± 14.3. There were 784 patients hospitalized for scheduled surgery, 597 for emergency surgery, 302 after trauma and 739 for medical reasons. Mean ICU length of stay was 7 days (4–15 IQR). ICU mortality was 17.3 and hospital mortality 23.9%.

On admission, 1876 (77%) patients had no hepatic dysfunction, 456 (19%) suffered from dysfunction and 90 (4%) from hepatic failure. Before any ICU-acquired infection, 408 other patients developed at least a hepatic dysfunction. Table 1 shows the number of patients with or without failure or dysfunction, the rate of ICU-acquired infection, the rate of septic shock, the hospital mortality and the number of infected patients with an increase in their hepatic SOFA score.

**TABLE 1**

| Hepatic SOFA score before ICU-acquired infection | Number of patients before ICU-acquired infection (%) | Patients with ICU-acquired infection (%) | Rate of septic shock (%) | Hospital mortality (%) | Number of infected patients with increase ≥ 1 in the Hepatic SOFA score (%) |
|---|---|---|---|---|---|
| 0 | 1468 (60.6) | 25 | 20.8 | 6.6 | 57 (3.9) |
| 1–2 (dysfunction) | 804 (33.2) | 33.2 | 34.1 | 20.6 | 47 (5.8) |
| 3–4 (failure) | 150 (6.1) | 38% (+52%) P=0.0012 | 57.9% (+ 278%) P <0.0001 | 36 P <0.0001 | 5 (3.3) |

The presence of hepatic dysfunction or failure worsened the rate of infection and especially the severity of infection. Hospital mortality increased accordingly. However only 57 new patients developed a hepatic dysfunction. During the ICU stay 173 patients acquired a liver failure, only 23 being acquired after ICU-acquired infection (13.3%).

**CONCLUSIONS.** The relationship between liver dysfunction during ICU stay and ICU-acquired infection mainly describes a link from the previous to the latter and not the opposite. Hepatic failure during ICU stay predisposes to ICU infection and increases its severity rather than to be a consequence of it.

# ICU nutrition 1: 0682–0695

## 0682

### NUTRITION SUPPORT PRACTICES IN A LARGE MULTIDISCIPLINARY PEDIATRIC INTENSIVE CARE UNIT

U. Kyle[1], N. Jaimon[1], J. Coss-Bu[1]

[1]Texas Children's Hospital/Baylor College of Medicine, Pediatrics, Houston, USA

**INTRODUCTION.** Critically ill children and especially infants in the pediatric intensive care unit (PICU) are at high risk of underfeeding. Recent studies suggest that calorie deficit is an indicator of worse outcome.

**OBJECTIVES.** To review clinical nutrition suppport practices in a large multidisciplinary PICU.

**METHODS.** Retrospective chart review of patients admitted to PICU for at least >48 h. All intravenous fluids, parenteral and enteral nutrition for the first 5 days (5D) were analyzed. Resting energy expenditure (REE) and protein needs were estimated by the Schoefield equation [1] and The American Society of Parenteral and Enteral Nutrition (A.S.P.E.N.) Clinical Guidelines [2], respectively. Results are mean ± SD.

**RESULTS.** There were 240 patients identified, with 171 (sex M/F 106/65) being in the PICU >5D for a total length of stay of 9 ± 7 days, with age 5 ± 6 year; admission Pediatric Risk of Mortality III (PRISM) and Pediatric Logistic Organ Dysfunction (PELOD) scores were 6 ± 5 and 9 ± 8, respectively. By day 5, 95 patients were on mechanical ventilation and 18 on inotropic support. Estimated REE for <2 year, n = 90; 2–5 year, n = 25; 6–12 year, n = 29; and >13 year, n = 27; was 53, 52, 36 and 30 kcal/kg/day, respectively. Average 5D energy intake was 43, 29, 16 and 16 kcal/kg/day, respectively (paired t test all $p < 0.001$). Estimated protein needs for <2, 2–5, 6–12 and >13 year was 2.5, 1.75, 1.7 and 1.5 g/kg/day; average 5D protein intake was 0.9, 0.7, 0.5 and 0.5 g/kg/day, respectively (paired t test all $p < 0.001$). Non-intubated patients (42% of the group) for the 5D were more likely to be provided <50% of estimated energy needs (pt days = 922, OR 2.3, CI 1.7–3.0) than intubated patients. Patients on inotropes (15% of the group) for the 5D were more likely not to be fed enterally (pt days = 963, OR 2.2, CI 1.5–3.2) than patients not receiving inotropes.

**CONCLUSIONS.** Between 42 to 83% of energy and 27 to 39% of protein needs were met during the first 5 days of PICU stay. Non-intubated patients and patients receiving inotropes are a greater risk for underfeeding. Critically ill children are at significant risk for underfeeding. Further efforts should be made to meet energy and protein needs of PICU patients and to identify risk factors to optimize their nutrition.

**REFERENCE(S).** 1. Schofield WN. Clin Nutr. 1985;39c supp:5–41.
2. Mehta NM, Compher C. J Parent Enteral Nutr. 2009;33:260–76.

## 0683

### PREDICTING ENERGY REQUIREMENT IN SEPSIS: PREDICTIVE EQUATIONS VS WEIR EQUATION

A. Subramaniam[1], M.J. Mcphee[2], R. Nagappan[3]

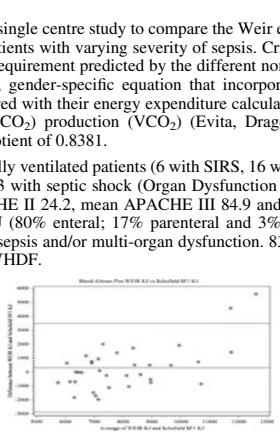
[1]Box Hilll Hospital, Eastern Health, Intensive Care, Melbourne, Australia, [2]Box Hill Hospital, Eastern Health, Nutrition and Dietitics, Melbourne, Australia, [3]Box Hill, Eastern Health, Monash University, Intensive Care, Melbourne, Australia

**INTRODUCTION.** In their desire to match energy expenditure many intensivists and nutritionists employ expedient nomograms to predict energy requirement and many add stress and/or activity factors. Patients with sepsis exhibit a wide spectrum—some patients are more severe than others. Septic patients were both hypo-and hyper-metabolic [1]. As a result, predictive equations can over- or under-estimate the energy requirements in these patients. While direct calorimetry is beyond many ICUs, Weir equation (Energy expenditure = $[(VO_2 \times 3.941) + (VCO_2 \times 1.11)] \times 1{,}440$ cal/day) is a useful alternative. We compared various predictive equations, including Schofield Ireton-Jones, Penn state and Harris–Benedict nomograms with the Weir calculation in a cohort of patients with severe sepsis and septic shock.

**OBJECTIVES.** Weir equation is a useful alternative to energy prediction nomograms in critically ill septic patients.

**METHODS.** Prospective single centre study to compare the Weir equation in predicting REE with other equations in patients with varying severity of sepsis. Critically ill ventilated septic patients had their energy requirement predicted by the different nomograms, which is an age-based, weight-determined, gender-specific equation that incorporates stress and/or activity factor. These were compared with their energy expenditure calculated from (a) end-tidal $CO_2$ derived Carbon dioxide ($CO_2$) production ($VCO_2$) (Evita, Drager) and (b) $VO_2$ deduced assuming a respiratory quotient of 0.8381.

**RESULTS.** 35 mechanically ventilated patients (6 with SIRS, 16 with severe sepsis (< 10 μg/min Noradrenaline) and 13 with septic shock (Organ Dysfunction + >10 μg/min Noradrenaline), with a mean APACHE II 24.2, mean APACHE III 84.9 and mean SOFA 8.9 received nutritional support in ICU (80% enteral; 17% parenteral and 3% combined) in addition to standard management for sepsis and/or multi-organ dysfunction. 83% received inotropic support and 6% received CVVHDF.



Schofield versus Weir method—severe sepsis and septi

**CONCLUSIONS.** Amongst all the nomograms, the Schofield method [2] compared most favourably with $VCO_2$ aided Weir equation. Both methods require comparison to direct calorimetry to enhance validity. The more commonly used Ireton-Jones and Penn state equations underestimated energy requirements compared to Weir equation.

**REFERENCES.** 1. Kao CC et al. Whole Body $CO_2$ Production as an Index of the Metabolic Response to Sepsis. Shock. 2008.
2. Schofield WN: Hum Nutr Clin Nutr. 1985;39[1]:5–41.

## 0684

### NON-INVASIVE METHOD FOR INSERTION OF NASO-JUJUNAL TUBES IN PATIENTS WITH ACUTE PANCREATITIS

T. Ali[1], R. Baba[1], I. Lambert[1], A. Ellis[1], S. Drew[2]

[1]Mayday University Hospital NHS Trust, Anaesthetics and Intensive Care Medicine, Croydon, UK, [2]Royal Shrewsbury Hospital, Shrewsbury, UK

**INTRODUCTION.** Nutritional support is essential in the management of acute pancreatitis. This is best achieved by the enteral route. Distal jejunal feeding provides splanchnic nutrition without stimulation of the pancreas allowing rest thus aiding in recovery of the inflammation. Various methods of insertion have been employed to place the tube correctly with variable success. Rives et al. report 90% success for Endoscopy assisted insertion and Pobiel et al. 97% success using fluoroscopic guidance. Both Endoscopy and Fluoroscopy, though successful, are time and cost ineffective, requiring trained staff, equipment, and impact on endoscopy and radiology departments. Fluoroscopy involves added radiation exposure. Slagt et al. demonstrated 88% successful post-pyloric insertion using erythromycin 200 mg and gastric air insufflation.

**OBJECTIVES.** To describe a novel technique combining metoclopramide and erythromycin to facilitate insertion of the NJ tube into the correct position.

**METHODS.** A single centre pilot observational study over 2 years in 31 consecutive unselected critical care patients with acute pancreatitis requiring nasojejunal tube insertion. Twenty minutes prior to insertion of the NJ tube, intravenous erythromycin 500 mg and metoclopramide 10 mg were administered. A Fine Bore Feeding Tube (Non-Weighted with stylet; Size 8 FR; Length 140 cm) was placed blindly at the bedside, advancing it slowly 1 cm at a time to a length of 120 cm. Two hours later the position was confirmed with a chest radiograph.

**RESULTS.** Of the 31 patients, 29 (93.5%) had a nasojejunal tube inserted into the correct position at the first attempt. Two patients (6.5%) did not pass the tube beyond the pylorus, deemed failed insertions, one of whom had a severely dilated stomach requiring endoscopy assisted insertion. No complications were noted in any of the patients.

**CONCLUSIONS.** We contend our method combining two prokinetics, acting as facilitators, is as effective (93.2% success), safer, less time and labour intensive and more cost effective compared to other methods. Further research is needed to evaluate efficacy for non-critically ill patients, however it should be considered in this setting given its demonstrated efficacy and minimal side effects.

**REFERENCES.**1. Ammori BJ. Role of the gut in the course of severe acute pancreatitis. Pancreas. 2003;26:122–9.
2. O'Keefe SJD, Lee RB, Anderson FP, Gennings C, Abou-Assi S, Clore JN, Heuman D, Chey W. The physiological effects of enteral and parenteral feeding on pancreatic enzyme secretion in humans. Am J Physiol. 2003;284:27–36.
3. O'Keefe SJD, Foody W, Gill S. Transnasal endoscopic placement of feeding tubes in the intensive care unit. JPEN. 2003;27:349–54.
4. Cornelis Slagt, Richard Innes, David Bihari, John Lawrence and Yahya Shehabi. A novel method for insertion of post-pyloric feeding tubes at the bedside without endoscopic or fluoroscopic assistance: a prospective study. J Intensive Care Med. Vol 30:1.2004:103–107.

## 0685

### COMPARISION OF MEASURED ENERGY EXPENDITURE AND ESTIMATED ENERGY EXPENDITURE AND DETERMINATION OF RELATIONSHIP BETWEEN SEVERITY OF ILLNESS AND ENERGY EXPENDITURE IN MECHANICALLY VENTILATED, CRITICAL ILL PATIENTS

M. Dayıoğlu[1], A. Yosunkaya[1]

[1]Selcuk University, Meram Medical School, Anesthesiology, Konya, Turkey

**INTRODUCTION.** Accurate determinarion of energy expenditure is essential in critically ill patients receiving nutritional support to meet metabolic needs.

**OBJECTIVES.** The purpose of this study was to compare the energy expenditure measured by 24-h continuous indirect calorimetry with calculated energy expenditure by four empiric equations, in mechanically ventilated patients and also investigate the correlation between measured energy expenditure and APACHE II and SAPS II scores and amounts of inotropic agents used.

**METHODS.** Fifty-five patients were enrolled the study. Harris- Benedict, Schofield, Ireton-Jones and Swinamer equations were used to estimate energy expenditure both with actual and adjusted body weight, when body weight is a determinant of equation. Then, three different correction factors were applied the values derived from Harris–Benedict and Schofield equations.

**RESULTS.** Although all equations were correlated with indirect calorimetry (Harris–Benedict: 0.62, Schofield: 0.55, Ireton–Jones: 0.52, Swinamer: 0.57) ($p < 0.01$), agreement between these were poor. Wide limits of agreement in each case highlight the potential under or over feeding of each individual patients, which might arise using these equations. Using adjusted body weights in calculations improved the correlation between calculated and measured energy expenditure values (Harris–Benedict: 0, 87, Schofield: 0.82, Ireton–Jones: 0.85); and also improved the accuracy of estimates with Harris–Benedict and Schofield the equations (80 and 75%, respectively).

**CONCLUSIONS.** In conclusion, this study demonstrated poor agreement between measured and calculated energy expenditure, during acute illness, although correlation were found. However, Harris–Benedict and Schofield Equations can be used, with weight adjustments and Long factors application, if indirect calorimetry is not available.

## 0686

### GASTRIC RESIDUAL VOLUME AND ENTERAL FEEDING IN 358 MECHANICALLY VENTILATED ICU PATIENTS: RESULTS FROM A MULTICENTER PROSPECTIVE TRIAL

A. Reintam Blaser[1,2], J. Starkopf[1,3], M. Björck[4], M.L. Malbrain[5], Gastro-Intestinal Failure Trial Group

[1]Tartu University Hospital, Tartu, Estonia, [2]Inselspital, Bern, Switzerland, [3]University of Tartu, Tartu, Estonia, [4]Uppsala University Hospital, Uppsala, Sweden, [5]ZNA Stuivenberg, Antwerpen, Belgium

**INTRODUCTION.** There is no consensus on the definition of high GRV, values ranging from 150–500 ml per single measurement have been suggested.

**OBJECTIVES.** To identify the threshold value the clinicians use for defining "high GRV" and to evaluate its importance as the reason to withhold/reduce the EF in mechanically ventilated (MV) ICU patients.

**METHODS.** Prospective observational multicenter study during 2 weeks in November 2009. Consecutive patients admitted to the participating ICUs and requiring MV for at least 6 h were included. Gastrointestinal symptoms, feeding pattern and reasons to reduce EF were documented on days 1, 2, 4 and 7. High GRV was not previously defined, but the investigators were asked if high GRV was the reason to withhold/reduce EF?

**RESULTS.** 358 patients from 39 ICUs were studied. Mean APACHE II score on admission was 19.8 (8.0) and 28-day mortality was 31%. Mean number (SD) of GRV measurements performed per day was 2.7 (2.0). The mean (SD) of maximum GRV per one measurement were 129 (164), 98 (129), 99 (180), and 101 (160) ml on days 1, 2, 4, and 7, respectively. The mean (SD) total GRV per 24 h was 211 (330), 192 (364) ml, 165 (384), and 198 (445) ml. High GRV was documented as a reason for reduction of EF in 36 patients (10.1%) on day 1, 29 (8.6%) on day 2, 19 (7.5%) on day 4 and 10 (5.2%) on day 7. The medians of GRV per measurement resulting in a decision to reduce EF were 280, 245, 300 and 250 ml on day 1, 2, 4 and 7. The mean total value of GRV/24 h in patients with reduced EF because of this reason was 598 (699) ml, as in patients without reduction of EF on this purpose it was 138 (181) ml, $p = 0.029$. The differences between enterally given calories and total caloric needs in patients with high GRV were similar to the patients without high GRV (1411 vs. 1640; 1121 vs. 1384; 875 vs. 1199 and 560 vs. 952 kcal on days 1, 2, 4 and 7, all p values were NS).

**CONCLUSIONS.** In clinical practice, GRV is considered to be high (defined as a reason for reduction of EF) if reaching 250–300 ml per measurement. The patients without high GRV did not receive more calories enterally compared to the patients with high GRV. High GRV is not a major reason for reducing the EF in MV patients.

## 0687

### SUCCESS AND FAILURE OF ENTERAL FEEDING IN MECHANICALLY VENTILATED ICU PATIENTS: PRELIMINARY RESULTS OF A MULTICENTRE OBSERVATIONAL STUDY

A. Reintam Blaser[1,2], J. Starkopf[1,3], M. Björck[4], M.L. Malbrain[5], Gastro-Intestinal Failure Trial Group

[1]University of Tartu, Tartu, Estonia, [2]Inselspital, Bern, Switzerland, [3]Tartu University Hospital, Tartu, Estonia, [4]Uppsala University Hospital, Uppsala, Sweden, [5]ZNA Stuivenberg, Antwerpen, Belgium

**OBJECTIVES.** To describe the enteral feeding (EF) practices and the reasons to withhold EF in mechanically ventilated ICU patients.

**METHODS.** Prospective observational multicenter study during 2 weeks in November 2009. Consecutive patients admitted to the participating ICUs and requiring MV for at least 6 h were included. Gastrointestinal (GI) symptoms, feeding pattern and the reasons to withhold/reduce EF were documented on days 1, 2, 4 and 7. Specified GI symptoms were: Absent bowel sounds, vomiting, high gastric residuals, diarrhoea, bowel distension, GI bleeding and constipation. Caloric requirements were calculated as basal energy expenditure according to the Harris–Benedict equation multiplied by the stress factor.

**RESULTS.** 358 patients from 39 ICUs were included. During the first day in ICU, 116 patients (32.4%) were fed enterally, increasing to 156 (45.1%), 172 (70.2%) and 142 (76.8%) during day 2, 4 and 7 respectively. There were no differences in 28-day mortality of the patients who were not fed enterally versus those who received EF. The reasons for withholding EF are presented in Table 1 (percentages of stated reasons in respective study days are given).

**TABLE 1** THE REASONS FOR WITHHOLDING EF

| Reason | Day 1 | Day 2 | Day 4 | Day 7 |
|---|---|---|---|---|
| GI symptoms | 39 | 39 | 56 | 65 |
| Procedures/weaning/NIV | 26 | 29 | 19 | 10 |
| Shock | 17 | 13 | 12 | 10 |
| Recent abdominal surgery | 14 | 13 | 4 | 5 |
| Intra-abdominal hypertension | 4 | 6 | 9 | 10 |

The reasons were not specified in 58% of cases, several reasons were given in 16% of patients not receiving EF. High gastric residual volumes and absent/abnormal bowel sounds were the most common GI reasons during the first 2 days; followed by bowel distension, GI bleeding and vomiting. Diarrhoea and constipation became more relevant towards the end of the first week of ICU stay. The patients who received EF, reached via enteral route 29% of their caloric needs on day 1, followed by 39, 47 and 58% on days 2, 4 and 7, respectively. Total caloric deficit in patients with EF was 1,234 (613) versus 1,702 (579) kcal in patients without EF on day 1 ($p = 0.001$), 664 (737) versus 1,448 (694) on day 2 ($p < 0.001$) and 416 (935) versus 1,147 (842) kcal in day 4 ($p = 0.034$). By the end of the first week in ICU caloric targets were nearly reached both in patients with and without EF.

**CONCLUSIONS.** The majority of MV patients did not receive EF during their first day and this was also the case for many patients during their first week in ICU. Patients without EF developed larger caloric deficit during the first 4 days, but also the patients receiving EF did not reach their caloric needs. Next to different GI symptoms, shock and procedures including weaning and non-invasive ventilation (NIV) are common reasons for withholding the EF during the first days in ICU.

## 0688

### $VCO_2$ BASED CALCULATION OF REQUIRED CALORIC INTAKE DIFFERS FROM ESPEN NUTRITIONAL GUIDELINES

N. Vieleers[1], R.J. Bosman[1], P.W.G. Elbers[1], H.M. Oudemans-van Straaten[1]

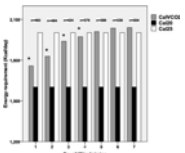
[1]Onze Lieve Vrouwe Gasthuis, Intensive Care Medicine, Amsterdam, Netherlands

**INTRODUCTION.** Malnutrition increases mortality and length of stay. Ideally caloric intake matches energy expenditure (EE). Indirect calorimetry is the most reliable method but also expensive and not always available. It measures $VO_2$ and $VCO_2$, and calculates EE from the Weir formula ($EE = 3.9 * VO_2(L) + 1.1 * VCO_2(L) - 61$). The ESPEN nutritional guidelines for ICU patients base their recommendation for caloric intake on body weight. They advocate to avoid exogenous energy supply in excess of 20–25 kcal/kg/day in the acute phase and to provide 25-30 kcal/kg/day during recovery.

**OBJECTIVES.** Many modern ventilators measure $VCO_2$ continuously. This allows individualized recommendations for caloric requirements. The goal of the present study was to compare $VCO_2$ based calculation of caloric requirements with the ESPEN guidelines.

**METHODS.** From our patient data management system (PDMS), we retrospectively retrieved all $VCO_2$ data from all ventilated patients admitted to our ICU from January 2008 until January 2010. Continuously measured $VCO_2$ was averaged hourly and stored in the PDMS. We also retrieved body weight, BMI, daily SOFA score, core temperature. Assuming a respiratory quotient of 0.85, daily caloric requirement (Cal) was calculated from the Weir formula as 8.3 times mean$VCO_2$ ($CalVCO_2$). The Student T test was used to compare $CalVCO_2$ to 20 kcal/kg (Cal20) and 25 kcal/kg (Cal25). $CalVCO_2$ was related to age, core temperature, SOFA score and BMI using regression analysis.

**RESULTS.** Of the 493 patients with $VCO_2$, mean age was 67 (12.7) years, body weight 80 (17.6) kg, SOFA score d1 9 (SD 3.0). Mean Cal (kcal/day), expressed as $CalVCO_2$, Cal20 and Cal25 at d1 to d7 is presented in the figure. $CalVCO_2$ increased from d1 to 4. Cal $VCO_2$ was significantly higher than Cal20 at all days, the difference increased from 150 kCal at d1 to 433 kcal at d7. At d1, $CalVCO_2$ was significantly lower than Cal25 (252 kCal). The difference gradually decreased over time; from d5 differences were not significant. $VCO_2$ was related to age, weight and temperature, but not to BMI or SOFA.



Energy requirement/day of ICU admission

**CONCLUSIONS.** Mean $CalVCO_2$ differs from ESPEN recommendations for caloric requirements, especially in the early course of disease. During recovery, 25 kcal/kg is a reasonable average estimate. However, $CalVCO_2$ may provide a useful tool for individual estimation of energy requirements because it reflects actual metabolism. The method can be refined by adjusting RQ to the type of feeding.

## 0689

### NUTRITIONAL STATUS INFLUENCES THE INCIDENCE OF CRITICAL ILLNESS MYOPATHY

R. Strang[1], P. Turner[2], A. Shenkin[3], M. Mogk[4], I. Welters[3]

[1]Royal Preston Hospital, Department of Nutrition and Dietetics, Preston, UK, [2]Royal Liverpool and Broadgreen University Hospital, Liverpool, UK, [3]University of Liverpool, Liverpool, UK, [4]Moredata GmbH, Giessen, Germany

**INTRODUCTION.** Critical illness myopathy (CIM) contributes to ICU and hospital mortality, significantly delays weaning from ventilation and prolongs rehabilitation. Although pathogenic factors such as the systemic inflammatory response have been identified, the exact mechanisms leading to CIM remain unclear. Links between nutritional status and muscle dysfunction in critical illness have been postulated [1].

**OBJECTIVES.** In this retrospective case–control study, we investigated the role of nutritional intake as well as levels and supplementation of trace elements on the incidence of CIM in a general Intensive Care Unit ICU.

**METHODS.** 18 patients diagnosed with CIM and 18 controls matched for gender, age, diagnosis and disease severity were included. Matching was performed with commercially available computer software. Data collection included length of stay, mortality data, use of inotropic drugs and steroids, nutritional intake, plasma levels and intake of trace elements (zinc, selenium, copper) as well as inflammatory markers such as white cell count, prealbumin and C-reactive protein. Clinical diagnosis of CIM was confirmed by nerve conduction studies.

**RESULTS.** CIM patients stayed significantly longer on ICU than the matched controls ($47.06 \pm 24.32$ vs. $19.78 \pm 16.63$ days, $p < 0.001$). Hospital mortality was higher in CIM patients (13 vs. 7 patients, $p = 0.044$). During the first week, total energy intake was significantly lower in patients with CIM compared to controls ($6756.25 \pm 3061.53$ vs. $8309.68 \pm 1425.87$ kcal, $p = 0.014$). In particular, enteral energy intake was lower in the CIM group during the first week on ICU (4,636.31 ± 4,278.54 vs. 6,871.40 ± 2,808.96 kcal). This corresponded with a significantly lower intake of selenium ($261.02 \pm 146.66$ vs. $368.95 \pm 100.22$ µg, $p = 0.014$), zinc ($60.89 \pm 33.61$ vs. $82.86 \pm 20.95$ mg, $p = 0.044$) and copper ($10.75 \pm 2.29$ vs. $8.33 \pm 4.29$ mg, $p = 0.019$) in CIM patients during their first week on ICU. Plasma trace element levels and nutritional intakes later in ICU stay did not differ significantly between groups. There was also no difference in the number of patients receiving parenteral nutrition between the groups.

**CONCLUSIONS.** Our results suggest a role for nutritional and trace element intake in the development of CIM. Larger studies are required to elucidate the differential impact of total energy intake, levels and supplementation of trace elements such as selenium, copper and zinc and the development of CIM. In particular, establishment of appropriate energy and trace element intake during the first week on ITU seems to have a major impact on the risk of developing CIM.

**REFERENCE(S).** 1. Tobin BW, Uchakin PN. J Nutr. 2005;135:1803S.

## 0690

### NUTRITION IN A INTENSIVE CARE UNIT: ENERGETIC NEEDS EVALUATION AND NUTRITIONAL SUPORT PRESCRIBED AND ADMINISTRATED

A. Martins[1], I. Asseiceira[1], A. Raposo[1], R. Mendes[1], L. Bento[1]

[1]Hospital São José, Unidade de Urgência Médica, Amora, Portugal

**INTRODUCTION.** Nutritional support is an essential part of care in critical patients. It is well characterized the need for adequate assessment and energetic need and nutrition in these patients.

**OBJECTIVES.** Characterizing the relationship between energetic needs in critical care and nutrition prescribed and supplied. We also propose to identify the most common complications and causes of interruption and nutritional support.

**METHODS.** We enrolled a hundred and thirty patients admitted to an Intensive Care Unit. Those patients where monitorized, from a nutritional view point, for 14 days. Their energetic needs were calculated according the Harris–Benedict formula adjusted for a stress factor. The nutritional support prescribed and administrated, as well as the most common causes for interruption and complications were registered by consultation of clinical records. We used Acute Physiology and Chronic Health Evaluation II (APACHE II) to access clinical severity.

**RESULTS.** Of the 130 patients, 84 (64.6%) were male and 46 (35.6%) female, the mean age was 61.6 ± 18.7 years. The length of stay was 13.8 ± 9.9 days. Mean APACHE II was 20.8 ± 7.9. Mean energetic needs was 1,999 kcal/day, mean energy prescribed was 1,276 kcal/day and mean energy administrated was 1,163 kcal/day. The most common complications associated with nutritional support were gastrointestinal, occurring in 22% of cases. Diarrhea was the most common (13%). There were 95 interruptions in nutritional support, most of them for procedures.

**CONCLUSIONS.** Of the calculated energetic needs 64% were prescribed and f those 91% were administrated. We concluded that besides the care in following nutritional recommendations there is still difficulty in fully applying them to Intensive Care Units in clinical practice.

## 0691

### HYPOCALORIC VERSUS NORMOCALORIC NUTRITION IN CRITICALLY ILL PATIENTS

S. Petros[1], M. Horbach[1], L. Weidhase[1], F. Seidel[1], K. Schwabe[1], I. Vogel[1], E. Dafova[1]

[1]University Hospital Leipzig, Medical ICU, Leipzig, Germany

**INTRODUCTION.** The optimal nutrition of the critically ill is yet a matter of discussion. Although the negative consequences of malnutrition are obvious, the advantage of normocaloric nutrition regarding clinical outcome is not clearly documented. Published observational studies showed that hypocaloric feeding at least in the initial phase of the acute disease may be beneficial regarding nosocomial infections and clinical outcome. However, adequate prospective randomised trials are not yet available.

**OBJECTIVES.** The aim of this ongoing prospective randomised controlled trial is to compare hypocaloric and normocaloric feeding in critically ill medical patients in the first 7 days of the acute illness regarding their influence on metabolic and clinical parameters.

**METHODS.** Critically ill non-surgical patients of a university medical ICU, who would need artificial nutrition for at least 3 days, were included after informed consent of the patient or guardian. Exclusion criteria were age <18 or >80 years, pregnancy, immunosuppressive therapy, active malignant disease and pre-existing malnutrition. Patients were randomised using an electronic randomisation list into group 1 (normocaloric feeding) and group 2 (feeding 50% of measured or calculated energy requirement) within 24 h of ICU admission. Energy expenditure was measured with indirect calorimetry or, if this was not possible, calculated using the Ireton–Jones formula. Enteral feeding was preferred, with daily rate increment to achieve target volume on day 3. If the enteral route was considered not possible by the treating physician, parenteral nutrition was administered. Blood glucose control was done every 3 h and insulin dose adjusted with a target blood glucose level of 6 to 8 mmol/l. C-reactive protein and procalcitonin were also daily measured. APACHE-II and SOFA scores and relevant clinical data were documented. Patients were otherwise managed according the standard procedures of the ICU based on international guidelines.

**RESULTS.** Eighty-four patients (45 in group 1 and 39 in group 2) were included until now. Mean age of patients was 66.6 ± 12.0 years with a mean body mass index of 27.2 ± 4.9 and APACHE-II-Score of 29.3 ± 8.7. Administered caloric amount was significantly different between the groups at any time during the study period. The insulin demand was significantly higher in group 1 than in group 2. There was no significant difference between the two groups regarding SOFA score as well as C-reactive protein and procalcitonin. Diarrhea was observed more frequently in group 1 than in group 2. The mortality rate was 20.5% in group 1 and 27.0% in group 2 (n.s.).

**CONCLUSIONS.** Our data show that glycemic control was better with hypocaloric than normocaloric feeding. Hypocaloric feeding was associated with lesser episodes of diarrhea than normocaloric feeding. There was no significant difference regarding clinical outcome; however, it is too early to make a definite conclusion.

## 0692

### EUROPEAN ICU NUTRITION DAY SURVEY: SPANISH ICUS NUTRITIONAL DATA AND MORTALITY RATES ACCORDING TO NUTRITION ROUTES IN MECHANICALLY VENTILATED VERSUS NON MECHANICALLY VENTILATED PATIENTS

S. Ruiz-Santana[1], B. Mora[2], A. Blesa[3], A. Robles[4], R. Sierra[5], J. López-Martínez[6], T. Honrubia[7], C. Vaquerizo[8], C. Sánchez[9], A. Bonet[10], P. Saavedra[11], M. Hiesmayr[12]

[1]Hospital Universitario Dr Negrín, Intensive Care Unit, Las Palmas de Gran Canaria, Spain, [2]General Hospital of Vienna, Department Cardiac-Thoracic-Vascular Anesthesia and Intensive Care, Vienna, Austria, [3]Hospital Clínico San Carlos, Intensive Care Unit, Madrid, Spain, [4]Hospital Universitari Vall d'Hebron, Intensive Care Unit, Barcelona, Spain, [5]Hospital Puerta del Mar, Intensive Care Unit, Cádiz, Spain, [6]Hospital Severo Ochoa, Intensive Care Unit, Leganés, Spain, [7]Hospital de Móstoles, Intensive Care Unit, Móstoles, Spain, [8]Hospital de Fuenlabrada, Intensive Care Unit, Fuenlabrada, Spain, [9]Hospital General Reina Sofía, Intensive Care Unit, Murcia, Spain, [10]Hospital Universitari Dr Josep Trueta, Intensive Care Unit, Girona, Spain, [11]Universidad Las Palmas Gran Canaria, Matemáticas, Las Palmas de Gran Canaria, Spain, [12]General Hospital of Vienna, Department Cardio-Thoracic-Vascular Anesthesia and Intensive Care, Vienna, Austria

**INTRODUCTION.** ICU Nutrition Day is a ECCRN supported multinational project to evaluate and compare nutrition care among European ICUs. We present 18 Spanish ICUs nutritional data and mortality rates according to nutritional routes.

**OBJECTIVES.** To investigate the nutritional route ratio in delivered versus planned nutritional support used in mechanically ventilated versus non ventilated patients and the association between nutritional support route and observed mortality.

**METHODS.** We recorded the type and amount, ratio kcal delivered over planned, of nutritional support given to the patients. Time until achieving caloric goals and the associations between type of nutritional support and ICU mortality were also investigated.

For all study groups, categorical variables are expressed as frequencies and percentages and continuous variables as mean and standard deviation (SD) when data followed a normal distribution, or as medians and interquartile (25th–75th percentile) range when distribution departed from normality. The evolution of energy intake, enteral and parenteral, was assessed according to the ICU stay. The adjustment was done using the k-nearest point procedure. We obtained the ratio between given and planned energy intake. A marker value close to one indicates that both inputs are similar.

**RESULTS.** 348 patients were studied (188 ventilated vs. 160 non-ventilated). Characteristics were similar in both groups: age (60 vs. 61 years), BMI (26.5 vs. 26.7 kg/m$^2$), emergency admitted (81 vs. 76%) and medical patients (64 vs. 62%). SAPS2 and SOFA score were significantly higher in mechanically ventilated patients ($p < 0.001$). Enteral nutrition alone was used in 34% (52 vs. 12%; $p < 0.001$), oral nutrition alone in 28% (2.7 vs. 56%; $p < 0.001$), parenteral nutrition alone in 17.6% (22 vs. 12%; $p < 0.001$), and enteral plus parenteral in 4.1% (5.5 vs. 2.5%; $p < 0.001$). Patients ventilated versus non ventilated received significantly more kcal by enteral ($p < 0.001$) and parenteral ($p < 0.001$) routes. Ratio delivered over planned nutritional support was 0.8 within 48 h with enteral and 1 with parenteral nutrition in mechanically ventilated patients. Observed mortality rate was 29.3% in patients receiving enteral nutrition ($n = 116$), 26.7% with parenteral ($n = 60$), 23% combined ($n = 14$), and 10% with oral ($n = 95$).

**CONCLUSIONS.** Enteral nutrition was the most common nutritional support utilized both in total and in mechanically ventilated patients, followed by oral and parenteral nutrition. Parenteral nutrition was significantly more used in ventilated ($p < 0.001$) and oral nutrition in non-ventilated patients ($p < 0.001$). Combined nutrition was only given to 4.1% of the patients. Delivered over planned enteral nutritional support ratio was 80% within 48 h after starting nutrition in ventilated patients. Enteral nutrition is feasible with a high delivered versus planned ratio success as shown in Spanish multidisciplinary ICUs.

## 0693

### EARLY ENTERAL NUTRITION IN INTENSIVE CARE

A. Ayucar Ruiz de Galarreta[1], M.J. Garcia Monje[2], F. Pita Gutierrez[3], B. Veiguela[3], F. Pampin[2], P. Fernández Ugidos[2], M. Mourelo Fariña[2], P. Vidal[2]

[1]A Coruña University Hospital, Nutritional Support Unit, A Coruña, Spain, [2]A Coruña Universitary Hospital, Intensive Care Unit, A Coruña, Spain, [3]A Coruña University Hospital, Endocrinology, A Coruña, Spain

**OBJECTIVES.** To compare enteral nutrition (EN) timing in our intensive care unit (ICU) with ESPEN guidelines recommendation.

**METHODS.** Prospective observational study from January to December 2009, in an ICU with coronary, cardiac postoperatory, heart transplant and trauma unit. This study has been performed by the Support Nutritional Unit (SNU) and ICU. Time from ICU admissions to initiation of EN was recorded.

**RESULTS.** 431 patients were involved. 91 of them were cardiac surgery patient. EN was started, in general, before 24 h from ICU admissions in 75% of the patients. But when we analyzed by the different units we could observed that in the trauma ICU only 17% of the patients received EN after the first 24 h from admission, in contrast with the cardiac surgery unit where 51.6% of the patients wait more than 24 h to get it.
Global median time was 19, 9 h (SD ±15 h), in trauma ICU 17 h (±11.9 h) and in cardiac surgery unit 30, 73 (±20.6) ($p>0.001$).
In the cardiac surgery unit 24.2% of the patients included needed inotropic support and BiACP, these patients had a start time of 45.4 ± 28.2 h vs. 25.8 ± 14.7 h ($p < 0.001$). Patients under extracorporeal circulation had similar EN timing compare with the rest of the patients (34 vs. 29, 5 h, $p = 0, 33$).
We also try to find a relationship between the day of admission and the start time and we found than patient admitted during weekend start EN before than those admitted during the week; 21 h ± 17 h vs. 18.5 ± 12.5 h ($p = 0.085$). We have studied the possible relationship between Intensivist Residents rotation in the SNU, and compared the month of rotation and the next 2 months compared to pre-rotation, finding in the first case an average of 17.2 ± 13 in the second 22.4 ± 18.6 h ($p = 0.082$).

**CONCLUSIONS.** 1. Early EN takes place in our ICU according to the ESPEN guidelines.

2. Only a quarter of the patients gets EN after 24 h from ICU admission, but more than half cardiac surgery patients wait more than 24 h. Only 10%in general ICU and 33% in cardiac ICU have more than 36 h delay.

3. Unstable cardiac surgery patients who required inotropes support and mechanical assistance are those with longer delay, even when hemodynamic stabilization is achieved EN is not started. This point should be review in our units and try to get shorter times without nutrition.

4. To spend part of the intensivist resident formation in the NSU is very useful, affecting the daily practice, improving early enteral nutrition times.

## 0694

### FEEDING CRITICALLY ILL PATIENTS: IS IT A PROBLEM?

A.D. Marinho[1], H. Castro[2], J.R. Monte[3], O. Afonso[4], E. Lafuente[5]

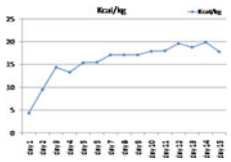
[1]Centro Hospitalar do Porto, Intensive Care Service, Porto, Portugal, [2]Centro Hospitalar do Porto, UCIP, Porto, Portugal, [3]Centro Hospitalar do Porto, SCIPC, Porto, Portugal, [4]Hospital Infante D. Pedro, Intensive Care Unit, Aveiro, Portugal, [5]Hospital Padre Américo, Vale de Sousa, Portugal

**INTRODUCTION.** Critically ill patients are at high risk to develope protein-energy malnutrition. Despite recommendations for early EN in critically ill patients, many authors have described the difficulty in reaching the prescribed energy intake.

**OBJECTIVES.** The goal of this study is to evaluate the amount of calories we give to the patients who stays longer than 10 days in Intensive Care Unit (ICU).

**METHODS.** Multicenter, prospective, observational and cohort study, during a 4 month period (January to April 2010). All patients staying more than 10 days in 5 ICUs of 3 different hospitals were enrolled. At base line, demographic and clinical information was obtained, including information necessary to determine the severity of illness. We collected all the nutritional support provided to the patients during the first 15 days in ICU.

**RESULTS.** 39 patients were enrolled. Mean age—57.07 ± 17.36 (55), mean SOFA score—8.02 ± 3.12 (8). Mortality rate of 20.51%. Mean caloric intake during 15 days—955.55 ± 268.22 (1008) Kcal or 13.92 kcal/kg/day.




Nutritional support

**CONCLUSIONS.** Despite all the efforts this insufficient coverage of energy needs is found in most of the studies on this topic. The The ESPEN guidelines on EN state that insufficient provision of nutrients is likely to result in undernutrition within 8–12 days following ICU admission. So we need to cautious about this problem in our patients.

**REFERENCE(S).** 1. Giner M, Laviano A, Mequid MM, Gleason JR. In 1995 a correlation between malnutrition and poor outcome in critically ill patients still exists. Nutrition 1996;12:23–9.
2. Kreymann KG, Berger MM, Deutz NE et al. ESPEN Guidelines on enteral nutrition: intensive care. Clin Nutr 2006;25:210–23.

## 0695

### ICU NUTRITIONDAY: IDEAL OR ACTUAL BODY WEIGHT WHAT IS CURRENTLY USED AS A REFERENCE FOR ENERGY INTAKE

B. Mora[1], P. Singer[2], S. Ruiz-Santana[3], M. Hiesmayr[4], ICU nutritionDay study group

[1]Medical University of Vienna, General Hospital, HTG Anesthesia and Intensive Care, Vienna, Austria, [2]Rabin Medical Center, Beilinson Hospital, Petach Tiqva, Israel, [3]Hospital Universitario de Gran Canaria, Las Palmas, Spain, [4]HTG Anesthesia and Intensive Care, Vienna, Austria

**INTRODUCTION.** The ICU nutritionDay project is an international audit about nutrition care and outcome. Currently recommended energy intake is 20–25 kcal $kg^{-1}$ $day^{-1}$. There is a controversy on the amount of energy to be given to the severely undernourished or obese patients. Several guidelines suggest that above a certain cutoff of body mass index ideal body weight should replace actual body weight as a reference.

**OBJECTIVES.** The aim of the analysis was to determine whether ideal or actual body weight appears to be used as a reference for the calculation of energy intake.

**METHODS.** We included all patients from 2007–2009 in the analysis. Energy intake as the sum of enteral and parenteral nutrition given. Total energy intake was either normalised to actual or ideal body weight. Ideal body weight was calculated as height −100. Proportions were compared with the $\chi^2$ test.

**RESULTS.** A total of 2,711 patients from 205 ICUs were included. Mortality was between 20–26% in the 3 years. Approximately half of the patients received artificial nutrition. Figure 1 shows that based on actual body weight energy intake decreases progressively with increasing BMI, whereas Fig. 2 shows that based on ideal body weight energy intake was similar for all BMI groups. The proportion of patients with under- or overnutrition within each BMI group is significantly determined by the normalisation reference. Based on ideal body weight the proportion of patients within the recommendations was less than half the patients. Overnutrition appears to be common in undernourished patients.

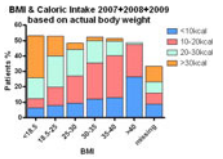



Fig. 1 Caloric intake and actual body weight.

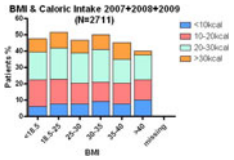



Fig. 2 Caloric intake % actual body weight.

**CONCLUSIONS.** Energy intake is highly variable and a standardisation is urgently needed.

**GRANT ACKNOWLEDGMENT.** Financial support from ESPEN and support from ECCRN.

# Coagulation disorders: Monitoring and treatment: 0696–0709

## 0696

### USING HAEMOVISCOELASTOGRAPHY FOR MONITORING RISK OF THROMBOEMBOLISM IN PATIENTS WITH CARCINOMA OF CORPUS UTERI AGAINST A BACKGROUND OF BEMIPARIN

O. Tarabrin[1], S. Tarasenko[1], A. Turenko[2], S. Shcherbakov[1], D. Gavrichenko[1]

[1]Odessa State Medical University, Odessa, Ukraine, [2]Regional Clinical Hospital, Odessa, Ukraine

**INTRODUCTION.** At autopsy signs of thrombotic complications are detected in approximately 50% of cancer patients (Kakkar et al. 1999). In 8–35% of patients with malignant neoplasms of pulmonary embolism was the cause of death, and at 43%—the background for other fatal complications.

**OBJECTIVES AND METHODS.** Investigate the results of surgical treatment of 54 patients with uterine cancer during the period from 2007 to 2009. Status hemostasis was monitored 12 standard biochemical tests, as well as the new instrumental methods—haemoviscoelastography preoperatively, intraoperatively and at 1 and 5 days after surgery. Prevention of thrombotic in group 1 (26 patients), conducted by bemiparin 3500: the first injection 12 h before surgery, then at 6 h after the operation in the future once a day for 10–14 days, group 2 (28 patients) received heparin 5000 units: the first injection 2 h before surgery, then 6 h after the operation, further to 4 times a day for 10–14 days.

**RESULTS.** All included in the study patients prior to surgery in the hemostasis system detected a shift towards hypercoagulation and inhibition of fibrinolysis: increase in maximum amplitude (MA) at 20.7%, reduction of F to 13.6% in both groups compared to normal rates. At 1 day after surgery in patients treated with bemiparin declines AM, r and k to 12.7, 8.4 and 9.6% respectively, and F increase by 4.6% compared with preoperative. In group 2, there was a similar picture: the reduction of AM, r and k to 10.3, 8.0 and 6.6% respectively, and F increase by 4.4% within 1 postoperative day compared with preoperative. At 5 day performance of hemostasis in both groups came almost to the same value—a modest hypocoagulation, normalized activity of fibrinolysis. Within 7 days of postoperative thrombotic complications developed in 3 patients (11.53%) 1 group. In group 2, complications developed in 5 (17.85%) patients—in 4 thrombosis and in 1 case—the bleeding.

**CONCLUSIONS.** Using haemoviscoelastography can quickly identify disorders of hemostasis in patients with cancer of uterine body before, during and after the surgery, allowing time to begin their prevention and treatment. Bemiparin at a dosage of 3,500 1 times per day before and after surgery is effective and safe method of prevention of thromboembolic complications in patients with uterine cancer after surgical treatment.

## 0697

### EVALUATION OF COAGUIOPATIES IN OBSTETRICS USING DOUBLE LOCAL ISHEMIA TEST OF THE UPPER LIMB

O. Tarabrin[1], V. Nagornaya[2], O. Nikolaev[1], S. Shcherbakov[1], D. Gavrichenko[3]

[1]Odessa State Medical University, Department of Anesthesiology and Intensive Care, Odessa, Ukraine, [2]Odessa State Medical University, Odessa, Ukraine, [3]Regional Clinical Hospital, Odessa, Ukraine

**INTRODUCTION.** Venous thromboembolism (DVT) is an important and potentially preventable complication following gynecologic surgery. The reported frequency of postoperative DVT in 23 studies that included 2,268 patients who underwent gynecologic surgery without prophylaxis varied between 4 and 38%, with an average of 16%.

**OBJECTIVES and METHODS.** Blood coagulation and fibrinolisis were studied in 321 pregnant women before surgery with the term of hestosis 19–36 weeks without clinical sings of coaguiopaties. Double local ishemia tests of the upper limb were performed to reveal coagulation disturbances. Lowfrequency haemoviscography (LHVG) was performed before using double local ishemia test and immediately after.

**CONCLUSIONS.** Double local ishemia test of the upper limb is useful in assessing the coaguiopaties that follow pregnancy with hestosis without any clinical signs and provide objective data for guiding prophylactic therapy to manage these coaguiopaties.

**REFERENCE(S).** 1. Samama CM. EJA 2006;23 Suppl 37:81.

2. Tarabrin O. EJA 2006;23 Suppl 37:84.

## 0698

### HAEMOVISCOELASTOGRAPHY FOR MONITORING OF COAGULOPATIES IN OBSTETRICS

O. Tarabrin[1], S. Posohova[2], V. Nagornaya[3], O. Nikolaev[1], S. Shcherbakov[1], D. Gavrichenko[1]

[1]Odessa State Medical University, Department of Anesthesiology and Intensive Care, Odessa, Ukraine, [2]Regional Clinical Hospital, Odessa, Ukraine, [3]Odessa State Medical University, Odessa, Ukraine

**INTRODUCTION.** One of the causes of obstetric hemorrhages is toxicosis of the second half of pregnancy accompanied by chronic form of DIC-syndrome, hypercoagulation and increased aggregation activity of platelets.

**OBJECTIVES AND METHODS.** To assess the functional state of the hemostasis system we have used our devised test with local ischemia of the upper extremity. The analysis of the coagulation, vascular-thrombocytic components of hemostasis and fibrinolysis was made on the basis of parameters of blood aggregate state obtained by using a method of haemoviscoelastography (HVG).

**RESULTS.** There have been examined 32 healthy pregnant women in the age range from 19 to 31 (a control group), and 32 pregnant women with revealed late toxicosis of different severity degree (nephropathy of II degree-12, nephropathy of III degree-20), While analyzing the functional state of the hemostasis system in healthy pregnant women there have been distinguished two types of response to the test: compensated type (1) in 33% and subcompensated type (2) in 67%. The pregnant women suffering from late toxicosis were registered to have subcompensated type of the hemostasis system response (3) in 26% of cases and decompensated type (4) in 74% of cases. The functional test in the group 1 resulted in decreased aggregation activity of platelets (Ar), reduced activity of I and II phases of blood coagulation (elevation of r and k) and activation of the fibrinolytic system (F). The group 2 is noted to have enhanced aggregation activity of platelets (Ar). Enhanced thrombin activity and acceleration of [the thrombin-formation and activation of II and III coagulation phases. The total fibrinolytic blood activity (F) was reduced by 44%.

**CONCLUSIONS.** Thus, late toxicosis is accompanied by changes in the hemostasis system causing exhaustion of compensatory potentials of the regulation system of the blood aggregate state promoting high risk of thrombohemorrhagic complications during delivery and in the postpartum period.

## 0699

### PERIOPERATIVE MONITORING OF COAGULATION IN PATIENTS AFTER ABDOMINAL SURGERY FOR CANCER

O. Tarabrin[1], P. Pustovoyt[2], S. Tarasenko[3], V. Velichko[3], S. Shcherbakov[1], D. Gavrichenko[1]

[1]Odessa State Medical University, Department of Anesthesiology and Intensive Care, Odessa, Ukraine, [2]Regional Clinical Hospital, Odessa, Ukraine, [3]Odessa State Medical University, Odessa, Ukraine

**INTRODUCTION.** Despite the evidence of perioperative hypercoagulability in cancer patients, there are no consistent data evaluating the extent, duration, and specific contribution of platelets and procoagulatory proteins by in vitro testing. This study compared efficacy of haemoviscoelastography versus thromboelastography for monitoring of coagulation imbalance.

**OBJECTIVES AND METHODS.** 536 Patients undergoing open surgery for abdominal cancer received MEDNORD (Ukraine Co analyzer) analysis (H VG), a viscoelastic test, measures clot formation and includes information on the cellular, as well as the plasmatic coagulation system. We examined the efficacy of a variety of coagulation tests. A complete coagulation screen activated clotting time (ACT), thromboelastography (TEG) and haemoviscoelastography (HVG) were performed before surgery, at the end of surgery, and bemiparin anticoagulation monitoring on postoperative days 1, 2, 3, and 7. There were analyzed for the reaction time and the maximal amplitude (MA).

**RESULTS.** We calculated the elastic shear modulus of standard MA (Gt) and H VG MA (GH) which reflect total clot strength and procoagulatory protein component, respectively. The difference was an estimate of the platelet component (Gp). There was a 16% perioperative increase of standard MA, corresponding to a 49% increase of Gt ($P < 0.05$) and an 79–85% contribution of the calculated Gp to Gt. We conclude that serial standard thromboelastography and HVG viscoelastic test may reveal the independent contribution of platelets and procoagulatory proteins to clot strength. Using multiple linear regressions, all coagulation, TEG and HVG variabilities were used to model postoperative hypercoagulation. Results showed that some components of the TEG failed to identify hypercoagulation ($r < 0.2$, $P > 0.75$). However, three components of the routine coagulation assay, including bleeding time, prothrombin time, and platelet count could be modeled to show prolonged postoperative hypercoagulability ($P < 0.01$). We conclude that all components of the HVG test reflect postoperative coagulopathies, these results suggests that it may be useful in determining the coagulation status of cancer patients perioperative.

**CONCLUSIONS.** Postoperative hypercoagulability, occurring for at least 1 week after major cancer abdominal surgery, may be demonstrated HVG viscoelastotest. Hypercoagulability is not reflected completely by standard coagulation monitoring and TEG and seems to be predominantly caused by increased platelet reactivity. HVG provides a fast and easy to perform bedside test to quantify in vitro coagulation, may he useful in determining the coagulation status of cancer patients preoperatively.

## 0700

### HAEMOVISCOELASTOGRAPHY AS A PERIOPERATIVE MEASURE OF BEMIPARIN ANTICOAGULATION THERAPY

O. Tarabrin[1], V. Suslov[2], S. Tarasenko[3], S. Kalinchuk[4], M. Uhal[3], S. Shcherbakov[1], D. Gavrichenko[1]

[1]Odessa State Medical University, Department of Anesthesiology and Intensive Care, Odessa, Ukraine, [2]Academy of Medical Science of Ukraine.The institute of Urology, Kiev, Ukraine, [3]Odessa State Medical University, Odessa, Ukraine, [4]Regional Clinical Hospital, Odessa, Ukraine

**INTRODUCTION.** Patients undergoing open prostatectomy are at risk, for venous thromboembolic complications for up to 3 weeks postoperatively. We evaluated the efficacy and safety of postoperative rigemen of bemiparin. Currently, there is no convenient test to measure the degree of anticoagulation from LMWH.

**OBJECTIVES AND METHODS.** We carried out a single-centre, prospective, randomized, double-blind trial with the aim of assessing the efficacy of postoperative prophylactic treatment. This prospective study examines the relationship of haemoviscoelastography (HVG) MEDNORD (Ukraine Co analyzer), a viscoelastic test, measures clot formation and includes information on the cellular, as well as the plasmatic coagulation, system and serum anti-Xa concentration in patients treated with bemiparin. 116 patients scheduled for open prostatectomy using epidural anesthesia were enrolled. Epidural catheters were removed the morning after surgery before the commencement of subcutaneous bemiparin 2500 once daily. Venous blood samples were obtained at: (1) the induction of anesthesia (baseline), (2) immediately before the third dose of bemiparin operatively; (3) 4 h after the third dose postoperatively, and (4) immediately before the fifth close postoperatively. Whole blood samples were obtained for haemoviscoelastography (HVG), activated clotting time, and anti-Xa level analyses at each of the four time intervals.

**RESULTS.** At the four sample intervals, the r time (mean $\pm$ SEM) ($5.91 \pm 0,65$; $7.5 \pm 0.25$; $9.5 \pm 0.55$ min) and the $\kappa$ time ($5.8 \pm 0.1$; $8.2 \pm 0,27$; $\pm 9$, $14 \pm 0.2$ min) of the HVG were significantly correlated with the expected peak and trough levels of LMWH and serum anti-Xa levels ($p < 0.05$). After fifth dose immediately, HVG r times exceeded the normal range in 29 of 116 patients (25%). Prolongation of r time and $\kappa$ time on postoperative day 5 may indicate an exaggerated response to LMWH. Low frequency haemoviscoelastography is a test that could potentially correlate with the degree of anticoagulation produced by low molecular weight heparin bemiparin.

**CONCLUSIONS.** Low frequency haemoviscoelastography MEDNORD (Ukraine Co analyzer), a viscoelastic test, measures clot formation and includes information on the cellular, as well as the plasmatic coagulation system is a test that could potentially correlate with the degree of anticoagulation produced by LMWH. The r time from the haemoviscogram correlates with serum anti-Xa concentration. HVG is a convenient test to measure the decree of anticoagulation from LMWH.

## 0701

### TROMBOELASTOGRAPHY VERSUS VISCOELASTOGRAPHY FOR EVALUATION OF COAGULOPATIES IN PATIENTS AFTER ABDOMINAL SURGERY FOR

O. Tarabrin[1], V. Suslov[2], S. Kalinchuk[3], S. Shcherbakov[1], D. Gavrichenko[1]

[1]Odessa State Medical University, Department of Anesthesiology and Intensive Care, Odessa, Ukraine, [2]Academy of Medical Science of Ukraine.The institute of Urology, Kiev, Ukraine, [3]Regional Clinical Hospital, Odessa, Ukraine

**INTRODUCTION.** The study compared efficacy of viscoelasthography versus thromboelasthography for monitoring of perioperative coagulation balance after abdominal surgery for cancer.

**OBJECTIVES AND METHODS.** A complete coagulation screen, activated clotting time (ACT), thromboelasthography (TEG) and viscoelasthography (VG) were performed before surgery, at the end of operation and monitoring of LMWH anticoagulation therapy on postoperative days 1, 2, 3, and 7. We tested the hypothesis that the parallel use of standard TEG and VG can fully access postoperative state of blood coagulation.

**RESULTS.** The elastic shear modulus of standard MA (GT) and VGMVA (GH), which reflect total clot strength and procoagulatory protein component, was been calculated. The difference was an estimate of platelet component (Gp). There was 14% increase of standard MA, corresponding to 48% increase of Gt ($P < 0.05$) and 80–86% contribution of the calculated Gp to Gt. Using multiple linea regression, all coagulation, TEG and VG variabilities were used to model perioperative thrombophylia. The results showed that some components of TEG failed to identify hypercoagulation ($r < 0.2$, $P < 0.75$). However, 3 components of the routine coagulation assay, including bleeding time, prothrombin time and platelet count could be modeled to show prolonged postoperative hypercoagulability ($P < 0.01$). We conclude that all components of viscoelasthography test reflect postoperative coagulopathies. Serial standard thromboelasthography and viscoelastic analyzer may reveal the independent contribution of platelets and of procoagulatory proteins to clot strength.

**CONCLUSIONS.** These results suggest that viscoelastic techniques might be useful in the determining the coagulation status in cancer patients perioperative. Hypercoagulability is not reflected completely by standard coagulation monitoring and TEG and seems to be predominantly caused by increased platelet reactivity.

**REFERENCE(S).** Samama CV. Anesthesiology. 2001;94:74–8.

## 0702

### AN AUDIT OF THE APPROPRIATENESS OF ADMINISTRATION OF THROMBOPROPHYLAXIS IN THE INTENSIVE CARE UNIT AT THE COUNTESS OF CHESTER HOSPITAL, CHESTER, UK

C. Whelan[1], M.E. Verghese[1], N.M. Robin[1]

[1]Countess of Chester Hospital Trust, Chester, UK

**INTRODUCTION.** Venous thromboembolism (VTE) occurs in 5–10% of patients in critical care in spite of adequate prophylaxis, causing increased intensive care unit (ICU) stay, morbidity and mortality [1]. Pharmacological anticoagulation with low molecular weight heparin (LMWH) is the mainstay of prophylaxis. However, despite evidence, it is used inconsistently.

**OBJECTIVES.** To assess use of thromboprophylaxis in our ICU, and compliance with the Intensive Care Society (ICS) consensus guidelines [2].

**METHODS.** A retrospective audit was made of 14 patients admitted consecutively to the ICU in June 2009. Data recorded included contraindications to thromboprophylaxis and the presence of risk factors for VTE; daily PT, APTT ratios and platelet count, LMWH administration and cited reasons for omission. A valid reason was defined as a PT or APTT ratio of >1.5, platelet count $<50 \times 10^9$/L or documentation of a reason in accordance with the ICS guidelines.

**RESULTS.** 14 patients' case notes were reviewed: a total of 64 ICU patient days. On 42 of 64 days LMWH was either given correctly (GC) or omitted correctly (OC). On 22 of 64 days LMWH was either omitted incorrectly (OI) or given incorrectly (GI): error rate 34%. When omitted incorrectly there was no cited reason in 17/20, and the drug was not prescribed in 3/20. When omitted correctly no reason was cited in 3/31, it was not prescribed in 6/31 and in 22/31 a valid reason was cited. The frequency of failure to prescribe LMWH was not significantly different between the OI group (15%) compared with the OC group (19.3%) $p = 0.72$ (Fisher's exact). When comparing the two groups: GC and OI there was no significant difference between the median PT/APPT ratios: $p = 0.21$(Mann–Whitney U). On all of the 20 patient days when LMWH was omitted inappropriately, there was at least one specific risk factor for VTE: 3 risk factors on 9 days (45%), 2 on 9 days (45%) and 1 on 2 days (10%).

**CONCLUSIONS.** Pharmacological prophylaxis reduces rate of fatal VTE and use of LMWH has been recommended in ICS and NICE guidance [2]. This audit demonstrates LMWH is rarely given inappropriately, but commonly omitted in error. On every ICU patient day when LMWH was omitted at least one risk factor was present for the development of VTE. Our results suggest failure in interpretation of results leads to erroneous omission of LMWH, and illustrates the need for a ratio rather than actual PT and APTT. Recommendations regarding VTE prophylaxis incorporating ICS and NICE guidance are now being implemented in our ICU.

**REFERENCE(S).**1. Twigg SJ, McCrirrick A, Sanderson PM. A comparison of post mortem findings with post hoc estimated clinical diagnoses of patients who die in a UK intensive care unit. Intensive Care Med. 2001; 27:706–71.

2. The Intensive Care Society. Venous Thromboprophlaxis in Critical Care. ICS Standards and Guidelines 2008

## 0703

### PERCEIVED AND ACTUAL BLOOD TRANSFUSION TRIGGERS IN CRITICALLY ILL ADULTS: A REGIONAL STUDY IN THE UK

M.N. Crews[1], T. Mahambrey[1]

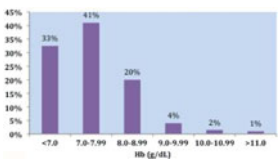
[1]St. Helen's and Knowsley Hospital Trust, Liverpool, UK

**INTRODUCTION.** Red cell transfusion is a potentially life saving therapy. However, it is associated with a number of potentially serious adverse effects in the critically ill. The Transfusion Requirements in Critical Care (TRICC) trial highlighted that a restrictive strategy of red cell transfusion is at least as effective and possibly superior to a liberal transfusion strategy in critically ill patients [1]. Despite this, a later study of 284 Intensive Care Units (ICU) revealed that the mean pretransfusion hemoglobin was $8.6 \pm 1.7$ g/dL [2].

**OBJECTIVES.** We sought to assess perceived and actual red cell transfusion triggers for critical care doctors in the Merseyside region in the UK to establish whether a restrictive transfusion policy was being followed.

**METHODS.** Two regional audits were undertaken involving nine adult ICUs throughout the Merseyside region. The first involved a questionnaire in which doctors were asked to identify at what level of haemoglobin (Hb) they would transfuse a patient. This was followed by a prospective audit of all transfusions taking place over a 2 week period on each unit. Data were collected as to the Hb at the time of transfusion and the indication. Exclusion criteria included patients with acute haemorrhage, acute myocardial infarction, early goal directed therapy and those under 16 years of age.

**RESULTS.** *Perceived Red Cell Transfusion Triggers:* The majority of responders confirmed that they would transfuse at a Hb < 8.0 g/dL, however 23% still felt transfusion above 8.0 g/dL was preferable. *Actual Red Cell Transfusion Triggers:* A total of 204 units of red cells were transfused over the study period. The majority of patients were transfused at a Hb < 8.0 g/dL. However, 27% of patients received RBCs at higher levels of Hb, as shown in the graph below.




Actual transfusion triggers

**CONCLUSIONS.** Despite evidence stating that a restrictive red cell transfusion policy is desirable, 27% of transfusions taking place across the Mersey region are occurring at a level considered to be unnecessary. As such, we are constructing a regional protocol to prevent unnecessary transfusion of such an expensive and potentially dangerous commodity.

**REFERENCE(S).**1. Herbert PC et al. A Multicentre, randomised, controlled clinical trial of transfusion requirements in critical care. NEJM. 1999;340:409–17.

2. Corwin HL et al. The CRIT Study: Anemia and blood transfusion in the critically ill–current clinical practice in the United States. Crit Care Med. 2004;32(1):39–52.

## 0704

### COMPARISON OF ACTIVITY OF CLOTTING FACTORS IN OCTAPLAS AND OCTAPLAS LG DURING STORAGE AT 4°C -+2°C CELSIUS FOR 6 DAYS

M. Krebs[1], M.K. Keller[1], C. Spies[1], K.-D. Wernecke[2], C. von Heymann[1]

[1]Department of Anesthesiology and Intensive Care Medicine, Charité-Universitätsmedizin Berlin, Campus Virchow Klinikum and Campus Charité Mitte, Berlin, Germany, [2]SOSTANA, Berlin, Germany

**INTRODUCTION.** Human plasma is used to replace moderate coagulation factor deficiency e.g. due to acute bleeding. For some years a pool plasma treated with a solvent/detergent step for virus inactivation is available on the market (Octaplas, Octapharma GmbH, Germany) that is associated with a reduced risk of transfusion related lung injury [1]. Recently, a new plasma (Octaplas LG, Octapharma GmbH, Germany) was introduced to the market, which is treated with a modified solvent/detergent step and additionally treated with a prion removal step (ligand gel) to gain even more safety in plasma therapy [2].

**OBJECTIVES.** The long-term stability of clotting factors in thawed and stored LG plasma has not been investigated so far.

**METHODS.** We investigated the long term stability and the bacterial contamination of OctaplasLG compared with Octaplas stored after thawing over 6 days at 4 (±2)°C. 5 plasma bags from each blood group were thawed and the coagulation factors at the following time points 0, 1, 2, 4, 6, 24, 48, 72, 96, 120 and after144 h were measured. The change of parameters over time was analyzed by means of a nonparametric ANOVA for repeated measurements.

**RESULTS.** The results are given as median and 25 and 75% quartiles, Octaplas 0–144 h versus Octaplas LG 0–144 h and p values. Octaplas LG showed significantly higher levels of Fibrinogen (g/l) (2.8 (2.62–2.87)–2.7 (2.6–2.7) versus 2.82 (2.73–2.84)–2.87 (2.75–2.99) $p < 0.0001$), FII (%) (80.3 (79.1–81.5)–74.5 (73.7–77.6) versus 92 (89.6–94.4)–89.6 (87.4–92) $p < 0.0001$),fPS (%) (79.6 (77.7–82.9)–76.1 (73–79.4) versus 87 (84.4–90.9)–82.3 (80.9–83.6) $p < 0.0001$) and PI (%) (33.2 (28.1–34.6)–29.3 (27.4–31.2) versus 57 (55.7–58.2)–56 (54.3–58.6) $p < 0.0001$) but lower levels of FV (%) (101.8 (93.8–104.9)–88.2 (83.8–93.5) versus 96.8 (90.6–99)–81.3 (76.3–84.9) $p = 0.0002$), FVII (%) (104.7 (104.2–109)–80.9 (97.7–83.6) versus 92.8 (91.6–95.4)–74.6 (71–76.4) $p < 0.0001$), FVIII (%) (85.5 (71.5–89.4)–69.7 (63–73.2) versus 73.5 (68.2–78.1)–54.3 (47.8–56.4) $p < 0.0001$), FIX (%) (103.6 (99.2–106.2)–95.9 (93–99) versus 86.6 (82.6–91.9)–86.6 (82.6–89.7) $p < 0.0001$) and FXI [%] (123.4 (112.7–138.3)–118.5 (111–136) versus 99.6 (96–102.3)–87.7 (85.1–89.5) $p < 0.0001$) at 144 h.

**CONCLUSIONS.** The activity of all coagulation factors in Octaplas LG remained in the range of the European Pharmacopoeia (3). The higher level of PI may be due to an improved manufacturing process. This indicates a high quality plasma after 6 days of storage after thawing and would allow transfusion to patients. This may reduce wastage of blood products in the clinical setting.

**REFERENCE(S).** 1. Sachs UJ et al. Transfusion 2005;45(10):1628–31

2. Heger A et al. Vox Sang 2009;97(3):219–25.

3. European Commission: Guide to the Preparation, Use and Quality Assurance of Blood Components, edn. 8, Council of Europe Publishing, Straßbourg, 2002.

**GRANT ACKNOWLEDGMENT.** This study was funded in part by Octapharma GmbH.

## 0705

### FIBRINOGEN FUNCTION AFTER SEVERE BURN INJURY

E. Schaden[1], D. Hoerburger[2], S. Hacker[2], P. Kraincuk[2], D.M. Baron[2], S. Kozek-Langenecker[2,3]

[1]Medical University of Vienna, General Hospital, Anesthesiology, General Intensive Care and Pain Management, Vienna, Austria, [2]Medical University of Vienna, General Hospital, Vienna, Austria, [3]Evangelisches Krankenhaus Vienna, Vienna, Austria

**INTRODUCTION.** Evidence regarding hypercoagulability in the first week after burn trauma is growing. This hypercoagulable state may partly be caused by increased fibrinogen levels. Rotational thrombelastometry offers a test which measures functional fibrinogen (FIBTEM®).

**OBJECTIVES.** To test the hypothesis that fibrinogen determines hypercoagulability in burn patients, we simultaneously measured FIBTEM® and fibrinogen concentration early after burn trauma.

**METHODS.** After Ethics Committee approval consecutive patients with severe burn trauma admitted to the intensive care unit for burn injuries of the General Hospital of Vienna were included in the study. Blood examinations were done immediately and 12, 24 and 48 h after admission. At each time point fibrinogen level (Clauss) and 4 commercially available ROTEM® tests were performed.

**RESULTS.** 20 consecutive patients were included in the study. Fibrinogen level and FIBTEM® MCF were within the reference range until 24 h after trauma but increased significantly 48 h after trauma There was a significant correlation between FIBTEM® MCF and fibrinogen level ($R = 0.714$, $p < 0.001$).

**CONCLUSIONS.** The results of this prospective observational study show that hypercoagulability visualized by ROTEM® occurs early after burn trauma and can be explained by elevated fibrinogen levels.

**REFERENCES.** 1. Luddington RJ. Thrombelastography/Thrombelastometry. Clin Lab Haematol 2005; 27:81–90.

2. Park MS, Martini WZ, Dubick MA et al. Thrombelastography as a better indicator of hypercoagulable state after injury than prothrombin time or activated partial thromboplastin time. J Trauma 2009; 67:266–75.

**GRANT ACKNOWLEDGEMENT.** The study was funded by the Oesterreichische Nationalbank.

## 0706

### PROTHROMBIN TIME AS A MARKER OF EARLY MORTALITY IN PATIENTS ADMITTED TO THE INTENSIVE CARE UNIT

A.H. Furtado Junior[1], B.B. Souza[1], V.N. Araújo[1], M.N.R.T. Henderson[1], J.A. Lino[1], M.A. Holanda[1], F.A. Meneses[1,2], A.A. Peixoto Junior[1,2]

[1]Universidade Federal do Ceará, Intensive Care Unit, Fortaleza, Brazil, [2]Faculdade Christus, Medicina, Fortaleza, Brazil

**INTRODUCTION.** The prothrombin time is a marker of extrinsic pathway of coagulation, which can reflect changes in the microcirculation.

**OBJECTIVES.** To establish an association between the prothrombin times of patients received in intensive care unit (ICU) and the prognosis.

**METHODS.** A retrospective study with analysis of 278 patients consecutively admitted to the ICU during the period from 01 January, 2009 to January 31, 2010.

**RESULTS.** There was a slight predominance of females (51.1%) with a mean age of 56.9 ± 20.5 years. The average length of stay was 7.9 ± 7.3 days and mean APACHE II score was 21.9 ± 9.0 points. Patients with early mortality (within the first 48 h after ICU admission) had higher value of prothrombin time on ICU entrance, expressed through the International Normalized Ratio (INR) (2.5 ± 1.9) than the survivors of this period (1.4 ± 0.5), $p < 0.05$. The multiple linear regression analysis indentified the INR as an independent predictor of progression to early death (Table 1). On the receiver operating characteristic curve, the INR value associated with the best discrimination, between patients with early mortality and survivors, was 1.48 (95% CI: 0.67–0.83, $p < 0.0001$).

**TABLE 1** THE MULTIPLE LINEAR REGRESSION ANALYSIS

| Variables | t score | *p* |
|---|---|---|
| Age | 0.190 | 0.849 |
| APACHE II score | −0.395 | 0.693 |
| INR | 3.705 | <0.001 |
| Lactate | −0.846 | 0.399 |
| Base excess | −0.247 | 0.805 |

R2 adjusted: 0.0712; Standard error: 0.168; Alfa: 0.050–0.968

**CONCLUSIONS.** The prothrombin time can be used as a predictor of early mortality during ICU admission.

## 0707

### URGENT REVERSAL OF VITAMIN K ANTAGONISTS WITH PROTHROMBIN COMPLEX CONCENTRATE (PROTHROMPLEX IMMUNO TIM 4): EFFICACY AND SAFETY IN 83 PATIENTS

T. Requena Portella[1], P. Paniagua[2], M. Belauchi[1], S. Novelli[3], J. Mateo[3]

[1]Hospital de la Santa Creu i Sant Pau, Anaesthesiology, Barcelona, Spain, [2]Hospital de la Santa Creu i Sant Pau, Anesthesiology, Barcelona, Spain, [3]Hospital de la Santa Creu i Sant Pau, Haematology, Barcelona, Spain

**INTRODUCTION.** Rapid reversal of oral anticoagulation with Vitamin K antagonists (VKA) is essential in acute life threatening bleeding and emergent surgery. Prothrombin complex concentrate (PCC) has proved to reverse it faster and safer in terms of volume overload than Fresh Frozen Plasma. Although European Guidelines have approved PCC for urgent reversal of VKA, just 19% of all physicians apply PCC instead of FFP. Thromboembolic risk is their major disadvantage. Prothrompex Immuno Tim 4 contents coagulations factor II, VII, IX and X, inhibitors: Protein C, Antithrombin III and Heparin. Following own Hospital's protocol a standard dose of 600 IU of Prothrompex was administered for urgent VKA-reversal.

**OBJECTIVES.** To ensure efficacy and safety of mentioned dose of PCC.

**METHODS.** A retrospective observational study was developed which inclusions criteria were every VKA treated patient who was admitted to our Hospital between 2007–2009 for urgent reversal due to bleeding or not bleeding reasons. All patients received 600 IU iv. of Prothrompex TIM 4, most of them also got 10-30 mg of Vit K iv and 10 mg of heparin iv. Reversal efficacy was defined as (1) achievement of INR ≤1.5 after PCC. INR follow up at 1, 3, 6, 12, and 24 h were recorded and compared. (2) Clinical response in terms of bleeding control or no abnormal bleeding after surgery. Safety was defined by adverse events.

**RESULTS.** 83 patients (age 71.83 years old, 60.2% men, 39.8% women) Distribution: Bleeding group (BG) n = 63 (75.9%): intracranial haemorrhage 71.4%, gastrointestinal bleeding 9.5%,soft tissue haematoma 7.9%, intracerebral haemorrhage 6.3%,haemoperitoneum 3.2%,haemoptyse 1.6%. Non bleeding group (NBG) n = 20 (24.1%): medical issues 50%, cardiac transplantation 35%,vascular surgery 15%.

Baseline INR's before PCC didn't difere between both groups (3.6 vs. 3.4) as well as INR's at 1 and 3 h after PCC. Significant differences were detected in BG and NBG at 6 h (1.5 vs. 2.6), 12 h (1.4 vs. 2.1) and 24 h (1.2 vs. 1.7) after PCC respectivly. INR reversal was achieved in 57.1 versus 6.7% in the BG within 6 h post PCC ($p < 0.001$). Rebleeding was more frecuent 42.1 versus 18% in the NBG ($p < 0.06$).No differences concerning Vit K, transfusion of blood products, thrombosis or anaphylaxia were detected. Intra hospital mortality were higher (52.6%, n = 10 vs. 25%, n = 15) in the NBG.

**CONCLUSIONS.** INR reversal was only successful in 57.1% of active bleeding patients within the first 6 h after PCC, meanwhile not satisfactory reversal was seen in 93% of the NBG. Reasons for not adequate reversal lie on [1] The standard dose of 600 UI could be ineffective for INR reversal above 3 [1]. Surgery leading to consumptions coagulopathy could explain persistent elevated INR.

**REFERENCE** 1. Vigué B et al. Ultra-rapid management of oral anticoagulant therapy-related surgical intracranial hemorrhage. ICM. 2007;33:721–25.

## 0708

### DELAYED TRANSFUSION IN SURGICAL SERVICES

J.-P. Tourtier[1], F. Trueba[1], S. Cottez-Gacia[1], J.-V. Schaal[1], E. Falzone[1], Y. Auroy[1], Y. Diraison[1], S. Ausset[2].

[1]Military Hospital Val-de-Grâce, Paris, France, [2]Military Hospital Percy, Clamart, France

**INTRODUCTION.** The SFAR/CépiDc-INSERM investigation put in evidence mortality due to a perfectible management of the blood losses in hundred of cases annually in France [1].

**OBJECTIVES.** The purpose of this survey is to look for the rate of delay in red cells transfusion within the surgical services.

**METHODS.** For each patient who received red cells transfusion in any of the surgical services in 2008, we included the surgical file, the anesthesia file, the transfusion record and peri-transfusion full blood counts (FBC) computer data. The absence of an element infers the exclusion. Transfusion triggers are discussed by 2 physicians, in light of the AFSSAPS recommendations [2]. The FBC data are then analyzed according to transfusion and clinical events. Delay [crossing of the trigger- transfusion] over 12 h is considered delayed transfusion. We noted the transfusion episodes (TE) considered unjustified.

**RESULTS.** Five patients corresponding to 5 transfusion episodes were excluded. In visceral surgery, 85 TE were studied, corresponding to 61 patients transfused (age 73 ± 8) and 204 red cells units. Eleven TE were delayed, and 4 TE unjustified. In urology, 65 TE were studied, corresponding to 34 patients transfused (age 77 ± 10) and 164 red cells units. 6 TE were delayed, and 2 TE unjustified. Concerning delayed transfusion, the delay [crossing of the threshold-transfusion] was 34.6 ± 20.5 h in visceral surgery, 29.5 ± 9.1 in urology. In neurosurgery, 6 TE were evaluated, corresponding to 5 patients. No transfusion was delayed or unjustified.

**CONCLUSIONS.** Delayed transfusion is generally found in 11% of transfusion episodes (13% in visceral surgery, 9% in urology). The rate of unjustified transfusion episodes is low: 4% (5% in visceral surgery, 3% in urology). The emphasis is from now placed on the daily reading in the late morning of the results of FBC by the anesthesiologist responsible for a surgical specialty who alerts at the need a member of the surgical team, before checking in late afternoon that required transfusions have been performed.

**REFERENCES.** 1. Anesthesiology 2006;105:1087–97.

2. AFSSAPS. Recommendations. Ann Fr Anesth Reanim. 2003;22:67–81.

## 0709

### EFFECTS OF FIBRINOGEN CONCENTRATE ADMINISTRATION DURING MAJOR HEMORRHAGE

H.R. Thorarinnsdottir[1], F.T. Sigurbjörnsson[2], K. Hreinsson[2], P.T. Onundarson[3,4], T. Gudbjartsson[4,5], G.H. Sigurdsson[2,4]

[1]Landspitali University Hospital, Department of Anaesthesia and Intensive Care, Reykjavik, Iceland, [2]Department of Anaesthesia and Intensive Care, Reykjavik, Iceland, [3]Landspitali University Hospital, Laboratory of Hematology and Coagulation Disorder Center, Reykjavik, Iceland, [4]University of Iceland, Faculty of Medicine, Reykjavik, Iceland, [5]Department of Thoracic Surgery, Landspitali University Hospital, Reykjavik, Iceland

**INTRODUCTION.** Administration of pasteurized fibrinogen concentrate has been shown to improve coagulation in dilutional coagulopathy in experimental studies, but clinical experience is still scarce.

**OBJECTIVES.** The aim of this study was to evaluate laboratory data and clinical outcome of fibrinogen administration in patients suffering from major hemorrhage.

**METHODS.** A retrospective study over a 3-year observation period of consecutive patients who received a single dose of fibrinogen concentrate but not recombinant factor VIIa as part of their treatment of major hemorrhage (>2.0 L).

**RESULTS.** Thirty-seven patients (mean age 74 years, range 23–87, 51% males) were included, most of them suffering from major hemorrhage following open heart (68%) or abdominal surgery (13%). After a median fibrinogen dose of 2 g (range 1-6 g) an absolute increase in plasma fibrinogen concentration of 0.6 g/L was observed ($P < 0.001$). Activated partial thromboplastin time (APTT) and prothrombin time (PT) were also significantly improved ($P < 0.001$), however, platelet counts and D-dimer values remained unchanged. Transfusion requirements for packed red blood cells (PRBC) were significantly reduced ($P < 0.01$) in the 24 h after fibrinogen administration, but fresh frozen plasma (FFP) and platelet concentrate (PC) transfusions were not significantly changed. No adverse effects were documented. Eight patients (22%) died in ICU, most within 28 days, but 27 (73%) were discharged from the hospital and were still alive 6 months later.

**CONCLUSIONS.** Administration of fibrinogen for major hemorrhage improved coagulation parameters and seemed to significantly reduce transfusions of PRBC but not FFP or PC when used as a supplement to conventional treatment.

# Perioperative care: Cardiac and thoracic surgery: 0710–0723

## 0710

### LEVOSIMENDAN IN A CARDIAC SURGICAL ICU

J. Kainz[1], T. Cavic[1], S. Fruhwald[1], T. Hudax[1], W. Toller[1]

[1]University Hospital of Graz, Anesthesiology and Intensive Care Medicine, Graz, Austria

**INTRODUCTION.** Several studies demonstrate a positive effect of levosimendan in patients undergoing cardiac surgery [1, 2]. Levosimendan acts positive inotropic without an increase of myocardial oxygen consumption or proarrythmic side effects. Up to now no data are available about the use of levosimendan in patients undergoing cardiac surgery in real life.

**OBJECTIVES.** Therefore, we conducted a retrospective analysis of the use of levosimendan in our cardiac surgical ICU.

**METHODS.** All patients admitted to our ICU within 1 year being treated with levosimendan were evaluated regarding personal data, use of levosimendan (bolus or not, start of the infusion, amount given), the combination of levosimendan with other drugs (dobutamine, norepinephrine, milrinon, vasopressin, epinephrine and beta-blocker) as well as patients ICU survival.

**RESULTS.** 102 out of 988 patients were treated with levosimendan (10.3%). Mean age was 65 years (5–83), the majority was male (n = 68) with a mean ejection fraction of 37% (12–74%). Mean Euro Score for predicting outcome in cardiac surgery was 12 (3–20). 43 patients (42%) underwent emergency surgery. In nearly half of our patients levosimendan was started during the operation (n = 48, 47%) and in a high proportion after the operation (n = 38, 37%), in 97% of the patients levosimendan was started continuously without a bolus. Virtually all patients (n = 99; 97%) were treated with additional norepinephrine, 41 patients (40%) with dobutamine while other catecholamines or vasopressin were used infrequently. Interestingly, 25 patients (25%) were on betablockers. Overall ICU survival of levosimendan treated patients was 81% (n = 83) with 79% (n = 34) of emergency patients surviving ICU. Patients treated with additional dobutamine or milrinone had higher survival rates (75.6 and 64.7%) compared to those patients requiring epinephrine or vasopressin plus levosimendan (45 and 31%).

**CONCLUSIONS.** Levosimendan is safe in patients undergoing cardiac surgery. Even in those highest risk patients with a mean Euro Score of 12 ICU survival rates were surprisingly high.

**REFERENCE(S).** 1. Tritapepe et al. BJA 2009.
2. Lehmann et al. EJA 2007.

## 0711

### DIAPHRAGMATIC PARALYSIS AS A CAUSE OF RESPIRATORY FAILURE AFTER CARDIAC SURGERY

I. Sáez de la Fuente[1], E. Renes Carreño[1], J.L. Pérez Vela[1], M. López Martínez[1], M.A. Corres Peiretti[1], J. Gutiérrez Rodríguez[1], P. Arribas López[1], N. Perales Rodríguez de Viguri[1]

[1]Hospital Universitario Doce de Octubre, Madrid, Spain

**INTRODUCTION.** Diaphragmatic paralysis is a non common complication of cardiac surgery that may cause further deterioration of pulmonary function, and may lead to secondary hypoxemia, prolonged ventilator use, pneumonia and atelectasis leading to increased ICU and hospital stay, as well as increased morbidity and mortality. The causes of the diaphragmatic paralysis during cardiac surgery are not clearly understood. Direct injury during harvesting of the internal mammary artery, cold injury owing to pericardial ice slush and inadvertent stretch injuries during intra-pericardial manipulation of the heart are some documented causes, but the injury may occur without an apparent reason.

**OBJECTIVES.** To assess the incidence of diaphragmatic paralysis in patients undergoing cardiac surgery and it's impact on morbidity and mortality.

**METHODS.** Retrospective, descriptive study of a population of 6,000 patients undergoing cardiac surgery during the years 1996–2010. The diagnosis of diaphragmatic paralysis was made based on the association of clinical criteria (ventilatory failure, paradoxical breathing), radiological criteria (diaphragmatic elevation) and the relationship between intra-abdominal and intra-thoracic pressure recorded simultaneously. There is an uncertain number of patients that could present milder forms of diaphragmatic paralysis with little impact on the postoperative care.

**RESULTS.** Twenty-five patients (0.40%) were including according to the criteria previously disscused. 68% male, with a mean age of 61 years. Aortic surgery 24%, valve surgery 40%, pericardiectomy 20%, heart transplant 12%, coronary artery bypass grafting 4%. The diaphragmatic paralysis was bilateral in 36%, Left in 48% and right in 16%. The median duration of mechanical ventilation was 168 h (8–3,600), with a following need of non-invasive mechanical ventilation in a 36% of cases. Reintubation occurred in 36% of patients, while 44% underwent tracheostomy. The median ICU stay in this patients was 14 days (2–151), much higher than global (2 days). Mortality of 12%.

**CONCLUSIONS.** Diaphragmatic paralysis in patients undergoing cardiac surgery is a non frequent complication, but with a great impact on morbidity and resource consumption. It should be considered in cases of difficult weaning. The difficulty in initial diagnosis prevents to know it's real incidence, delaying appropriate treatment. The early onset of non-invasive mechanical ventilation could be useful in milder forms.

**REFERENCE(S).** Ko MA, Darling GE. Acquired paralysis of the diaphragm.Thorac Surg Clin. 2009;19(4):501–10.
Miñambres E, García García A, Rodríguez Borregan JC et al. Parálisis diafragmática bilateral tras cirugía cardíaca. Arch Bronconeumol 2000;37:454–6.
De Vita MA, Robinson LR, Rehder J, Hattler B, Cohen C. Incidente and natural history of phrenic neuropathy occurring during open heart surgery. Chest 1993;103:805–56.

## 0712

### ANALYSIS OF RISK FACTORS FOR ACUTE RENAL FAILURE AFTER CARDIOPULMONARY BYPASS: RELATIONSHIP WITH HAEMOLYSIS AND SERUM FERRITIN LEVEL

O. Aydın[1], Y. Bicer[2], N. Yapici[1], F. Coskun[1], Y. Altuntas[1], G. Golcukcu[1], Z. Aykac[1]

[1]Siyami Ersek Cardiothorac-Vasc Sur. Center, Istanbul, Turkey, [2]Siyami Ersek Cardiothorac-Vasc Sur. Center, Anaesthesiology, Istanbul, Turkey

**INTRODUCTION.** Development of acute renal failure (ARF) after cardiac surgery is related with increased mortality, morbidity and length of hospital stay [1]. It was proposed that free iron emerged after haemolysis could be one of the responsible factors of ARF devolopment after cardiopulmonary bypass and high levels of ferritin which is known to bind free iron could prevent ARF [2]. In this study, risk factors (including serum free haemoglobin level) of acute renal failure development after cardiac surgery were investigated. It was also investigated that whether or not high serum level of ferritin is protective for ARF.

**MATERIAL AND METHOD.** 50 consecutive patients who had normal preoperative renal functions and undergone open heart surgery at our hospital were included in the study after getting Ethic Commitee approval. Preoperative, operative and postoperative clinical and laboratory findings of patients were recorded. ARF was described as a 25% or more increases of preoperative creatinin level during 48 h of surgery. The relationship between recorded variables and ARF development were investigated.

**RESULTS.** ARF was developed in 26 of 50 (52%) patients studied. Age, diabetes mellitus (DM), high preoperative levels of blood urea and creatinin, body mass index (BMI) were found to be risk factors for ARF development after cardiopulmonary bypass. Precence of preoperative hypertension (HT), and/or low left ventricular ejection fraction (EF <40%) were found to be unrelated with ARF development. Serum ferritin level was lower than 130 μg/L in 63.9 and 54.2% of ARF developed and nondeveloped cases, respectively, although it was not reach statistical significance. Intraoperative variables that were found to be related with ARF development were valvular surgery, cross clamp time, cardiopulmonary bypass time, operation time and low urinary output. Entubation time, intensive care unit and hospital stay were longer in ARF developed patients. Preoperative, operative and postoperative serum free haemoglobin level's of ARF developed and nondeveloped patients were not different.

**CONCLUSIONS.** Since ARF after cardiac surgery is related with high morbidity and mortality, it is very important to define the patients at high risk of ARF preoperatively. After defining high risk patients, ARF could be perevented by improved care, detailed monitorization and optimization of renal perfusion.

**REFERENCES.** 1. Mangano CM, Diamondstone LS, Ramsay JG, Aggarwal A,Herskowitz A, Mangano DT: Renal dysfunction after myocardial revascularization: Risk factors, adverse outcomes and hospital resource utilization. Ann Intern Med 1998;128:194–203.
2. Davis CL, Kausz AT, Zager RA, Kharasch ED, Cochran RP: Acute renal failure after cardiopulmonary bypass is related to decreased serum ferritin levels. J Am Soc Nephrol. 1999;10:2396–402.

## 0713

### STUDY OF RISK FACTORS AND STERNAL DEHISCENCE USING INTERNAL THORACIC CORONARY ARTERIES ON CABG

M.V. Boado Varela[1], R. Voces[2], P. Serna Grande[1], I. Seijas Betolaza[1], E. Diaz Garmendia[1], T. Cantera[1], M. Ugalde Gutierrez[1], A. Sanchez Bustinduy[1], J.I. Aramendi[2], L. Martinez Indart[3]

[1]Hospital de Cruces, ICU, Barakaldo, Spain, [2]Hospital de Cruces, Cardiac Surgery Department, Barakaldo, Spain, [3]Hospital de Cruces, Research Unit, Barakaldo, Spain

**INTRODUCTION.** The use of both right and left internal thoracic arteries in CABG increase graft patency and life span. Nevertheless, the inconvenient could be a higher risk of sternal dehiscence and infection.

**OBJECTIVES.** We review the use of both internal thoracic arteries and the subsequent sternal complications considering preoperative risk factors and highlighting the triad obesity, EPOC, DM.

**METHODS.** Data were collected retrospectively from 662 patients who underwent isolated CABG over the last 6 years. Patients were allocated to none or one internal thoracic artery grafting (group A) or two internal thoracic arteries (group B) and then, evaluated on classic risk factors (RF)of dehiscence: gender, age, obesity, DM, COPD, smoking condition, renal impairment, peripheral vascular disease (PVD), cardiac low output. We define two high risk groups: first one with ≥ 3 risk factor and second one with the triad obesity-COPD-DM.

**RESULTS.** Of 662 CABG, both arteries were used in 190 patients (28%).Data showed higher sternal dehiscence in group A than in group B (1 to 0.06%). More prevalence of ≥ 3 risk factors in group A $p < 0.01$ and the same for the triad. Once the data has been corrected by age, no differences were found in the distribution of RF between groups apart from shock or low EF. No differences were found in sternal dehiscence.

**CONCLUSIONS.** The use of both right and left thoracic arteries can not be excluded in patients of <70 age with high risk factor of dehiscence using skeletonized technique. Postoperative complications as profuse bleeding, reoperation, shock and prolonged mechanical ventilation can have more influence on dehiscence.

**REFERENCE(S).** Circulation. 2008;118:S210–5.
Circulation. 2008;118:S216–21.
Circulation. 2008;118:705–712.

## 0714

### TRANSCATHETER AORTIC VALVE IMPLANTATION (TAVI): INCIDENCE OF ACUTE KIDNEY INJURY (AKI)

P. Maniglia[1], L. Salvi[1], V. Mazzanti[1], S. Gregu[1], E. Sisillo[1]

[1]Centro Cardiologico Monzino IRCCS, Department of Anaesthesia and Intensive Care, Milan, Italy

**INTRODUCTION.** TAVI is an emerging procedure for patients who are considered at very high or prohibitive risk for standard surgery. Moreover, these patients are prone to the contrast induced nephropathy (CIN), due to the angiographic procedure needed.

**OBJECTIVES.** We decided therefore to study the incidence of AKI following TAVI procedures and to analyze if any of the preexisting co-morbidities, of the patients characteristics and of perioperative factors could influence its developement.

**METHODS.** After Ethical Committee approval and written personal informed consent, 148 patients undergoing TAVI were enrolled in this prospective observational study. AKI was defined according to the AKINetwork definitions [1]. We analysed 17 peri-operative variables with univariate statistical analysis. Then, the factors statistically significant underwent a multivariate logistic regression analysis to verify the relative risk for AKI. A p value $< 0.05$ was considered significant.

**RESULTS.** 28 out of 148 patients (18.9%) fulfilled postoperatively the criteria for AKI. Of these patients, 25 recovered a normal renal function during the hospital stay, 3 died and 6 required RRT (4%). The risk factors identified by the univariate analysis were Euroscore ($p < 0.0265$), perioperative administration of inotropic drugs ($p < 0.0001$), transfusion of red blood cells ($p < 0.0009$), time of ventilation ($p < 0.0013$). The multiple logistic regression model evidenced that only two of these variables, the administration of inotropic drugs and the time of ventilation, have statistical significance as indipendent risk factors for the developement of postoperative AKI (Table 1).

**TABLE 1**

| Variable | Odds Ratio | 95% CI | p Value |
|---|---|---|---|
| Euroscore | 1.156 | 0.890–1.502 | 0.2784 |
| Inotropic drugs | 4.146 | 1.507–11.405 | 0.0059 |
| Hemotransfusions | 1.205 | 0.963–1.507 | 0.1034 |
| Time of ventilation | 1.354 | 1.101–1.666 | 0.0041 |

**CONCLUSIONS.** The patients undergoing TAVI remain at high risk for developing AKI although submitted to a miniinvasive procedure [2]. Our data suggest that the need of inotropic drugs and of a prolonged mechanical ventilation in the perioperative period are indipendent risk factors for the developement of postoperative AKI.

**REFERENCE(S).** 1. Mehta RL, Kellum JA, Shah SV, Molitoris BA, Ronco C, Warnock DG et al. Acute Kidney Injury Network: report of an initiative to improve outcomes in acute Kidney injury. Crit Care 2007;11:R31

2. Strauch JT, Scherner MP, Haldenwang PL, Pfister R, Kuhn EW, Madershahian N et al. Minimally invasive transapical aortic valve implantation and the risk of acute kidney injury. Ann Thorac Surg 2010;89:465–70.

## 0715

### LOCALIZED TAMPONADE: DIAGNOSIS AND PROGNOSTIC FACTORS

A. Grümann[1,2], L. Barreto[3], A. Dugard[2,3], J.-B. Amiel[2,3], G. Lheritier[2,3], P. Morera[4], E. Cornu[4], N. Pichon[2,3], M. Clavel[2,3], B. François[2,3], P. Vignon[2,3,5]

[1]Dupuytren Teaching Hospital, Medical-Surgical ICU, Limoges, France, [2]CIC-P 0801 Limoges, Limoges, France, [3]Dupuytren Teaching Hospital, Medical-surgical ICU, Limoges, France, [4]Teaching Hospital of Limoges, Cardiac and Thoracic Surgery, Limoges, France, [5]Faculty of Medicine, University of Limoges, Limoges, France

**INTRODUCTION.** Localized (single-chamber) tamponade may occur after cardiac surgery or severe blunt chest trauma as a result of the development of a compressive hematoma. Bedside diagnosis frequently relies on transesophageal echocardiography (TEE).

**OBJECTIVES.** To determine prognostic factors and TEE findings associated with localized tamponade.

**METHODS.** We retrospectively studied 27 ventilated patients (median age [25–75th percentiles]: 73 [55–75] years; SAPSII: 38 [30–44]; SOFA: 8 [5–10]) who were diagnosed with a localized tamponade (post-cardiac surgery: $n = 22$; trauma: $n = 5$) during their ICU stay. Severity scores (SOFA), clinical findings (mean blood pressure, central venous pressure, vasopressor-resistant shock), biological values (hemoglobin level, lactates, ASAT and ALAT) were recorded on admission and at the time of tamponade diagnosis, and compared between survivors and non survivors. Prognostic factors were determined using an univariate analysis due to the small sample size. Studied TEE findings were: inverted cardiac chamber free wall curvature, blood flow turbulence with color Doppler mapping, respiratory variations of maximal mitral E wave velocity, area and maximal anteroposterior and lateral distances of the compressive hematoma.

**RESULTS.** Nineteen patients (70%) presented with early tamponade (≤6 days before diagnosis. Seven patients died during their hospital stay (25%). On ICU admission, factors predictive of hospital mortality were ASAT and ALAT levels ($P = 0.02$). In contrast, SAPSII ($P = 0.3$) and SOFA scores ($P = 0.9$) were not related to patient outcome. At the time of tamponade diagnosis, lactate ($P = 0.02$), SOFA score ($P = 0.02$), ASAT and ALAT levels ($P = 0.01$) were the only predictive factors of death. In contrast, mean blood pressure ($P = 0.13$), central venous pressure ($P = 0.9$), hemoglobin level ($P = 0.3$), vasopressor-resistant shock ($P = 0.4$) were not predictive of mortality. Transthoracic echocardiography depicted the localized tamponade in only 3 out of 4 examined patients, whereas TEE was always conclusive. The compressive hematoma appeared as an echodense mass ($n = 15$) or as an echo-free space ($n = 12$) of variable size (median area [25th–75th percentiles]: 14 $cm^2$ [4–32]; size: 38 mm [18–52] × 67 mm [37–100]). The free wall curvature of the involved cardiac chamber was inverted and blood flow turbulences were present in all patients. In these ventilated patients, respiratory variations of mitral E wave maximal velocities was always <20%.

**CONCLUSIONS.** Since localized tamponade has various clinical presentations, the diagnosis mainly relies on TEE which solely allows the identification of the collapsed cardiac cavity at bedside. Conventional echocardiographic findings associated with unloculated tamponade are not valid in this setting. ASAT and ALAT levels appeared as relevant biological markers, potentially predictive of death.

## 0716

### RELATED FACTORS TO THE DEVELOPMENT OF RENAL FAILURE IN THE POSTOPERATIVE PERIOD OF CARDIAC SURGERY AND ITS RELATIONSHIP TO EARLY MORTALITY IN THE ICU: ARIAM DATABASE FOR CARDIAC SURGERY IN ANDALUSIA

E. Curiel Balsera[1], J. Muñoz Bono[1], M.D. Fernandez Zamora[1], C. Lopez Caler[1], J.C. Escudero Varela[1], M. Alvarez Bueno[1], ARIAM Cardiac Surgery registry in Andalusia

[1]Carlos Haya Regional University Hospital, Intensive Care Unit, Málaga, Spain

**INTRODUCTION.** Acute renal failure (ARF) is a common risk factor of increased morbidity and mortality in many of our patients.

**OBJECTIVES.** We analyzed which factors have a relationship in the development of ARF in patients after cardiovascular surgery and its relationship with mortality.

**METHODS.** Multicenter and retrospective study of patients under cardiovascular surgery included in ARIAM database between March 2008 to November 2009 in all public and private hospitals with cardiac surgery. We analyzed clinical, epidemiological features and management during the surgery and intensive care unit stay. ARF was defined as a deterioration in renal function with an increased levels of creatinine up of 2 mg/dl, or clearance creatinine (ClCr) <50%. We analyzed clinical and demographic data, the length of stay in the ICU and hospital, mortality during stay in the ICU and the presence of ARF. Data are expressed as mean, median or percentage, using the Student test to compare means and Chi square to detect possible associations between variables.

**RESULTS.** We analyzed 2,453 patients, 60.7% were male patients, with a mean of 62.9 ± 12.7 years old. Patients had an EUROSCORE of 5.7 ± 3.2 and SAPS 3 of 40.3 ± 11.3. ARF appeared in 8.5%. The presence of ACR was associated with higher mortality [$p = 0.0001$. OR 7.48 IC95% (5.3–10.5)]. The global mortality was 8.2%. The age, the time of extracorporeal circulation, the ejection fraction of the heart, euroscore and saps 3 (all $p = 0.0001$), diabetes [$p = 0.017$ OR 1.4 (1.06–1.91)], the previous treatment with diuretics [$p = 0.0001$ OR 1.9 (1.4–2.6)], the elective surgery [$p = 0.0001$ OR 0.38 (0.26–0.53)], the combined coronary artery bypass graft (CABG) and valve replacement surgery [$p = 0.0001$ OR 2.8 (1.9–4.2)] and early complication after surgery such as shock [$p = 0.0001$ OR 6.4 (4.6–8.9)], POMI [$p = 0.04$ OR 1.7 (1–3.1)], sepsis [$p = 0.0001$ OR 7.3 (4.6–11.5)] o pneumonía [$p = 0.0001$ OR 6.3 (4.1–9.7)] were identified as predictive risk factors for ARF by univariate analysis.

**CONCLUSIONS.** In our series older patients with diabetes and previous treatment with diuretics underwent emergency combined CABG and valve replacement surgery had higher rate of acute renal failure. Patients with ARF had a higher early mortality in the ICU.

**REFERENCE(S).** Park M, Coca SG, Nigwekar SU, Garg AX, Garwood S, Parikh CR. Prevention and Treatment of Acute Kidney Injury in Patients Undergoing Cardiac Surgery: A Systematic Review. Am J Nephrol. 2010 Apr 6;31:408–18.

**GRANT ACKNOWLEDGMENT.** Health Counseling Board of Andalucia that supports economically the maintenance of the registration.

## 0717

### UTILITY OF CALCIUM SENSITIZER IN LOW CARDIAC OUTPUT SYNDROME IN THE POSTOPERATIVE MITRAL VALVE REPLACEMENT

R. Garcia Gigorro[1], J.L. Pérez-Vela[1], I. Sáez de la Fuente[1], E. Renes Carreño[1], M.A. Corres Peiretti[1], P. Arribas López[1], J. Gutierrez Rodríguez[1], N. Perales Rodríguez de Viguri[1]

[1]Hospital 12 de Octubre, Intensive Medicine, Madrid, Spain

**INTRODUCTION.** The low cardiac output syndrome (LCOS) during postoperative mitral valve replacement has an incidence of 20%. This is associated with a higher morbidity and mortality, an increase of stay in Intensive Care Units and in the consumption of resourcers.

**OBJECTIVES.** We describe the demographic characteristics, treatment option, complications and evolution of a series of 18 cases with LCOS in the postoperative mitral valve.

**METHODS.** We conducted a retrospective study analyzing the use of levosimendan in adult patients with mitral valve replacement who develop LCOS (cardiac index $< 2.2$ l/min/$m^2$ and $SvO_2 < 65\%$) and not respond to treatment with inotropic agents, from January 2009 to April 2010. We collect demographic, hemodynamic and respiratory variables, response to amines, complications and outcome. The results are expressed as mean and standard deviation or percentage.

**RESULTS.** There were 121 mitral valve replacements. 18 patients (14.9%) had LCOS, 11 women (61%) and 7 men (39%), with a mean age of 63 years and a mean euroescore of 6.88. The indication of valve replacement was for: 7 patients rheumatic heart disease (39%), 5 with annular calcification (28%), mitral valve prolapse in 2, annular dilatation (secondary to dilated cardiomyopathy) in 2, one with ischemic mitral regurgitation, and one prosthetic dysfunction.In the postoperative hemodynamic management we use dobutamine for LCOS after optimizing preload and heart rate; in these 18 cases we report, is also given levosimendan. Only 2 patients used a loading dose (6 μg/kg); continuous infusion was starting at doses of 0.1 μg/kg/min and reaching maximum levels (0.2 μg/kg/min) in 10 patients (55%). Favorable response was achieved in 17 patients (94%), which was considered complete (stopping dobutamine within 24 h of treatment) in 9 patients, and partial (decrease of at least 75% of dobutamine in 24 h) in 7 patients. Only one patient was a non-responder who required amines restart. Side effects potentially attributable to levosimendan were an episode of hypotension that responded to fluid intake and a self-limited FA. Mean ICU stay was 4.6 days, with mean time of mechanical ventilation of 13 h. One patient died after surgery.

**CONCLUSIONS.** In our series, levosimendan was helpful in the management of LCOS during postoperative mitral valve replacement, allowing removal of the amines. It has been shown to be a safe drug with few adverse effects attributable.

**REFERENCE(S).** 1. St. Andre AC. Hemodynamic management of patients in the first 24 h after cardiac surgery. Crit Care Med. 2005;33:2082–92.

2. Levin RL et al. Superioridad del sensibilizante al calcio levosimendan comparado con dobutamina en el síndrome de bajo gasto cardiaco postoperatorio. Rev Esp Cardiol. 2008;61(5):471–9.

3. Garcia Gonzalez MJ. Efectos del levosimendan en el tratamiento del aturdimiento miocárdico y del síndrome de bajo gasto cardiaco después de cirugía cardiaca. Rev Esp Cardiol. 2006;59 (8):850–2.

## 0718

### BEDSIDE MEDICAL THORACOSCOPY IN MANAGEMENT OF THE REFRACTORY EXUDATIVE PLEURAL EFFUSION WITH ACUTE RESPIRATORY FAILURE BY USING A FLEXIBLE BRONCHOSCOPE AND PIG-TAILED CATHETER

H. Ooi[1], L.K. Chiu[1], M.C. Liu[2], M.S. Chang[1]

[1]Tzu-Chi Hospital, Taichung Branch, Chest Division, Internal Medicine Department, Taichung, Taiwan, Republic of China, [2]Tzu-Chi Hospital, Taichung Branch, Taichung, Taiwan, Republic of China

**INTRODUCTION.** The advances of endoscopic technology provided high optical resolution and small diameters of the instruments. These always carried out in the endoscopy room or operating room.

**OBJECTIVES.** We used a flexible bronchoscope to entry a wound which was less than 1 cm.The whole procedures were done in the ICU bedside. A 16 Fr pig pig-tailed catheter inserted after the procedures.

**METHODS.** We used chest sonography to locate the entry in patients with exudative pleural effusion. Then the endoscopy went through a tocar 5.5 mm under local anesthesia; A 16 Fr pig pig-tailed catheter inserted after the procedure. Then the clinical data retrospectively studied.

**RESULTS.** The Bedside 's Thoracoscopy was done on 8 patients. There were 5 patients (63%) proved to be malignant, 2 (25%) were parapneumonic effusion and 1 (13%) was empyema; and 1 patients (13%) reported as tuberculosis. All of the patients were received adhesiolysis due to the septated formation. There were no major complications noted after the procedure.

**CONCLUSIONS.** This modified thoracoscopy is considered to be used in the bedside of ICU due to it's simple and safe technique, which daily using in medical pulmonologist.

**REFERENCE(S).** 1. Dhanya S, Ravindran C (2009) Medical thoracoscopy-minimal invasive diagnostic tool for a trained pulmonologist. Calicut Med J 7:1–9.

2. Toshhinobu Y, Reiko T (2009) Medical Thoracoscopy performed using a flexible bronchoscope inserted through a chest tube under local anesthesia. Diagn Ther Endosc 39481:1–4.
3. Pyng L, Henri C (2007) State of the art: Pleuroscopy. J Thorac Oncol 2:663–70.

## 0719

### HYPEROXIA IMPAIRS OXYGEN UTILIZATION IN PORCINE MODEL OF RUPTURED ABDOMINAL AORTIC ANEURYSM REPAIR

J. Hruda[1], P. Suk[1], I. Cundrle Jr.[1], M. Helan[1], J. Krbusik[1], M. Vlasin[2], R. Vlachovsky[3], Z. Konecny[3], M. Matejovic[4], M. Pavlik[1], V. Sramek[1]

[1]St. Anna's University Hospital, Masaryk University and ICRC Brno, Department of Anaesthesia and Intensive Care, Brno, Czech Republic, [2]University of Veterinary and Pharmaceutical Sciences and ICRC Brno, Brno, Czech Republic, [3]St. Anna's University Hospital, Masaryk University and ICRC Brno, II.nd Clinics of Surgery, Brno, Czech Republic, [4]University Hospital Pilsen and Charles University Pilsen, 1 st Department of Internal Medicine, Plzen, Czech Republic

**INTRODUCTION.** The opinion on administration of oxygen has been repeatedly rewieved over the past few years. Though hyperoxia might be benefitial in certain conditions, it is as well harmful due to oxygen toxicity. Since pathophysiology of AAA rupture is a combination of haemorrhagic shock and ischaemia/reperfusion trauma it can be assumed that many involved mechanisms might be affected by hyperoxia.

**OBJECTIVES.** To evaluate the effect of hyperoxia (100% inhaled oxygen) in a porcine model of ruptured abdominal aortic aneurysm (AAA) repair.

**METHODS.** Twenty-four male pigs weighting 38 (37–39) kg were separated to normoxemia ($FiO_2 = 0.25$) and hyperoxia group ($FiO_2 = 1.0$); 8 pigs in each group underwent the simulation of AAA rupture under general anaesthesia. Data of 4 sham-operated pigs in each group are not presented. Multiple transit time flow probes and catheters were used to determine regional blood flows, blood sampling and measurement of systemic hemodynamics. Baseline values (T1) were obtained after 2 h following the initial instrumentation. Subsequently, AAA rupture was simulated by bleeding the pigs to MAP 45 mmHg and abdominal cavity infused with warmed saline to reach intra-abdominal pressure of 25 mmHg. Hyperoxia started within this period. Data were collected after 4 h (T2) of shock. During repair surgery phase, infrarenal aortic clamping was performed (T3) and hemodynamics was resuscitated with shed blood. Intensive care then followed for 11 h (T4). Only systemic hemodynamics, oxygen transport and lactate data are presented in this abstract as median (IQR). Data were processed with appropriate non-parametrical tests.

**RESULTS.** Data are presented in Tables 1 and 2. Oxygen consumption ($VO_2$) and extraction (OER) were significantly lower in hyperoxia group during clamping. Also lactate levels were clearly higher in hyperoxia pigs but did not reach statistical significance. (# $p < 0.05$ vs. Normoxemia, ## $p < 0.01$ vs. Normoxemia).

**TABLE 1** CO AND LACTATE

| | Group | T1 (baseline) | T2 (end-bleeding) | T3 (end-clamping) | T4 (end-study) |
|---|---|---|---|---|---|
| CO l/min | Norm | 5.62 (4.93–6.96) | 1.86 (1.34–2.11) | 7.92 (6.12–8.90) | 7.77 (6.77–9.25) |
| CO l/min | Hi-oxy | 5.33 (4.34–5.67) | 1.51 (1.29–1.72) | 5.84 (5.48–6.50) | 6.34 (4.96–8.00) |
| LAC mmol/l | Norm | 1.05 (1.00–1.67) | 10.59 (7.00–11.91) | 2.55 (0.94–4.73) | 0.52 (0.43–0.75) |
| LAC mmol/l | Hi-oxy | 1.15 (0.98–1.60) | 8.35 (6.89–9.25) | 4.45 (2.34–5.55) | 0.59 (0.40–0.90) |

**TABLE 2** $DO_2$, $VO_2$ AND OER

| | Group | | | | |
|---|---|---|---|---|---|
| $DO_2$ ml/kg/min | Norm | 16.89 (12.75–25.77) | 3.79 (3.53–6.68) | 20.66 (18.86–21.94) | 20.21 (17.62–26.33) |
| $DO_2$ ml/kg/min | Hi-oxy | 16.07 (15.25–17.16) | 4.30 (3.96–4.81) | 17.52 (15.46–21.50) | 21.23 (15.93–22.28) |
| $VO_2$ ml/kg/min | Norm | 3.71 (2.94–4.40) | 2.33 (1.35–4.17) | 4.04 (3.02–4.15) | 3.54 (2.99–4.31) |
| $VO_2$ ml/kg/min | Hi-oxy | 3.11 (2.18–4.00) | 2.16 (1.75–2.67) | 1.33 (0.60–2.52)## | 2.70 (2.28–2.93) |
| OER % | Norm | 18.10 (16.00–29.00) | 51.30 (37.50-57.80) | 18.05 (16.00–19.10) | 16.30 (10.10–19.80) |
| OER % | Hi-oxy | 16.05 (13.75–23.40) | 53.10 (40.00–57.90) | 7.90 (3.05–16.05)# | 14.15 (10.00–18.40) |

**CONCLUSIONS.** Hyperoxia leads to impaired oxygen metabolism in porcine model of AAA rupture.

**REFERENCE(S).** Bitterman, H. Bench-to-bedside review: Oxygen as a drug. Crit Care. 2009;13:205. doi:10.1186/cc7151.

**GRANT ACKNOWLEDGMENT.** Supported by IGA MZCR NS 10109-4 and VZ MSM 0021620819.

## 0720

### ELEVATED TROPONIN LEVELS PREDICTIVE ROLE IN CORONARY REVASCULARIZATION SURGERY POSTOPERATIVE MANAGEMENT

L.D. Muñoz Jimenez[1], A.M. Cabrera Calandria[1], J. Muñoz Bono[1], R. Gomez Calvo[1], L. Chimali Cobano[1], R. Olalla Sanchez[1]

[1]Hospital Carlos Haya, Malaga, Spain

**INTRODUCTION.** Troponin is the biomarker of choice for the detention of myocardial injury. Elevated troponin levels are frequently detected following cardiac surgery, however understanding this elevation is clinically controversial.

**AIM.** To evaluate if cardiac revascularization surgery postoperative elevated troponin levels are predictive of higher hospital mortality risks.

**METHOD.** 120 patients undergoing coronary revascularization surgery on our premises in the last 2 years were included. Preoperative data regarding gender, age, cardiovascular risk factors, previously diagnosed acute myocardial infarction, number of affected vessels and ventricular function was collected. Following surgery, type of intervention carried out was evaluated as well as grafting needed, extubation time, indicators of postoperative bleeding, highest troponin levels, necessity for blood derivatives transfusion, vasoactive drugs or intra aortic balloon pump (IABP) counterpulsation, renal failure development, auricular fibrillation, neurological complications and surgical reintervention.

**RESULTS.** 80% of the patients included are men while 20% are women aged 65 ± 8 years. Risk factors related, 66.9% of the patients are hypertensive, 56.2% of them smoke, 39.7% of the patients are diabetics and 59.5% of them suffer from dyslipidemia. 63.3% of the patients were previously diagnosed with acute myocardial infarction. Most predominantly, 69.4% of the patients had three vessel disease conditions. Respectively, 32.2% of the patients required blood derivatives transfusions; 38% required vasoactive drugs; and, in 5% of them, balloon pump counterpulsation was required. Renal failure was diagnosed in 12.4% of the patients but only 3 subjects needed hemodialysis. Neurological complications were observed in 2.5% of the patients and 1.7% of them underwent reintervention. 19.8% of the patients experienced auricular fibrillation while average extubation time is 9.3 h. Elevated troponin levels were observed in 47.9% of the patients averaging 7.9 ± 11 ng/ml with 5% mortality. Following our multivariate analysis, elevated troponin outstood as an independent mortality predictive factor (OR 1.14, IC, 95% of them, 1.05-1.24, $P = 0.002$).

**CONCLUSION.** Postoperative elevated troponin levels can be associated with higher hospital mortality risks among patients undergoing coronary revascularization surgery.

## 0721

### OFF-PUMP CORONARY REVASCULARIZATION SURGERY POSTOPERATIVE MANAGEMENT VERSUS CONVENTIONAL SURGERY

A.M. Cabrera Calandria[1], L.D. Muñoz Jimenez[1], J.M. Mora Ordoñez[1], V. Olea Jimenez[1], J. Muñoz Bono[1], R. Gomez Calvo[1]

[1]Hospital Carlos Haya, Malaga, Spain

**INTRODUCTION.** Conventional coronary surgery using extracorporeal circulation (ECC) casts beneficial results over the years. However, ECC is known to be related with a number of physiopathological bodily dysfunctions such as systemic inflammatory syndrome, myocardial ischemia, renal failure, neurological damage, respiratory distress and coagulation and immune system alterations causing morbidity and sometimes mortality. Coronary surgery without ECC aims at reducing those physiopathological alterations while increasing the benefits for high-risk patients.

**AIM.** To evaluate and compare postoperative management between patients undergoing on-pump and off-pump coronary revascularization surgery.

**METHODS.** A study was conducted that included patients undergoing surgery without ECC in the last 5 years on our premises. For every patient stated, another patient receiving conventional surgery was included. Preoperative data regarding gender, age, cardiovascular risk factors, previously diagnosed acute myocardial infarction, number of affected vessels and ventricular function was collected. Following surgery, time until extubation was recorded together with indicators of postoperative bleeding, highest troponin levels, necessity for blood transfusion, vasoactive drugs or intra aortic balloon pump (IABP) insertion, renal failure development, auricular fibrillation, neurological complications and surgical reintervention.

**RESULTS.** Each group studied included 69 patients without significant differences relating to average age, gender, cardiovascular risk factors, history of previous heart attack and ejection fraction after surgery with and without ECC. Subsequently, postoperative management results following on-pump and off-pump surgery respectively show that the average extubation time was 9.6 versus 9 h; average postoperative bleeding was 410 cc versus 390 cc; 37.7 versus 1.9% ($P < 0.05$) of the patients required blood derivatives transfusion, 38.5 versus 36.2% of the patients required vasoactive drugs, and 7.7 versus 2.9% ($P < 0.05$) of the patients required IABP insertion. Increased levels of troponin T were observed in 59.6 versus 39.1% ($P < 0.05$) of the patients, averaging 9.7 versus 6.3 ng/ml. 23.3 versus 15.4% of the patients experienced auricular fibrillation episodes; and, 15.4 versus 10.1% underwent renal failures. None of the patients undergoing surgery without ECC reported neurological complications, compared to a 3.8% when undergoing conventional surgery. Only 1 patient on each group required reintervention. Average ICU stay was 3.9 ± 4.8 versus 3.7 ± 5.3 days. Total mortality averaged 3.9 versus 2.76% respectively.

**CONCLUSIONS.** According to our own experience, off-pump coronary bypass revascularization surgery proves to be a safe and efficient alternative to conventional coronary bypass surgery showing low mortality and reducing postoperative morbidity while increasing the benefits for high-risk coronary patients.

## 0722

### THORACIC AORTIC SURGERY: PROGNOSTIC SCORING SYSTEMS FOR PREDICTING MORTALITY

M.J. Chaparro Sánchez[1], E. Curiel Balsera[1], V. Olea Jiménez[1], M. Alvarez Bueno[1], T. Garcia Paredes[1],

ARIAM Cardiac Surgery in Andalusia

[1]Hospital Carlos Haya, Intensive Care Unit, Málaga, Spain

**INTRODUCTION.** The predictive accuracy of Euroscore for predicting mortality for patients undergoing cardiac surgery is now firmly established. An earlier scoring system for predicting mortality in cardiac surgery include Parsonnet, the first to demonstrate that his method could be applied to European practice. We have asked ourselves about the ampliation of use of Euroscore in thoracic aortic surgery (TAS). There are little experience about this.

**OBJECTIVES.** To know the clinical profile and the accuracy of Euroscore and other risck-predicting models (Parsonnet and SAPS 3) to predict operative risk in TAS in our setting(patients included in ARIAM database of Andalusian hospitals).

**METHODS.** Euroscore, Parsonnet and SAPS 3 models were applied prospectively to all patients underwent TAS since March 2008 to November 2009. The database contains information collected during perioperative period (demographical data, risk factors, operative details, postoperative curse in ICU and mortality). Model discriminations were tested by determining the area under the ROC curve. The data were expressed in mean±typical deviation, median and percentages.

**RESULTS.** 239 patients were analysed. 40 patients (16.7%) with TAS without aortic valve replacement; 106 patients (44.4%) with TAS with aortic valve replacement; 39 patients (16.3%) with endovascular stent-grafting. 49 patients (20.5%) with other kind of surgery. Table 1 represents the clinical characteristics of the whole group.

**TABLE 1** CLINICAL CHARACTERISTIS OF THE GROUP

| Male gender | Smoking | Diabetes mellitus | Dislypemia | High blood pressure | Family medical history | Angina | Myocardial infarction | Heart failure |
|---|---|---|---|---|---|---|---|---|
| 79.5% | 43.9% | 14.6% | 36.4% | 66.9% | 1.7% | 19.7% | 4.2% | 25.5% |

**TABLE 2** SOME OF THE SURGICAL DETAILS

| Urgent and emergent surgery | Death at operating room | Extracorporeal circulation | Intraortic ballon counterpulsation (IABP) | Inotropics agents |
|---|---|---|---|---|
| 23.8% | 3.8% | 7.5% | 2.1% | 51.5% |

**TABLE 3** COMPLICATIONS AT ICU

| Shock | Cardiac tamponade | Myocardial infarction | Sternal dehiscencia | Cardiac arrest | Bleeding (>1,000 cc) | Massive transfusion | Low platelets |
|---|---|---|---|---|---|---|---|
| 12.1% | 2.9% | 3.8% | 2.5% | 4.2% | 18.4% | 15.5% | 9.2% |
| Sepsis | Mediastinal infection | Pneumotorax | Pleural effusion | Pneumonia | Acute respiratory distress syndrome (ARDS) | Renal failure | Stroke |
| 5.4% | 1.3% | 2.5% | 9.2% | 8.8% | 5.9% | 22.2% | 4.2% |

Mean age was 61.01 ± 14.05 years old. Table 2 expresses some of the surgical details. Around 61% of the patients had no postoperative complications. We can see major complications in Table 3. The length of stay was 3(2–6) days. The mortality rate was 10.5%. The area under the ROC curve was: Euroscore 0.690 ($p = 0.002$); Parsonnet 0.705 ($p = 0.001$) y SAPS 3 0.823 ($p = 0.000$).

**CONCLUSIONS.** The clinical profile of the patient undergoing TAS in our setting is a 61 years old man, smoker, with high blood pressure. It is an off-pump scheduled surgery with aortic valve replacement. There usually aren't postoperative complications and the most important ones are renal failure, bleeding and shock. In this kind of patients, the observed mortality was 10.5%, and it seems that model SAPS 3 discriminates better than Euroscore or Parsonnet.

**REFERENCE(S).**

Barmettler, H. Risk-stratification in thoracic aortic surgery: should the EurosCORE be modified? Eur J Cardiothorac Surg. 2004;25:691–4.

**GRANT ACKNOWLEDGMENT.** Health Counseling Board of Andalusia that supports economically the maintenance of the registration.

## 0723

### ACUTE MESENTERIC ISCHEMIA IN POSTOPERATIVE OF CARDIAC SURGERY

E. Zogheib[1], M. Henry[1], A. Duwat[1], M. Moubarak[1], G. Mulieri[2], E. Bartoli[3], C. Renard[4], T. Caus[5], H. Dupont[1]

[1]University Hospital, Anesthesiology and Intensive Care Department, Amiens, France, [2]University Hospital, Digestive Surgery, Amiens, France, [3]University Hospital, Gastroenterology, Amiens, France, [4]University Hospital, Radiology, Amiens, France, [5]University Hospital, Cardiac Surgery Department, Amiens, France

**INTRODUCTION.** Postoperative cardiac surgery (0.07 to 0.49%). The diagnosis is very difficult. Despite appropriate medical or surgical treatment, acute mesenteric ischemia appears to be associated with a high morbidity rate.

**OBJECTIVES.** The aim of this study is to Gastrointestinal complications is rare in describe patients with mesenteric infarction in post-operative cardiac surgery and to evaluate a means of early diagnosis.

**METHODS.** From January 2006 to March 2010, 26 patients who underwent cardiac surgery and presented with symptoms of acute mesenteric ischemia were included. Demographic factors, pre operative risk factors, intra operative information, post operative and outcome data were noted. We analyzed the diagnosis methods of mesenteric ischemia. Quantitative variables were expressed as mean and range.

**RESULTS.** Twenty-six patients had mesenteric ischemia in a total of 2,208 patients (incidence 1.18%) undergoing cardiac surgery during the same period. The mortality rate was 84.6% (n = 22). The risk factors found in pre-operative period were: coronary artery disease (84.6%), hypertension (80%), dyslipidemia (50%). Arrhytmia, smoking, arteriopathy, diabetes were present in less than 38% of patients. Abdominal pain symptoms is the most constant at 61%, sometimes associated with SIRS in 15.4%. The biological balance sheets suffer a major disruption with cytolysis, the rise of myoglobin and CK in conjunction with a decrease of troponin, and hyperkalemia in the hours preceding the diagnosis. Diagnosis and treatment applied to the patients are summarized in the following table:

DIAGNOSIS

| | (n) | (%) | | (n) | (%) |
|---|---|---|---|---|---|
| Colonoscopy | 11 | 42.3 | Normal | 1 | 9.1 |
| | | | Abnormal | 10 | 90.9 |
| Abdominal CT scan | 12 | 46.2 | Normal | 9 | 75 |
| | | | Abnormal | 3 | 25 |
| Laparotomy | 22 | 86.6 | Normal | 1 | 4.5 |
| | | | Abnormal | 21 | 95.5 |
| Treatment | | | | | |
| Surgery | 23 | 88.4 | | | |
| Medical | 3 | 11.5 | | | |

The scanner has proved to have a poor sensitivity. The colonoscopy was contributive in 90.9% (when realized).

**CONCLUSIONS.** The diagnosis of acute mesenteric ischemia (with very low incidence) is very difficult in post-operative cardiac surgery. The prognosis is initiated upon confirmation of diagnosis. Patients with coronary heart disease are at higher risk of intestinal ischemia. A more specific management perioperatively is necessary to try to anticipate before the onset of multiorgan failure.

**REFERENCE(S).** Klotz S, Vestring T, Rötker J, Schmidt C, Scheld HH, Schmid C. Diagnosis and treatment of nonocclusive mesenteric ischemia after open heart surgery. Ann Thorac Surg. 2001;72(5):1583–6.

# Education and training 2: 0724–0733

## 0724

### UNANNOUNCED IN SITU SIMULATION REPRESENTS A REALISTIC METHOD FOR TEACHING THE TECHNICAL AND NON-TECHNICAL SKILLS REQUIRED FOR RESUSCITATION

S. Walker[1], S. Lambden[2], A. McKay[2], S. Gautama[2], R. Aggarwal[3], C. Vincent[1]

[1]Imperial College London, Centre for Patient Safety and Service Quality, London, UK, [2]Imperial College Healthcare NHS Trust, London, UK, [3]Imperial College London, Department of Surgery and Cancer, London, UK

**INTRODUCTION.** High quality performance in emergency situations is dependent upon technical and non-technical skills. A number of national bodies recommend team training to promote good teamwork and improve the quality and safety of healthcare [1]. Simulation training offers an authentic, low-risk environment for teaching technical and teamwork skills [2]. Simulations can be delivered in many different ways from low fidelity "part task" simulators, to integrated fully immersive simulation environments. Immersive simulator environments are, however, extremely expensive to develop, relatively inaccessible to clinicians and trainees, and struggle to achieve realism. In recent years a new phenomenon of "in situ" simulation has been described, in which simulation activity takes place in a clinical setting [3]. Given that a degree of "buy in" is required by those undertaking simulation training, in situ simulation has great potential as the environment, equipment and team are all genuine, at a fraction of the cost.

**OBJECTIVES.** To assess attitudes towards unannounced in situ simulation for resuscitation training.

**METHODS.** An appropriate clinical location is selected in which simulation can be delivered. Equipment is set-up accordingly, using the "SimMan 3G" Mannequin, and a portable audiovisual recording system to facilitate structured feedback. A pertinent scenario is chosen and one member of staff from the clinical area is brought to the simulation location and asked to respond to the situation as they would to actual events. The on-call cardiac arrest team for the day attend, without prior warning, when a "crash" call is made by the local staff. The progress of the simulation then continues without further interaction by the faculty with the exception that as members of the cardiac arrest team arrive they are informed that they are to manage the simulation as though it were a real cardiac arrest. The simulations run for approximately 30 min, divided equally between simulation and structured feedback related to technical and non-technical performance. Finally, we ask participants to complete a questionnaire.

**RESULTS.** Of team members attending simulations, 47 completed questionnaires. Results demonstrated that all participants strongly agreed that the simulation was realistic, that the clinical environment improves realism and that unannounced in situ simulation is useful for resuscitation training.

**CONCLUSIONS.** Unannounced in situ simulation should be considered as a routine part of multidisciplinary resuscitation team training.

**REFERENCE(S).** 1. Joint Commission on Accreditation of Healthcare Organizations. Sentinel event statistics, 2004.
2. Beaubien J, Baker D. The use of simulation for training teamwork skills in healthcare: how low can you go? Qual Saf Health Care 2004;12:51–6.
3. Hammam W. In situ Simulation: Using Aviation Principles to Identify Relevant Teamwork and Systems Issues to Promote Patient Safety. CRICO/RMF Forum (2008).

## 0725

### ENABLING JUNIOR DOCTORS TO RECOGNISE SEVERE SEPSIS: A TOOL TO DIFFERENTIATE INFECTION AND SEVERE SEPSIS ON THE WARDS

E. Potter[1], J. Brostoff[2], A. Kapila[3]

[1]Kingston Hospital, Intensive Care, Kingston upon Thames, UK, [2]Royal Berkshire NHS Foundation Trust, Intensive Care, Reading, UK, [3]Royal Berkshire NHS Foundation Trust, Anaesthetics, Reading, UK

**INTRODUCTION.** Early recognition and treatment of sepsis is widely recognised to reduce ICU admissions, morbidity, and mortality. We set out to improve recognition, investigation and management of sepsis by junior doctors.

**OBJECTIVES.** To establish:

1. FY1 doctors' knowledge of the criteria for systemic inflammatory response syndrome (SIRS), organ dysfunction indicating severe sepsis and basic initial management steps for septic patients.
2. Whether a targeted brief intervention using an attachable laminated data card could improve their knowledge.
3. If such a brief and economical intervention could lead to a sustained change in knowledge.

**METHODS.** We used a standardised questionnaire on 26 FY1 doctors. Questions included what the parameters for SIRS were, which organ dysfunctions may indicate severe sepsis, what initial investigations they would organise and management steps including specifying a time frame they felt appropriate for antibiotic administration.

We then gave them a laminated data card that could be attached to their lanyard, and repeated the questionnaire immediately after they had the chance to look at these and then again 2 months later to assess whether a lasting educational impact could be made.

**RESULTS.** An immediate improvement was seen after initiating the cards. Those able to state the parameters required for SIRS improved from 12% to 100% and state six organs whose dysfunction indicated severe sepsis increased from 0 to 93%. Investigation improvements included a rise from 33% of doctors to 93% requesting a lactate and antibiotics administered within the hour went from 69 to 85%. We repeated the questionnaire 2 months after initiating the card and 24 FY1 s responded. 16 of the 24 had attended the initial session and received a laminated card. Of those who had received the card 12 still carried it with them. Of the FY1 s who continued to carry the card 83% knew the parameters for SIRS compared to 0% in the other groups. In a similar pattern 83% carrying the card would request a lactate compared to 50% of FY1 s no longer carrying the card. 92% of those still carrying the card were able to identify 5 or 6 organs affected by sepsis, compared to 75% of those not carrying the card and 50% of those who did not attend the initial session. The number giving antibiotics within the hour showed a sustained improvement at 92% of card carriers compared to 75% who did not carry the card.

**CONCLUSIONS.** Junior doctors are poor at recognising sepsis and there are significant gaps in their investigation and management of such patients. We demonstrated the use of a brief, cost-effective intervention increases their theoretical ability to recognise, investigate and initiate suitable management of the septic patient. The laminated card is designed to clip onto the doctors' name badge so it remains with them at all times. A sustained improvement was only seen in those doctors who continued to carry the card with them.

**GRANT ACKNOWLEDGMENT.** N/A.

## 0726

### TRAINING ON IMPROVING PATIENT SAFETY AT RISK: EXPERIENCE AND EVALUATION OF A COURSE FOCUSED TO PHYSICIANS AND NURSES WORKING AT THE RADIOLOGY DEPARTMENT

A. Quesada[1], M.A. Ballesteros[1], F.J. Buron[1], A. Gonzalez Mandly[2], G. López Resines[2], J.C. Rodríguez Borregán[1], J.M. Rabanal[3], C. González Fernández[1], E. Benito[1]

[1]Hospital Universitario Marqués de Valdecilla, Critical Care Dpt, Santander, Spain, [2]Hospital Universitario Marqués de Valdecilla, Radiology Dpt, Santander, Spain, [3]Hospital Universitario Marqués de Valdecilla, Anesthesiology Dpt, Santander, Spain

**INTRODUCTION.** Occurrence of critical events in healthy and in patients at risk is becoming more frequent at the Radiology Department (RD). Some aspects have been proposed as causes of this fact: elderly population, extended duration of certain techniques, use of contrasts and, especially, the widespread development and practice of interventional techniques. Sometimes these events are unpredictable and, if crisis happens, it triggers an emergency that requires an urgent decision making process. Radiologists are concerned about it and think these aspects can be improved. During 2008–2009 we developed a training program (5 courses), involving 25 physicians and 25 nurses from the RD.

**OBJECTIVE.** Patient safety training program assessment.

**METHODS.** We designed a 7-h (80% practical) seminar. Airway management, ventilation and BCPR workshops were organized in small groups. We developed usual scenarios with human patient simulator (HPS) and actors, that represented common critical events: anaphylaxis, seizures, altered consciousness, respiratory failure, etc. After simulation and with video-assisted sessions, discussion of the proceedings were carried out.Finally, participants completed a survey that assessed various aspects in a score from 1 to 5. Results indicated the most and least interesting and included suggestions for improvement.

**RESULTS.** 50 surveys were distributed and analyzed, 100% participation. Overall results: appropriate targets and goals accomplished (4.6), clear targets and appropriate content objectives (4.7), time invested in developing activity (4.4), oral presentations (4.55), competent faculty and interest (4.85), teachers adaptability (4.9), organization (4.65), practices, utility and satisfaction degree (4.75).Most interesting recurrent comments: very useful course (18), small groups for training (14), HPS high fidelity scenarios (12), teamwork (11), encourages reflection on common problems (5).Least interesting: oral presentations (8).Suggestions: repeat annually (20), add defibrillation (5), too short seminar (5).

**CONCLUSIONS.** Overall assessment was very positive, and most valued aspects were adaptive capacity and competence of teachers. Oral presentations were the least valued aspect.The utility, small groups of practices and use of HPS high fidelity scenarios were the most appreciated aspects.40% suggested repeating it annually and 10% thinks it was too short.

**FINAL COMMENT.** Important factor in the excellent course assessment was that the training was requested by the RD, and so we think this education program can be included as a usual activity of our Critical Care Department.

**REFERENCES.** 1. Tubbs RJ et al. High-fidelity medical simulation as an assessment tool for radiology residents' acute contrast reaction management skills. J Am Coll Radiol. 2009;6(8):582–7.
2. Gaca AM et al. The radiology perspective: needs and tools for management of life-threatening events. Pediatr Radiol. 2008;38 Suppl 4:S714–9.

## 0727

### MULTIMODAL EDUCATIONAL INTERVENTION IMPROVES RESIDENTS' KNOWLEDGE AND PERFORMANCE IN CENTRAL VENOUS CATHETER INSERTION

C. Inan[1], V. Cartier Faessler[1], J. Garcia[2], W. Zingg[3], F. Clergue[1], B. Walder[1], G.L. Savoldelli[1]

[1]Hopitaux Universitaires Genève, Anesthesiology, Geneva, Switzerland, [2]Hopitaux Universitaires Genève, Anesthesiology Simulation Program, Geneva, Switzerland, [3]Hopitaux Universitaires Genève, Infection Control Program, Geneva, Switzerland

**INTRODUCTION.** At our institution, we observed a high incidence of central line-associated bloodstream infections (CLABSI). In this 2,100-bed primary and tertiary care center, 1,500 central venous catheters (CVC) are inserted each year and 45% are done by anesthesiologists. We decided to implement an ongoing quality improvement program on CVC insertion, care, and removal. A multimodal educational intervention was specifically designed to improve clinical knowledge of and technical skills in CVC insertion.

**OBJECTIVES.** The aim of this study was to evaluate the effectiveness of this intervention among anesthesia residents.

**METHODS.** Thirty-seven anesthesia residents were enrolled in this prospective pre and post-interventional study. They attended a half-day training course consisting of: (1) pre-intervention test; (2) interactive theoretical lecture; (3) simulation-based practice on a Laerdal® IV Torso mannequin; (4) videotape review of the simulation practice with constructive feedback by an instructor; (5) post-intervention test. Throughout the course emphasis was put on improving hand hygiene, asepsia and minimizing the risks of mechanical complications.Pre and post-intervention tests were identical and consisted of a multiple choice questionnaire (MCQ), testing global knowledge of CVC, and a practical CVC insertion on the mannequin. The practical test was video recorded and all videos were then randomly reviewed by one single rater. The rater was unaware of the sequence of the recording and evaluated each participant's performances with the use of a checklist (assessing hand hygiene and technical procedures) and a global rating scale of technical skills[1].Primary outcome measures included the MCQ scores, hand hygiene compliance and technical procedure checklist score. The global rating scale of technical performance was used as a secondary outcome.Statistical analyses were performed using paired Student's t test or Wilcoxon signed-rank test as appropriate. Data are expressed as mean ± SD.

**RESULTS.** The MCQ score improved from 76.0% (±7.9) in pre-test to 87.7% (±4.4) in post test. Hand hygiene compliance score improved from 33.8% (±12.8) to 64.2% (±14.2) in post-test. Technical procedure score improved from 65.8% (±11.9) to 93.9% (±7.2) in post-test. Technical skills score assessed with the global rating scale improved from 56.4 (±9.2) in pre-test to 79.6% (±11.0) in post-test. All improvements were highly significant (all $p < 0.001$).

**CONCLUSIONS.** A simple multimodal educational intervention was highly effective in improving immediate theoretical knowledge, hand hygiene compliance and technical performance in CVC insertion. Our study is limited by the lack of distant evaluation of knowledge retention and the absence of any measurement on patient care; infection control follow-up of anesthesiologists related CLABSI is currently ongoing at our institution.

**REFERENCE.** Reznick R et al. Am J Surg. 1997;173(3):226.

## 0728

### THE USE OF ELECTRONIC SHEET FOR BEDSIDE LUNG ULTRASOUND REPORTING HAS HIGH IMPACT ON LEARNING CURVE TREND AND PHYSICIAN'S PERFORMANCE

L. Tutino[1], F. Barbani[1], G. Cianchi[2], S. Batacchi[2], R. Cammelli[2], M. Bonizzoli[2], R. Spina[2], G. Zagli[2], A. Peris[2]

[1]Postgraduate School of Anesthesia and Intensive Care, Faculty of Medicine, University of Florence, Florence, Italy, [2]Anaesthesia and Intensive Care Unit of Emergency Department, Careggi Teaching Hospital, Florence, Italy

**INTRODUCTION.** Bedside Lung Ultrasound (LUS) has been widely suggested as a goal standard in bedside patients examination in Intensive Care Unit (ICU). From April 2008, trained intensivists of the ICU of a regional referral center for respiratory failure (Careggi Teaching Hospital, Florence, Italy) started to use bedside LUS on a daily basis in order to make diagnosis and monitor chest pathologies. A procedure ad hoc has been conceived in order to make every bedside LUS comparable.

**OBJECTIVES.** The aim was to introduce a standard and comparable method for thorax ultrasound exams reporting, and to test the operator's improvements.

**METHODS.** Since the introduction of LUS, a close control of the exam reporting was performed. At first, LUS report consisted in an empty sheet only. Then, to uniform the way of reporting, an electronic sheet was added in our database. This sheet was divided into fields, regarding pleural line, diaphragm mobility, parenchyma, pleural effusion and pneumothorax evaluation. For each of them, several data were requested such as anatomical directions, quantification and nature of the ultrasonographic finding. Imagines of each LUS were stored in order to be re-examined. From April 2008, two senior intensivists not involved in LUS performance and expert in chest US, started to control the quality of reports by a comparison to the imagines provided. A mark for each field has been given, obtaining a score for each report ranging from 0 to 24. A mark > 14 was designed as limit for a sufficient report. We supposed that and high report mark could be related with an high LUS performance quality.

**RESULTS.** The study took 1 years, during which a total of 637 LUS have been performed and mean marks per month has been considered (Fig. 1). Seven months were needed to achieve a sufficient score into LUS report. From there, and high mark per month has been maintained, confirming high performance level of LUS with a gradual increase trend. Main missing in LUS reporting regarded diaphragm motility, clear anatomical direction for findings in lung parenchyma field, comparisons between supine and lateral position in pleural effusion quantification.

**CONCLUSIONS.** A standardized method and unique electronic report sheet for LUS seemed useful for a more precise and efficient report system and for physicians' learning curve trend, confirmed by the high score achieved in the reporting during the study period (>14 in the last 5 months of study).

## 0729

### INDICATIONS AND DOCUMENTATION OF CHEST X-RAYS IN INTENSIVE CARE UNIT

J.T. Paul[1], A. Gunasekera[2], C.J. Chacko[1], P.D. Stewart[1]

[1]The Burton Hospitals NHS Foundation Trust, Anaesthesia and Critical Care, Burton on Trent, UK, [2]The Royal Wolverhampton Hospitals NHS Trust, Anaesthesia and Critical Care, Wolverhampton, UK

**INTRODUCTION.** Chest X-rays are frequently performed in ICUs for various indications. There are currently no specific guidelines or protocols on this subject either nationally or locally. Some of the chest X-ray scans performed were avoidable, especially by combining the indications, thus limiting the cost for hospitals and radiation exposure to patients. The documentation of the X-ray scans performed showing evidence that it was read and reported was frequently missed by doctors. The Ionising Radiation (Medical Exposure) Regulations 2000 (IR(ME)R 2000) implement for Great Britain the majority of the provisions of EC Directive 97/43/Euratom which concerns the protection of persons undergoing medical exposures. The Regulations require that all medical exposures to ionising radiation must go through a referral and justification process prior to the exposure, and a clinical evaluation of the results must be made and recorded after the exposure i.e. the images must be reported or "read". If it is known prior to the examination that no clinical evaluation will take place, then the exposure cannot be justified.

**OBJECTIVES.**

1. To determine the indications of chest X-rays.
2. To determine the number of indications with each chest X-rays.
3. To determine whether chest X-rays were read and documented.

**METHODS.** Details of chest X-rays performed on 39 Level 3 care patients admitted to our ICU between January–March 2009 were collected and analysed. The indications for the Chest X-rays were found from the HISS system (computerised ordering system) and the documentation after the X-ray was looked up in the patient's notes.

**RESULTS.** A total of 137 chest X-ray scans were performed in a 3 month period. Major indications were lung pathology, central venous line, tracheostomy, endotracheal intubation, chest drain insertion and naso-gastric tube insertion. Only 25% of the X-ray scans were performed for lung pathology. Eighty-nine percent of X-ray scans were performed looking for only one indication where as 18% of X-ray scans were performed looking for two indications. And 4% of X-ray scans were performed looking for three or more indications. Only 57% of the X-ray scans performed were read and documented in the notes.

**CONCLUSIONS.** Unless the results will impact patient management, a chest X-ray is not indicated. We probably need specific protocols for ordering chest X-ray scans which may reduce the total number of chest X-ray scans performed and also reduce the cost and radiation exposure. We are not complying to IR(ME)R in 43% of chest X-ray documentation during the audit period.

**REFERENCE(S).** 1. ACR Standard for the Performance of Pediatric and Adult Chest Radiography. American College of Radiology, 1997. ACR Publications, Reston, VA 22901.
2. Briggs GM. Chest imaging: indications and interpretation. Med. J. Aust. 1997;166:555–560.

## 0730

### HOW WELL DO ICU NURSES KNOW THE ANATOMY AND PHYSIOLOGY OF THE RESPIRATORY TRACT?

S.O. Labeau[1,2], D.M. Vandijck[2,3], B. Claes[4], S.I. Blot[1,2,3], the Flemish Society for Critical Care Nurses

[1]University College Ghent, Faculty of Healthcare, Ghent, Belgium, [2]Ghent University, Faculty of Medicine and Health Sciences, Ghent, Belgium, [3]Ghent University Hospital, General Internal Medicine and Infectious Diseases, Ghent, Belgium, [4]Antwerp University Hospital, Critical and Perinatal Care Department, Edegem, Belgium

**INTRODUCTION.** Anatomy and physiology are major components of any nursing education. After graduation, nurses need to integrate this theoretical knowledge into daily practice in order to provide high-quality patient care. In ICU nurses caring for mechanically ventilated and critically ill patients, a thorough knowledge of the anatomy and physiology of the respiratory tract is pivotal.

**OBJECTIVE.** To evaluate knowledge of the anatomy and physiology of the respiratory tract among ICU nurses.

**METHODS.** Survey using a 10-item multiple-choice questionnaire concerning anatomy and physiology of the respiratory tract. Following expert validation, the questionnaire was distributed and collected during the Flemish Society for Critical Care Nurses' annual congress (Ghent 2009). Demographics included gender, ICU experience, number of ICU beds and acquisition of a specialized ICU qualification.

**RESULTS.** We collected 534 questionnaires (response rate: 71.2%). 73% of respondents knew that the venae pulmonales transport oxygenated blood to the heart's left atrium; 56% correctly identified the lung volumes after a normal expiration as the expiratory reserve volume and the residual volume; and 80% knew that breathing results in an intake of oxygen, elimination of $CO_2$, and loss of $H_2O$ and body heat. It was known by 73% that an increase in the expiratory minute volume decreases the $pCO_2$ and increases the pH. In hyperventilating patients, $pCO_2$ levels are decreased and $PO_2$ levels are increased, which was known by 68% of our respondents; 95% knew that Fowler is the preferred position in patients breathing difficultly, and 93% that laryngeal edema can cause stridor. It was known by 79% that in anemic patients tissue oxygenation may be inadequate despite an $SpO_2 = 95\%$. Only 30% knew that metabolic acidosis may be compensated by breathing faster and deeper; 71%, finally, recognized an increase in pH and a decrease in $pCO_2$ as potential signs of respiratory alkalosis. The mean test score was 71.8% (standard deviation: 1.81); the median score was 7 (interquartile range: 6–9). Nurses holding a specialized ICU qualification scored better than those not holding this qualification ($p = 0.008$) and male nurses scored better than their female colleagues ($p = 0.005$). There were no significant differences between scores of junior nurses and nurses working in the ICU for more than 5 or 10 years.

**CONCLUSIONS.** Flemish ICU nurses have a good knowledge of the anatomy and physiology of the respiratory tract. Nursing education in Flanders seems to succeed in providing a good theoretical background for integrating the related knowledge in subsequent daily practice.

**GRANT ACKNOWLEDGMENT.** S. Labeau holds a doctoral grant from University College Ghent, and the ESICM ECCRN-Edwards Nursing Science Award 2008. S. Blot is supported by the ESICM/iMDsoft Patient Safety Award 2008.

## 0731

### BARRIERS TO FOCUSED ECHO TRAINING AND SUGGESTED SOLUTIONS

S.R. Kinnear[1], C.L. Nutt[1], C.R. Russell[1]

[1]Ulster Hospital, Belfast, UK

**INTRODUCTION.** The utility of focused echo (FE) in ICM has now been well described and accepted. Training courses are widely available. However, the development and delivery of formal clinical training has been slow and FE has not been added to the ICM curriculum in the UK. The development of competency in FE has been slow for ICM trainees.

**OBJECTIVES.** To characterise the current state of FE training in ICM trainees in Northern Ireland and identify barriers to training and competency development.

**METHODS.** We conducted a survey to investigate trainee experience and training in FE.

**RESULTS.** The survey was distributed to all ICM trainees with 94% response rate. All units had an ultrasound machine and 81% of trainees had attended a course; all trainees had used ultrasound for vascular access; 63% had performed at least 1 FE; 30% had performed 5 or more scans; 12% had completed an echo logbook. No ICU provided regular training or review of scans. Only 1 unit had a Consultant Lead for FE; 1 unit provided a FE logbook; ALL trainees rated FE as valuable or very valuable; 38% rated themselves 'not at all confident' at performing FE and only 12.5% rated themselves as 'very confident'; none rated themselves as 'very confident' at interpreting scans. All trainees desired further training in FE; 81% felt it should be formally included in ICM training.

**CONCLUSIONS.** There is a training void in FE. The majority of trainees feel FE training should be incorporated into the ICM curriculum in the UK. Many ICM Consultants have attended courses and do perform FE. The lack of clinical training may be due to lack of confidence amongst Consultants who are themselves still learning. There is little scope for further training beyond these courses. Formal accreditation such as the British Society of Echocardiography (BSE) certification is unobtainable in most cases and lacks specificity for ICM. Previous studies have shown that novices can be taught to perform a focused echo after focused training. We propose that a 3 month programme be adopted. This should include didactic teaching on basic machine function and image acquisition followed by bedside teaching, independent learning and use of multimedia resources. Then a 3 month period for the trainee to perform and interpret 25 scans which are reported on a standardised training report form. The images and reports should be reviewed by an ICM consultant and a BSE certified echocardiographer.

**REFERENCE(S).** Echocardiography in the ICU: time for widespread use! Cholley, Vieillard-Baron. Intensive Care Medicine November 2005.
Royce CF, Seah JL, Donelan L and Royse AG. Point of Care Ultrasound for basic haemodynamic assessment: novice compared with an expert operator. Anaesthesia. 2006;61(9):849–55.
Vignon P et al. Focused training for goal orientated hand-held echocardiography performed by noncardiologist residents in the intensive care unit. Intensive Care Medicine. 2007;33(10):1795–9.

## 0732

### HIGH-FIDELITY SIMULATION: CAN WE PLAY WITH THE LUNG DISEASE?

E. Marangoni[1], L. Farabegoli[2], L. Astolfi[2], V. Alvisi[1], R. Ragazzi[2], R. Alvisi[2], C.A. Volta[2]

[1]Azienda Ospedaliera-Universitaria S. Anna Ferrara, Emergenza, Ferrara, Italy, [2]Università degli Studi di Ferrara, Ferrara, Italy

**INTRODUCTION.** In recent years the high fidelity simulation has been used to train and upgrade the students [1], medical and paramedical staff. An extension of the already large potential of the Laerdal SimMan (Laerdal, Norway) is to faithfully reproduce the monitoring of respiratory function in different diseases by using a modified lung simulator (QuickLung®-IngMarMedical).

**OBJECTIVES.** The purpose of this study is the creation of a more realistic respiratory system than that currently available in the SimMan aimed to realise simulation scenarios in which patients with acute respiratory failure are assisted by mechanical ventilators.

**METHODS.**

1. To measure the respiratory mechanics of the SimMan, it was intubated with a Rüsh endotracheal tube (8.5 mm) and connected to a mechanical ventilator (Servo-i®, Maquet). Special care was taken to prevent air leakage and to obtain a closed system. The latter was obtained by a blocking pressure valves at the end of the bronchial tube.
2. To vary the respiratory mechanics of the SimMan, we excluded its respiratory system by connecting a lung simulator to the ventilator.

The lung simulator allowed to vary the flow resistance from 5 to 50 $cmH_2O/l/s$ and the compliance from 10 to 20 $ml/cmH_2O$. Lastly we inserted a starling resistor between the lung simulator and the mechanical ventilator to simulate the presence of expiratory flow limitation (EFL).

**RESULTS.** Static compliance of the SimMan was about $40 \pm 3.1$ $ml/cmH_2O$ while the resistance to flow and additional resistances are respectively $9.3 \pm 1.1$ and $7.13 \pm 0.9$ $cmH_2O/l/s$.By using this new pulmonary setup, we were able to obtain flow and volume curves that faithfully reproduce the presence of EFL.

**CONCLUSIONS.** The resistance and the compliance of SimMan can be compatible to ARDS, COPD and Pumonary Cardiogenic Edema [2]. However, the possibility to change those parameters together with the ability of reproducing the graphic characteristics of EFL increases the potentiality for high fidelity simulation in lung disease.

**REFERENCE(S).** 1. McIvor WR. Using mannequin-based human simulation during the third-year medical student clerkship in perioperative medicine. Anesth Analg. 2002;952:S121.
2. Broseghini C et al. Respiratory mechanics during the first day of mechanical ventilation in patients with pulmonary edema and chronic airway obstruction. Eur Respir J. 1988;138:355–61.

## 0733

### CPR REGISTRATION USING PDMS (PATIENT DATA MANAGEMENT SYSTEM) METAVISION OF IMD-SOFT ® (TEL_AVIV, ISRAEL)

E.A. Icke[1], R. Driessen[1]

[1]VU University Medical Center, Amsterdam, Netherlands

**INTRODUCTION.** CPR registration is often incomplete because of the hectic during resuscitation, which can result in a possible loss of data due to late registration. Records show that in 2009 there were in the Intensive Care Unit VU University medical center (VUmc), 13 CPR records directly found in the database, but there was only one mention in the written reports. This resulted in an unreliable review of the actual number of resuscitations and there was confusion about duration of CPR, given medication and executed actions. By developing a specific mode for the resuscitation in the PDMS from the ICU, you have a reliable registration of the duration of the resuscitation, which medication was given and who participated in the CPR.

**METHODS.** MetaVision is a PDMS with the possibility of speed keys for recuscitation, making quick registration possible. This configuration has taken place within MetaVision by the functional manager of the ICU VUmc.

**RESULTS.** The tab "CPR" contains a form which after pressing a start button shortcuts to a speedkey on the screen. At this point in time the recording starts and a timer pops up on the screen. You can also open a window with access to the ERC guidelines for resuscitation.

The speed keys are used to send drug transactions and orders to the task list. The validation of the orders must be done after resuscitation, a final confirmation is needed that the medication has been given or that the orders actually took place. After pressing the stop button an evaluation form is instantly displayed on the screen.

**CONCLUSIONS.** CPR registration through PDMS MetaVision provides protocol monitoring and increases the quality of the data. It also provides an evaluation moment from which acquired data can be used for training and education. Using this modus makes it possible to record a complete and reliable report of the resuscitation, containing all actions and orders in time. Targeted querying the database can now rapidly generate complete and reliable data. These data can contribute to research.

# Ethical aspects of organ donation and research: 0734–0742

## 0734

### IMPROVING ORGAN DONATION RATES THROUGH THE IMPLEMENTATION OF REQUIRED REFERRAL AND THE ESTABLISHMENT OF AN IN-HOUSE TRANSPLANT CO-ORDINATOR

S. Hellings[1], N. Hargreaves[1], T. Holzmann[1], S. Mousdale[1]

[1]Royal Blackburn Hospital, Blackburn, UK

**INTRODUCTION.** Organ donation rates in the UK are amongst the lowest in Europe. The need for solid organs for transplant is growing, whilst the total number of donors in the UK has fallen. Spanish, Italian and US models place empasis for donation on Co-ordiantors who are embedded within the local hospital, and these countries have signifiantly higher organ donation rates. A number of key changes were introduced in our hospital following the publication of the report "Organs for Transplants" by the UK Organ Donation Task Force. These included the appointment of an organ donation co-ordiantor based within our critical care unit and the introduction of a system of required referral.

**OBJECTIVES.** To examine the impact on organ donation of the introduction of a system of required referral, and the embedding on the critical care unit of an organ donation co-ordinator.

**METHODS.** Records of referral rates and donation rates were examined restrospectively both before and after the introduction of these changes.

**RESULTS.** A substantial increase in referral rates was seen from 31% in September 2009 to 80% in March 2010. An increase in organ donation rates was seen, with a particular increase in eye donation. However, in a significant proportion of patients who might have been candidates for non-heartbeating donation, organ donation was not considered.

**CONCLUSIONS.** The implemention of two key recommendations of the UK Organ Donation Taskforce has brought about a substantial increase in referral rates for organ donation, and appears to be having a positive impact on organ donation rates on our critical care unit. Much work remains to be done to increase donation rates, particularly in potential non-heartbeating donors.

**REFERENCE(S).** Organs for transplants—a report from the organ donation task force. DOH Publications, 2008.

## 0735

### AN ETHICAL APPROACH TO TEMPORARY ALTERNATIVES AS A BRIDGE TO PAEDIATRIC TRANSPLANT

N. Masnou[1], T. Pont[1], A. Bach Faig[1], P. Salamero[1]

[1]Hospital Vall d'Hebron, Direcció Planificació i Avaluació de Trasplantament, Barcelona, Spain

**INTRODUCTION.** Vall d'Hebron Hospital, in Barcelona, is one of three centres in Spain performing paediatric heart and lung transplants (PHT-PLT).Shortage of paediatric organs compared with adults obliges us to look for new, albeit temporary, strategies. Long waiting lists(WL)and progressive patient deterioration lead us to, occasionally, utilise temporary alternatives such as Ventricular Assistance Devices (VAD) sometimes combined with Extra Corporeal Membrane Oxygenation (ECMO) as a bridge to transplant (BTT). However, even the final solution (transplant) is in reality temporary, as all paediatric transplants will require re-transplantation.

**OBJECTIVES.** In this study, we aim to consider whether our best option is the use of mechanical devices (VAD and/or ECMO) where this is the only possibility of reaching transplantation, given its high cost and poor medium term survival rates.

**METHODS.** Prospective and descriptive study of all patients on mechanical device as a BTT between 2007–2009.

**RESULTS.** We have performed 5 PHT, using VAD in 3 patients: One died because of stroke, due to coagulation disturbances and became an organ donor. Two are still alive after cardiac transplant (one of them with an adult graft). Average on WL time: 1–78 days.; on DVA: 8–78 day and 2–12 day on ECMO.

We transplanted 15 paediatric lungs (PLT) and used ECMO as a BTT in two patients, one is alive (with an adult graft) and the other died during transplant surgery. Average on WL time: 38–75 days, 16–32 days on ECMO.

**DISCUSSION.** The use of DVA and ECMO has proved to be effective in extending WL time until transplantation. Nevertheless, the use of this technique must be restricted to those cases where successful transplantation is the expected outcome, but never as a compassionate treatment. It is imperative that we make humane decisions based on ethical, as well as clinical, criteria. As paediatric patients are legally unable to make decisions and their parents and physicians are emotionally involved, limits need to be set and Advanced Care Planning discussed before arriving at Theatre. We might consider three aspects related to the use of these devices: ranging from Autonomy, the promotion of the patients' best interests, including decision-making from their standpoint as terminal disease sufferers. Physicians must seek Justice in terms which assure Equity and Utility in the limited and costly resource distribution.

**CONCLUSIONS.** Stricter indications on life-sustaining techniques (DVA-ECMO) must be applied in the field of paediatric transplant. Common policies must be drawn up if we are to avoid futile costly and over-zealous treatment.

**REFERENCE(S).** Aaron G Rizzieri[†]1, Joseph L Verheijde*[†]2, 3, Mohamed Y Rady[†]4 and Joan L McGregor[†]3 Ethical challenges with the left ventricular assist device as a destination therapy Philosophy, Ethics, and Humanities in Medicine 2008.

## 0736

### THE VALUE OF TRANSCRANIAL DOPPLER SONOGRAPHY WITH A TRANSORBITAL APPROACH IN THE CONFIRMATION OF CEREBRAL CIRCULATORY ARREST

M. Fragou[1], P. Zotos[1], A. Zacharaki[1], A. Damelou[1], K. Tsikritsaki[1], C. Tsakalakis[1], A. Kalogeromitros[1], I. Poularas[1], G. Koukoulitsios[1], C. Mandila[1], D. Karakitsos[1], A. Karabinis[1]

[1]G. Gennimatas General Hospital of Athens, Department of Intensive Care Unit, Athens, Greece

**OBJECTIVES.** We performed transcranial Doppler sonography (TCD) with a transorbital approach and compared findings to standard angiography in brain dead patients. Additionally, we evaluated whether reporting the angiographic and sonographic confirmation of cerebral circulatory arrest (CCA) to the families of patients improves their comprehension of brain death and their satisfaction from the medical information provided.

**METHODS.** Twenty clinically brain dead patients underwent four-vessel angiography, TCD of the basilar and middle cerebral arteries, and TOD of the ICAs. Relatives were randomly allocated to 10 in whom brain death was presented as a clinical diagnosis (group A) and to 10 in whom brain death was presented as a clinical diagnosis confirmed by TCD and angiography examinations (group B). Comprehension and satisfaction of the relatives were assessed by an interview and a completion of a questionnaire.

**RESULTS.** Both angiography and TCD verified CCA in all cases. In 3 subjects with absent bone windows CCA was confirmed by the transforaminal and transorbital TCD recordings only.The addition of TOD enabled 9.5% more cases of CCA to be diagnosed by TCD. Group B exhibited improved comprehension and higher satisfaction rates ($p < 0.05$) but not significantly higher transplantation rate as compared to group A.

**CONCLUSIONS.** The addition of TOD increases the efficacy of TCD in confirming CCA in brain death. Reporting angiographic and sonographic confirmation of CCA to families of brain dead patients may improve their comprehension of brain death and their satisfaction from the medical information provided.

## 0737

### A SURVEY OF THE ORGANISATIONAL AND ETHICAL DILEMMAS ENCOUNTERED WHEN INTENSIVE CARE UNITS IN THE UK ARE FULL

M.J. Brett[1], M. Al-Haddad[1], N. O'Donnell[1]

[1]NHS Greater Glasgow and Clyde, Western Infirmary Department of Anaesthesia and ICM, Glasgow, UK

**INTRODUCTION.** Increased centralisation and demand for critical care services in the UK is increasing pressure on Intensive Care Units (ICU) to accommodate patients when existing facilities are full. The non-clinical transfer of a critically unwell patient to another intensive care unit is sometimes required. Previous guidance from the UK Department of Health[1] and Intensive Care Society [2] has recommended each hospital should have escalation policies to prevent non-clinical transfers for capacity reasons. The decision to transfer a critically ill patient between hospitals often causes ethical dilemmas. Patients and families often voice concerns regarding such transfers.

**OBJECTIVES.** We sought to survey lead consultants current plans for capacity problems, their opinions regarding non-clinical transfers and their experiences of complaints.

**METHODS.** A postal questionnaire was designed to ask what contingency UK ICUs had to ventilate an extra patient, lead clinicians opinions regarding the transfer of critically ill patients and their experiences of complaints. 239 lead consultants working in UK general ICUs were surveyed.

**RESULTS.** 3 units were removed from the analysis due to closure. From the remaining 236 ICUs we received replies from 151 (64%). In the event that their ICU was full the surveyed consultants indicated several different facilities were available to ventilate an extra patient.

**TABLE 1**

| Facility available | Number |
|---|---|
| Theatre/recovery | 129 |
| Level 2 Bed | 72 |
| Bring in extra staff | 54 |
| Specialist/other ICU | 14 |
| No facility | 4 |

See Table 1. 98 (64.9%) of respondents did have a specific unit policy to address capacity problems and 61(40.4%) had a regional network policy. 116(76.8%) of the consultants who replied have had to transfer an existing ICU patient to make room in a full ICU for a new patient. A variety of reasons were offered as to what had prevented consultants transferring the new patient requiring ICU to another unit. See Table 2.

**TABLE 2**

| Reason not to transfer | Number (%) |
|---|---|
| Unstable physiology | 97 (64.2%) |
| Unstable physiology and specialized care required | 21 (13.9%) |
| Specialized care required | 4 (2.6%) |

69 (45.7%) consultants had received formal complaints from patients or their families as a result of transferring a patient.

**CONCLUSIONS.** Our survey indicates that UK consultants have several informal contingencies to deal with peaks in demand with many dependent upon Level 2 beds and theatre recovery. Despite guidance 35% of respondents did not have a specific local policy and 59% did not have a regional policy. Formal complaints are being received as a result of non-clinical transfers.

**REFERENCE(S).** 1. Comprehensive Critical Care. UK Department of Health. 2000.
2. Guidelines for the transport of the critically ill adult. The Intensive Care Society (UK) 2002.

## 0738

### LUNG PROCUREMENT: STILL A CHALLENGE

N. Masnou[1], T. Pont[1], A. Bach[1], C. Canton[1], P. Salamero[1]

[1]Hospital Vall d'Hebron, Direcció Planificació i Avaluació de Trasplantament, Barcelona, Spain

**INTRODUCTION.** Difficulties in organ procurement are of particular concern when we consider lung transplant. Vall d'Hebron, Barcelona is one of the seven Spanish hospitals with lung transplant programs (adult and paediatric).This activity started in 1990 and we perform >30 lung transplants (LT) per year and >50 the last 2 years. Our ratio of LTs is high (6.8 pmp) when compared with Spanish ratio (4.7 pmp) or European (2.6 pmp). Activity indicators are excellent : peri-operative mortality 10% (standard 15%) and 1 year-survival 79% (standard 65%).

**OBJECTIVES.** To analyse whether our organizational changes and expanded criteria affected organ procurement and hence transplant activity.

**METHODS.** Retrospective, descriptive study of all organ donors between 2006–2009. Our Hospital is a University Hospital, with 1150 beds (60 intensive care beds). Follow-up protocol of all patients with neurological damage admitted in the hospital with GCS <8 is carried out by transplant coordinators.Data about specific organ function (phisiological, X-ray, sputum culture…) were collected. We analysed specifically the "suboptimal group",related with lung retrieval,with a cut-off age >55.

**RESULTS.** In this period we have followed up 813 patients (GCS <8), 218 brain death (BD), 132 BD-donors, 47% (n = 62) aged between 55–87 years. A recent important change at our hospital has been the substitution of a pneumologist for a thoracic surgeon as head of our LT program. This has led to improved acceptance criteria and facilitated transplant coordinator discussion of potential donors with the thoracic team.Our efficiency in lung retrieval is 25% (33 patients), and 33% (11patients) of them could be considered suboptimal donors,due to age >55.Characteristics of these lungs: median age: 60.5 years (55–67), 54% men/46% female; main neurological damage: 54% stroke 27% Subarachnoidal Haemorrhage. Length of stay: 5 days (range 1–21 days). All patients in mechanical ventilation and antibiotic treatment. X-ray: 73% strictly normal, 27% abnormal (one with right basal infiltration was discarded but left lung was used, another two were used as bipulmonary grafts). In total 81% were utilised as bipulmonary grafts. Blood gases were acceptable, median $PaFiO_2 > 490$ mmHg. Recipients median age was 51 (range: 21–64). First month survival rates were similar to "optimal" grafts.

**CONCLUSIONS.** Lung retrieval in our hospital,Vall d'Hebron, Barcelona, is far greater (25%) when compared with other Spanish Hospitals (14%). Bedside discussion of potential donors between physicians and the appointment of a thoracic surgeon as head of the LT program have led to increased lung retrievals.Preliminary data leads us to consider grafts proceeding from extended criteria donors (over 55 years, X-ray abnormal,over 48 h on mechanical ventilation) as suitable donors.

## 0739

### KNOWLEDGE ABOUT ORGAN DONATION IN A SECONDARY HOSPITAL

J.C. Pasco[1], V. Perez[1], A.C. Caballero[1], A.B. Lopez[1], A.M. Lubombo[1], A.A. Merino[1], S.M. Cortes[1], A. Marcos[1], F.C. Tarancon[1], T.L. Alvarez[1], A. Alvarez[1], A.E. Fabre[1]

[1]Virgen de la Concha Hospital, Zamora, Spain

**INTRODUCTION.** Organ donation for transplants requires the support of all people that work in a hospital. There are few other activities in medicine that requires the collaboration of the whole hospital staff.

**OBJECTIVES.** The goal of this study is to find out the grade of knowledge and attitude of the staff of our hospital towards organ donation and transplantation.

**METHODS.** A predesigned anonymous survey was done about health and no health workers of a secondary hospital authorized for organ extraction. The survey contained 15 multiple-choice questions related to subjects such as: brain death, refusal to donate, need of information, etc. A total of 466 surveys were done.

**RESULTS.** Distribution by sex: female: 84.5%, male: 15.5%. Most frequent age range: 41–50 years old (38%). Staff: health professionals: 356 (76.39%), no health workers: 110 (23.61%). Occupation: nurse: 38.6%, nurse-assistant: 21.8%, administration personal: 13.3%, doctor: 11.6%, orderly: 8.1%, obstetrician: 4.2%, other: 2.1%. 96% think that donation is something good. 93% had ever listened about brain death. 96.2% think that brain death is not reversible. 71% know somebody who had received an organ transplant. 89% would agree to be an organ donor. The most frequent reasons to refuse be an organ donor were: religious causes and lack of information about donation (30% each one). 78% think that AIDS is a contraindication to donation, 56% that cancer is, 26% age, 47.2% any previous infectious disease and 3% think that there are no contraindications. 87% think that need more information about donation. 50% know the organization responsible of donation in Spain. 68% think that organ's distribution is according to emergency of receiver and 60% think that it is according to waiting list.

**CONCLUSIONS.** It is necessary a right information about organ donation. The great majority of those polled indicated that they would agree to be an organ donor. The majority of the hospital staff had information about organ donation, however, a high percentage needs more information and considered the information disseminated on the subject insufficient. The knowledge about contraindication of donation is something that health professionals must know.

**REFERENCE(S).** 1. Leal M, Flores E, Rimolo F et al. Conocimientos y actitudes del personal de salud hacia la donación de órganos para trasplante. Rev Costarric Cienc Med. 2005;26(1–2).

2. Palacios, JM. Conocimiento sobre donación y trasplante de órganos en un hospital con programa de trasplante. Rev. Chil. Cir. 2003;55(3): 244–8.
3. López MJ, Campos M, Aliaga N et al. Encuesta de opinión: Formación-información de los alumnos de la Universidad de Murcia sobre el proceso donación-trasplante de órganos. Enf Global. 2002;(1):1–7.

## 0740

### KNOWLEDGE AND ATTITUDES OF ICU STAFF ON LIVING WILLS

J. DeLeon-Belmar[1], A. Ferrandiz-Selles[1], R. Gonzalez-Luis[1], R. Abizanda-Campos[1], R. Zaragoza-Martinez[1], J. Arguedas-Cervera[1], M. Ibañez-Santacruz[1], P. Lorente-Garcia[1]

[1]ICU Dpt, University Associated General Hospital, ICU, Castellon, Spain

**INTRODUCTION.** Living wills are accepted by law in Spain.

**AIM.** To evaluate the ICU staff perception, knowledge and attitudes regarding living wills.

**METHOD.** Cross-sectional descriptive study using an anonymous questionnaire where respondents were asked to give a written answer using dichotomous variables and a five-point Likert-like scale (LS). The healthcare professionals of a multidisciplinary Intensive Care Unit of a reference academic hospital completed the questionnaire, where therapeutic effort limitation is over 50% of dying patients. The data were analyzed using SPSS 12.0 for Windows.

**RESULTS.** Forty-five people answered the test. The mean age was $37.86 \pm 8.98$ years and 38% of the respondents were males. Regarding the working category, 50% were qualified physician specialists, 23% in training doctors and 27% were nurses, with no differences between genders. People rated their knowledge with a 4.57 on a LS. Most of them (92%) think that health professional must have some kind of knowledge about vital wills, but only a third of them had read the legal documents about the subject, in spite that 50% of surveyed professionals plan to write a living will in the coming year. We found no statistically significant differences between the different staff categories. When comparing results according to gender, women were found to be more aware of the necessity of knowing about living wills. They also support their implementation, both personally and professionally, and these differences are statistically significant ($p < 0.05$). According to the respondents, the sources of information for patients should rely on general practitioners and this should be focused on the entire population.

**CONCLUSIONS.** We found some contradiction between theory and practice There is a positive attitude from ICU professionals about living wills, but they do not feel personally involved enough and the knowledge should on legal conditions have to improve. Women are more aware of the importance of living wills and they are more likely to implement them. Knowledge and attitudes are not related to professional categories.

## 0741

### LIFE-SAVING DEATH. OPINIONS, KNOWLEDGE AND ATTITUDE CONCERNING DONATION AND TRANSPLANTATION IN HUNGARY

A. Olah[1], A. Simon[1], A. Muller[1], K. Nemeth[1], J. Roznar[2], N. Gal[1], I. Kriszbacher[3], I. Boncz[4], A. Sebestyen[5], J. Marton-Simora[6], J. Betlehem[6]

[1]University of Pecs Faculty of Health Sciences, Department of Nursing Science, Pecs, Hungary, [2]University of Pecs Faculty of Health Sciences, Department of Foreign Languages, Szombathely, Hungary, [3]University of Pecs Faculty of Health Sciences, Institute of Health Science, Pecs, Hungary, [4]University of Pecs Faculty of Health Sciences, Department of Health Policy and Economics, Pecs, Hungary, [5]Baranya County Health Insurance Fund, Pecs, Hungary, [6]University of Pecs, Faculty of Health Sciences, Department of Emergency Care, Pecs, Hungary

**AIM.** Examining the knowledge, attitude and opinion of professionals working in intensive care unit and layman employees and students in higher education in Baja regarding the organ donation.

**METHODS.** 297 person took part in the study, out of that the number of the health care professinals was 153 (8 from the intensive care unit), and 144 from the training-school college at Baja. The data obtained from questionnaire were analyzed with Chi-square test and frequency reliability range were counted.

**RESULTS.** Among the health care professionals significantly higher rate of doctors would offer his relative's organs ($p = 0.0197$), and nearly sigificant degree out of them believe ($p = 0.0593$), that offering the organs may help abide the mourning. This latter opinion was carried in nearly significant degree by more lecturers and students, than employee helping in education ($p = 0.0565$). Significantly higher rate of doctors would offer any of their organs ($p = 0.0436$), than nurses with secondary qualification. The number of those doctors, who knew the concept of the cerebral death were significantly higher among health care professionals ($P < 0.001$), and the rate of the relegious one's among them were also significantly higher than among nurses without higher edutational degree ($p = 0.0471$). The health care professionals avow themselves in significantly higher degree practising believers in totally ($p = 0.0369$), among them significantly more know the concept of the cerebral death ($P < 0.001$) and the legal background of the inhibitory declaration ($P < 0.001$).

**CONCLUSIONS.** The organ deficiency is reducible with the correction of the organization, with the expansion of the layman's and health care professional's knowledge, without conciderable expenses.

**REFERENCES.** 1. Hayes J. Public to be asked its views on ethics of incentives for organ donation. BMJ. 2010;340:c2182.

2. Olender E, Palczynska A, Rykowski M, Uhrynowska-Tyszkiewicz I, Kaminski A. Knowledge and opinions about tissue donation and transplantation among Polish students and physicians. Cell Tissue Bank. 2010 Apr 14. [Epub ahead of print]
3. Hannah S. Increasing awareness of tissue donation: in the non-heart beating donor. Intensive Crit Care Nurs. 2004;20(5):292–8.

## 0742

### OPERATIVE MANAGEMENT OF THE TRANSPLANT OF ORGANS FROM RESCUED AND OFFERED DONORS' IN AN INSTITUTION OF THIRD COMPLEXITY LEVEL

R. Camargo[1], R. Vargas[1]

[1]Clinica General del Norte, Barranquilla, Colombia

**INTRODUCTION.** The availability of donor's organs in encephalic death for transplant is for very limited definition [1]. Certainly lower than the patients' demand with chronic pathologies of liver, kidney, heart, lung, which they need of an organ as the only therapeutic alternative [2]. The rate of donation for Colombia in 2007 reached 10.7 Donors For Million of Population, with an increase of 71%, in the donation (3). To recognize the characteristics of the donors in an Institution, it is a line of important base for the design of strategies and plans orientated to the improvement of the process.

**OBJECTIVE.** To describe the operative management of the process of transplant of organs from rescued (obtained by the institution) and offered (from other institutions) donors' in the Clinica General del Norte, Barranquilla, Colombia, during 2007–2009.

**METHODS.** Descriptive longitudinal Study. There are analyzed demographic and clinical variables, of 24 organs donors, alerted to the Network of regional Transplant 5 (CDTOT), for intensive care units, for 36 months, in Barranquilla's city.

**RESULTS.** The mean age was 35.5 years (SD ±13.8). 70.8% were male. The head trauma was the principal diagnosis, with 62.5% followed by the hemorrhage subarachnoid with 12.5%. With regard to the origin of the donor, 9 were offered and 15 rescued ones. In all the cases they were donors of kidney, none of the rescued ones was a donor of heart, but if 33.3% of the offered ones; likewise, only 40% of the group of rescued was donors of liver, opposite to 55.6% of the offered ones. On having compared the values of the group of donors offered with the rescued ones, there were not statistically significant differences in reference to average values of hemoglobin, hematocrit, leukocytes, % of neutrophiles, Sodium, chlorine or creatinine, AST or ALT ($p > 0.05$).

LABORATORY PARAMETERS IN RESCUED AND OFFERED DONORS

| | Offered | | Rescued | | t | p |
|---|---|---|---|---|---|---|
| | Mean | ±SD | Mean | ±SD | | |
| Haemoglobin | 11.622 | 2.918 | 12.067 | 2.982 | 0.356 | 0.725 |
| Hematocrit | 35.433 | 8.625 | 36.180 | 8.719 | 0.204 | 0.840 |
| Leucokytes | 14,232.222 | 3,205.713 | 12,908.000 | 4491.424 | 0.771 | 0.449 |
| % Neutrophiles | 79.667 | 6.225 | 72.867 | 17.529 | 1.114 | 0.277 |
| AST | 41.444 | 22.165 | 65.573 | 33.591 | 1.845 | 0.081 |
| ALT | 30.556 | 12.064 | 44.380 | 16.609 | 2.054 | 0.056 |
| Sodium | 152.444 | 10.076 | 148.000 | 11.844 | 0.938 | 0.358 |
| Chlorine | 4.131 | 0.692 | 3.849 | 1.293 | 0.608 | 0.554 |
| Creatinine | 1.000 | 0.232 | 1.013 | 0.223 | 0.133 | 0.896 |

**CONCLUSIONS.** The majority of donors were young adults, and male. Differences do not exist, with regard to laboratory variables in donors of organs transplanted (offered and rescued), during the period of study.

**REFERENCE(S).** 1. Salim A, Martin M, Brown C. Complication of brain death: frequency and impact on organ retrieval. Am Surg 2006;72 (5):377–81.

2. Mate Sanz R. Donación y Trasplante en España. MED Intensiva 1993; 311–6.

**GRANT ACKNOWLEDGMENT.** Clínica General del Norte- Coordinación para la Donación y **Trasplante** de Organos y Tejidos.

# Improving monitoring use: 0743–0753

## 0743

### TESTING NEUROMUSCULAR BLOCKADE IN ICU PATIENTS: EDUCATING STAFF AND IMPROVING PRACTICE

B.J. Moor[1], D. Gardiner[1], T.D. O'Leary[1]

[1]Nottingham University Hospitals NHS Trust, Critical Care, Nottingham, UK

**INTRODUCTION.** Neuromuscular blockade is often used as an adjunct to ventilation in sedated patients on ICU. Monitoring the degree of neuromuscular blockade is important in preventing long-term neuropathies and avoiding paralysis-with-awareness when sedation is stopped. Monitoring the degree of neuromuscular blockade is normally done using a peripheral nerve stimulator and observing muscle twitches. Correct placement of the electrodes requires knowledge of anatomy and interpreting the motor response.

**OBJECTIVES.** Evaluate medical and nursing staff knowledge in monitoring neuromuscular blockade and improve practice within our ICU.

**METHODS.** We surveyed medical and nursing staff on our ICU to gauge the level of knowledge on placing electrodes in order to test neuromuscular blockade. Staff were asked to identify a primary and a secondary site for placing electrodes. They could do this either by description or by placing electrode stickers on the questioner. They were then asked to describe or demonstrate the appropriate muscular response at each site. Acceptable sites were ulnar and common peroneal nerves at wrist and fibular head respectively. In all cases, both the electrode position and expected motor response had to be correct. After the initial survey, we undertook a programme of education involving seminars, posters and instruction sheets included with nerve stimulation equipment. A laminated referenced sheet attached to all nerve stimulator equipment was designed. We then repeated our survey to evaluate the impact of this intervention.

**RESULTS.** The results of our initial survey showed a poor level of knowledge of electrode placement. Of 20 staff surveyed only two correctly demonstrated primary and secondary sites for positioning electrodes and described the correct motor responses in each case. The most common error was placing electrodes over the radial aspect of the wrist. Eight correctly identified one site (either ulnar or common peroneal nerve) but were unable to suggest a secondary site and motor response. Following the programme of education there was a significant increase in the number of staff who could accurately place nerve stimulation electrodes and anticipate the correct muscle twitch response. There was a similar increase in the number of staff able to correctly place an electrode at a secondary site.

**CONCLUSIONS.** Our survey showed that the placement of nerve stimulator electrodes and the interpretation of muscle twitches was inconsistent amongst ICU staff but can be significantly improved with targeted education and memory prompts.

## 0744

### A SURVEY OF CAPNOGRAPHY UTILISATION IN UK ICUS

D.J. Harvey[1], A.N. Thomas[2]

[1]University Hospitals Nottingham, Nottingham, UK, [2]Hope Hospital, Salford, UK

**INTRODUCTION.** A recent review of incidents reported to the UK National Patient Safety Agency suggested that airway incidents in intensive care are associated with significant harm to patients [1]. Capnography use was not described in any of these reports.

**OBJECTIVES.** We aimed to establish how commonly capnography was used in UK ICUs and why it has not been more widely adopted.

**METHODS.** A postal questionnaire was sent to all UK Adult ICUs in January 2009 and resent to non-responders in April 2009. Opinions were assessed by Likert scale.

**RESULTS.** 163 replies were received from total of 268 ICUs (61% response rate). Not all respondents answered every question. A total of 884 patients were connected to mechanical ventilators of which 308 (35%) were continuously monitored by capnography. Capnography utilisation for 3 common indications is shown in Fig. 1. 74% of responders strongly agreed (Likert score >7 out of 10) that capnography improved patient safety. Respondents gave reasons for non-adoption of routine capnography as free text, these included concern over inappropriate replacement of arterial blood gas analysis, problems with staff training and expense (Table 2).

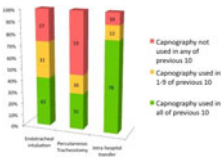



Fig. 1 Capnography utilisation for 3 common indications

**CONCLUSIONS.** Our results show that capnography has not been universally adopted as a standard for monitoring in critical care, despite evidence that clinicians believe it increases patient safety. Since the adoption of capnography as an anaesthetic monitoring standard there has been a significant reduction in an anaesthetic mortality and morbidity although cause and effect is impossible to prove. Capnography is not 100% sensitive or specific for diagnosing correct airway placement, but it is still superior to reliance on clinical signs alone hence it's potential to improve airway safety. In a recent UK Intensive Care Society standards document we have strongly recommended the use of capnography during all airway placements in ICUs.

**TABLE 2** REASONS FOR NON-ADOPTION OF CAPNOGRAPHY

| |
|---|
| Capnography is not a substitute for arterial $CO_2$ monitoring and this may have lead to disillusionment about other potential benefits. |
| Capnography was frequently not used, even when available. This may reflect problems with staff training. |
| Capnography is not 100% sensitive and specific in the diagnosis of airway misplacement. |
| There has been no system in place to share information about harm associated with airway misadventure in critical care. The risks may therefore go unrecognised. |
| The adoption of capnography into critical care may be more expensive than in anaesthetics. This is in part because of the requirement for humidification of inspired gases. |
| It would be very hard to train all the staff who work in ICU to reliably use capnography. |

**REFERENCE.** 1. Thomas AN, McGrath BA. Patient safety incidents associated with airway devices in critical care: a review of reports to the UK National Patient Safety Agency. Anaesthesia. 2009;64:358–65.

## 0745

### ABDOMINAL MONITORING OF CRITICALLY ILL PATIENTS: THE ROLE OF CT SCANS

T.R.D. Lara[1], C.S.V. Barbas[1], M. Perroni de Oliveira[1], F. Colombari[1], P.R. Sanches[1], P.F. Scherer[1], L.C. Moraes[1], G.O. Leite[1], R. Caruso[1], M. Funari[1], O.F.P. Santos[1], E. Knobel[1]

[1]Hospital Israelita Albert Einstein, Sao Paulo, Brazil

**INTRODUCTION.** CT monitoring can help in the diagnosis and management of acutely ill ICU patients. The data that these scans provide and the help they entail in the treatment of the acutely ill patients has not yet been established. We hypothesized that the analysis of a series of abdominal CTs will help to understand the abdominal diseases that affect the ICU adult patients.

**OBJECTIVES.** To analyze, over a 3-month period, abdominal multi-slice CT scans performed in the adult ICU of Albert Einstein Hospital in São Paulo, Brazil.

**METHODS.** From May 1st to August 31st, 2009, all the abdominal CTs performed in the adult ICU patients were analyzed by two radiologists from the Albert Einstein Hospital staff according to a pre-established protocol:

1. Presence of gastrointestinal obstruction;
2. Bowell wall edema:
3. Gastrointestinal distension;
4. Pneumoperitoneum;
5. Ascitis;
6. Intra-abdominal fluid collections;
7. Intra-abdominal tumors;
8. Hepatic abnormalities;
9. Spleen abnormalities;
10. Kidney and urinary tract abnormalities;
11. Pancreatic abnormalities and.
12. Presence of retroperitoneal hematomas.

**RESULTS.** Fifty-one abdominal CTs were analyzed from 27 (52.9%) males and 24 (47.1%) females, mean age 67.5 ± 15.1 years. The abdominal CT findings were: (1) presence of gastrointestinal obstruction = 0; (2) Bowell wall edema = 13 (25.4%); (3) gastrointestinal distension = 11 (21.5%); (4) Pneumoperitoneum = 11 (21.5%); (5) Ascitis = 33 (60.7%); (6) Intra-abdominal fluid collections = 1 (1.9%); (7) intra-abdominal tumors = 1 (1.9%); (8) hepatic abnormalities = 30 (58.8%); (9) spleen abnormalities = 10 (19.6%); (10) kidney abnormalities = 27 (52.9%); urinary tract abnormalities = 13 (25.4%); (11) pancreatic abnormalities = 5 (9.8%) and (12) presence of retroperitoneal hematoma = 2 (3.9%).

**CONCLUSIONS.** Considering the increasing number of liver transplantations performed in our unity, we noticed a high prevalence of hepatic and kidney abnormalities as well as ascitis and bowell wall edema, allowing us to perform a more accurate diagnosis and management of this population.

**REFERENCE** Zorger N, Schreyer AG. Multidetector computed tomography in abdominal emergencies. Rev German Radiologe. 2009;49(6):523–32.

**GRANT ACKNOWLEDGMENT.** Hospital Israelita Albert Einstein.

## 0746

### CRITICAL CARE TRANSOESOPHAGEAL ECHOCARDIOGRAPHY: RECONCILING THE DRIVE FOR QUALITY WITH THE CONSTRAINTS OF COST. A UNIVERSITY HOSPITAL EXPERIENCE

A.H. Lind[1], S.P.K. Linter[1], I.M. Davies[1], M.J. Platt[1]

[1]Bristol Royal Infirmary, Department of Anaesthesia, Bristol, UK

**INTRODUCTION.** Transoesophageal echocardiography (TOE) is used during cardiac surgery to identify myocardial dysfunction and to guide surgery for valve replacement or repair. The American Society of Anesthesiologists and the Society of Cardiovascular Anesthesiologists have produced practice guidelines on the use of perioperative TOE [1, 2]. These specify a list of Category One indications where there is the strongest evidence or consensus of expert opinion that TOE is likely to improve clinical outcome.

**OBJECTIVES.** The aim of our study was to assess compliance with the guidelines and to survey our use of TOE for coronary bypass surgery. Bristol Royal Infirmary has maintained a prospective database of all adult cardiac surgery patients since 1996.

**METHODS.** The database was searched from 1997 (the first complete year of data collection) onwards.

**RESULTS.** For Category One Indications there was a significant increase year on year for patients with (1) left ventricular ejection fraction <30% (p 0.002), (2) endocarditis (p 0.673), (3) congenital heart disease (p 0.007), and (4) thoracic aneurysm surgery (p 0.035). Overall, there was a significant increase year on year for the total percentage of patients where TOE was used (p 0.001), and for patients undergoing on-pump coronary bypass surgery. There was no significant increase in patients undergoing pericardial surgery, off-pump coronary bypass surgery or valve repair.

**CONCLUSIONS.** The increasing use of TOE has been postulated as one of the reasons why mortality from cardiac surgery has decreased over the last decade (3), and it is an important factor in intraoperative decision making (4). This study shows that in 60% of cases TOE is used in our institution for category one indications. Access and use of TOE will increase with training and investment in technology, however further research is required to prove a link between TOE use and improvement in clinical outcome.

**REFERENCE(S).** 1. Practice Guidelines for Perioperative Tranesophageal Echocardiography—A Report by the American Society of Anesthesiologists and the Society of Cardiovascular Anesthesiologists Task Force on Transesophageal Echocardiography. Anesthesiology 1996;84:986–1006.

2. Practice Guidelines for Perioperative Tranesophageal Echocardiography—An Updated Report by the American Society of Anesthesiologists and the Society of Cardiovascular Anesthesiologists Task Force on Transesophageal Echocardiography. Anaesthesiology 2010;112:1–1.
3. Society for Cardiothoracic Surgery in Great Britain and Ireland: 6th National Adult Cardiac Surgical Database Report 2008.
4. Kolev N, Brase R, Swanevelder J et al. The Influence of Transoesophageal Echocardiography on Intra-operative Decision Making: A European Multicentre Study. Anaesthesia 1998;53(8):767–73.

## 0747

### THE IMPACT OF AN INTENSIVE CARE INFORMATION SYSTEM (ICIS) ON THE NURSING STAFF: RESULTS OF A QUESTIONNAIRE

N. Mauws[1], A. Boeckx[1], D. Myny[1], K. Colpaert[1], C. Danneels[1], J. Decruyenaere[1]

[1]University Hospital of Ghent, Ghent, Belgium

**INTRODUCTION.** An ICIS is a dedicated IT system for the ICU with automated collection of physiologic and monitoring variables from monitors and ventilators and an integrated electronic prescription tool. We progressively started the implementation of our ICIS (Centricity Critical Care Clinisoft, GE) in 2003 and completed at 2008.

**OBJECTIVES.** The aim of the study was to explore the impact of ICIS on the nursing staff regarding overall satisfaction, training, time investment, communication and collaboration with physicians, user friendliness and other perceived advantages or drawbacks.

**METHODS.** The study took place in a tertiary university centre with 56 ICU beds. All ICU nurses (n = 197), participating in direct patient care, received a questionnaire 1 year after implementation of the ICIS in their ICU department (SICU, MICU, CSICU, PICU or Burn Unit). The questionnaire consisted of 204 questions divided into 10 domains. All statistical analyses were carried out with PASW Statistics 18 and statistical significance was defined as a P value equal or less than 0.05.

**RESULTS.** There was a response rate of 79% (n = 156). The majority of the responders were female (73%), between 30 and 39 years (42%), with at least 5 years ICU experience (76%) and working full time (69%). 82% of the nursing staff was positive or very positive towards ICIS implementation and 70% did not want to return to the paper record. There is an impression of increased workload with ICIS (76%). Especially more time-consuming were ICU admission (86%) and discharge (58%) administration, recording of administered medication (55%) and recording of the patient nursing care (73%). 72% answered that use of the ICIS made it more difficult to obtain a general overview of the patient status. Benefits of working with an ICIS were a more accurate and complete registration (72%) and the automatic variable recording from monitors, ventilators and syringe pumps (98%). The nursing staff preferred the ICIS over the paper record for computing the fluid balance (75%) and writing the nurse shift report (80%). The collegial relationship was not impaired since the implementation of the ICIS (66%) and nurses found it even easier to pass information to a colleague from the next shift (75%) as there was more information available than before (76%). The nursing staff experienced a loss of communication between the medical- and the nursing staff since the implementation of the ICIS (75%). No relevant correlations were found between the above results and variables such as age, sex, full- or part-time work, ICU characteristics and years of ICU experience.

**CONCLUSIONS.** Overall, nurses are very satisfied of working with the ICIS and the majority do not want to return to a paper-based record. Beside important benefits, this study identified several drawbacks of introducing an ICIS. However, the knowledge of these potential disadvantages may give opportunities to optimize an ICIS configuration and implementation.

## 0748

### TEMPORAL AND QUANTITATIVE IMPACT OF REMOVAL OF PULMONARY ARTERY CATHETHER ON PLATELET COUNTS

E.J. Zeedijk[1], F. Ismael[1], C.R. Barends[2], M.W. Nijsten[1]

[1]UMC Groningen, Critical Care, Groningen, Netherlands, [2]UMC Groningen, Anesthesiology, Groningen, Netherlands

**INTRODUCTION.** Despite decreased overall use, pulmonary artery catheters (PAC) remain useful for specific indications. Although PAC cathethers have long been associated with thrombocytopenia, the precise quantitative and temporal nature of this effect has not been established. In particular with current continuous cardiac output (CCO) PACs, this effect is not known. In a previous pilot study we found that daily platelet counts (PC) indicated that PAC removal may be related with early improvement in PC.

**OBJECTIVES.** To better define the changes in PC with daily multiple PC determinations in patients with a PAC. To quantitatively estimate the extent of PC decreases in patients with a PAC.

**METHODS.** All consecutive patients admitted over 1-year period who received an Edwards CCO PAC were evaluated. PC (reference range 150–300 $\times$ $10^9$/L) was determined trice daily, until 1 day after PAC-removal. PAC-removal time was accurately recorded and individual changes PC were determined for interpolated and compared with PAC-removal time, before 2 days before to 2 days after PAC removal. Weighed median and mean PC were calculated for at 2-h intervals for this period.

**RESULTS.** 44 patients could be included. Both the nadir (lowest) mean PC of $91 \pm 41 \times 10^9$/L and the nadir median PC of $79 \times 10^9$/L coincided within 2 h with PAC removal. The rate of change in PC rose by $18 \pm 45 \times 10^9$/L/d after PAC removal ($p < 0.001$).

**CONCLUSIONS.** The narrow coincidence of the lowest platelet counts and PAC-removal provides vvery strong evidence of a causal role of PAC in platelet count decreases. This direct temporal relationship points to increased consumption as the prime mechanism by which PACs affect platelet counts. The extent of PC consumption related with an in situ CCO-PAC appears considerable and will be clinically relevant when evaluating thrombocytopenia in such patients.

**REFERENCE.** 1. Vicente Rull JR, Loza Aguirre J, de la Puerta E et al. Thrombocytopenia induced by pulmonary artery flotation catheters. A prospective study. Intensive Care Med. 1984;10(1):29–31.

## 0749

### THE ROLE OF ROUTINE CHEST X-RAY AFTER PERCUTANEOUS DILATATIONAL TRACHEOSTOMY

S. Petros[1], L. Weidhase[1]

[1]University Hospital Leipzig, Medical ICU, Leipzig, Germany

**INTRODUCTION.** Percutaneous dilatational tracheostomy (PDT) is nowadays an established procedure in the management of the critically ill patient. The ease of performance and the availability of bronchoscopic control contributed to its safety in the hands of experienced operators and to its widespread acceptance. Routine post-procedural chest X-ray (CXR) has been used as a standard means of quality control for a long time. However, retrospective chart reviews and prospective observational studies have concluded that routine radiologic control is unnecessary. However, prospective randomised studies have not yet been published.

**OBJECTIVES.** This ongoing prospective randomised controlled study addresses the issue whether routine CXR is necessary after a PDT.

**METHODS.** Critically ill patients on mechanical ventilation, in whom a tracheostomy was considered necessary based on the pre-existing standard procedure of the ICU, were included. Immediately before the PDT, patients were randomised into group 1 (routine post-procedural CXR) and group 2 (CXR only when there is an assumed or sure procedure-related complication) using an electronic randomisation list. Indications for CXR in group 2 were subcutaneous emphysema, major bleeding, false placement of the tracheal canula, marked damage to the tracheal wall, post-procedural hypoxia of unknown cause, or decision of the operating physician. PDT was carried out using the Ciaglia Blue Rhino set under bronchoscopic visualisation.

**RESULTS.** Sixty-one patients are included until now. Mean age of the study population is 62.0 $\pm$ 14.0 years (24 females, 37 males). Indications for tracheostomy were long-term mechanical ventilation and respirator weaning. There was no major complication observed in both groups. Minor bleeding at the tracheostomy site was observed in 9 patients in group 1 and 6 patients in group 2. Tracheal ring fracture was observed in one patient per group. There was no need for CXR in group 2. Routine CXR in group 1 did not reveal any unexpected radiologic abnormality.

**CONCLUSIONS.** Routine chest X-ray is unnecessary after a percutaneous dilatational tracheostomy carried out under bronchoscopic visualisation. Limiting radiologic control to those cases with presumed or observed procedural complications will contribute to reduction of costs and radiation exposure of patients and staff.

## 0750

### THE IMPACT OF AN INTENSIVE CARE INFORMATION SYSTEM ON NURSING ACTIVITIES IN THE PEDIATRIC INTENSIVE CARE UNIT (PICU): WORK SAMPLING BEFORE AND AFTER IMPLEMENTATION

A. Boeckx[1], N. Mauws[1], K. Colpaert[1], B. Janssens[1], A. De Jaeger[1], J. Decruyenaere[1]

[1]University Hospital, Ghent, Belgium

**INTRODUCTION.** An intensive care information system (ICIS) was implemented in the 56-bed intensive care unit (ICU) of our tertiary university hospital between 2003 and 2008. The 6-bed PICU was computerized in 2008. A total of 470 PICU patients are admitted annually, median age 3 year (IQR 0.7–9) and median LOS 1.9 day (IQR 0.9–4). The exact impact of an ICIS on time allocation for different nursing activities remains unclear and has till now never been investigated in a PICU.

**OBJECTIVES.** The objective of the study was to determine how nurses spend their time during their shift regarding the different nursing activities before and after the ICIS implementation. We were especially interested in the impact of an ICIS on time allocation for direct patient care and documentation.

**METHODS.** Data were collected through the methodology of work sampling. Nursing activities were allocated in 7 categories: direct patient care, indirect patient care, unit-related activities, documentation, guarding and personal time, patient transport and others. Work sampling occurred before and 1 year after the implementation of the ICIS. On randomised moments data were collected 3 times per hour, throughout in total 16 shifts. Age, length of stay (LOS) and "Nine Equivalents of nursing Manpower use Score" (NEMS) at time of registration were registered to assure comparability between the patient groups pre- and post ICIS implementation. Kruskal–Wallis statistics (PASW Statistics 18) was used for statistical analysis and a P value of <0.05 was considered as significant.

**RESULTS.** During the study, 41 different patients were admitted to the PICU. There was always a 1:2 nurse/patient ratio at all times of registration. A total of 561 data points before and 624 data points after ICIS implementation were recorded.

RESULTS OF WORK SAMPLING

| Nursing activity category | Before ICIS (%) | After ICIS (%) | P value |
|---|---|---|---|
| Direct Patient Care | 43.32 | 43.43 | 0.188 |
| Indirect Patient Care | 17.47 | 13.62 | 0.634 |
| Unit-related activities | 11.41 | 7.21 | 0.124 |
| Documentation | 11.59 | 16.35 | 0.058 |
| Guarding and personal time | 10.70 | 12.82 | 0.081 |
| Patient transport | 3.39 | 1.60 | 0.700 |
| Others | 2.14 | 4.97 | 0.040 |

There was a significant age difference of 6.1 year (IQR 2.8–11.8) before implementation versus 0.69 year (IQR 0.3–3.8) after implementation ($p < 0.001$). However, both groups were comparable regarding LOS, median of 4 day (IQR 1–7) before ICIS versus 4 day (IQR 1–8) after ICIS ($p = 0.848$) and severity of illness, median NEMS before ICIS 21.5 (IQR 18–27) versus 24.0 (IQR 21–27) after ICIS ($p = 0.242$).

**CONCLUSIONS.** Although a non-significant increase in the time spent on documentation after the ICIS introduction was observed, there was no difference at all in nursing time spent on direct patient care documented.

## 0751

### PERIPHERALLY INSERTED CENTRAL CATHETERS (PICC) ARE A SAFE AND PRACTICAL ALTERNATIVE TO TRADITIONAL CENTRAL VENOUS CANNULAE IN INTENSIVE CARE PATIENTS

L. Finch[1], S. Hubble[1], C. Boulanger[1], H. Williamson[1]

[1]Royal Devon and Exeter Hospital, Intensive Care, Exeter, UK

**INTRODUCTION.** Central venous catheterization is a hazardous but necessary intervention in critically ill patients with a catheter related bloodstream infection (CRBSI) rate estimated at 3-8% and a mechanical complication rate between 10–20%. Nearly all of this published data applies to catheters inserted via the internal jugular, sub-clavian and femoral routes. Peripherally (multiluminal) Inserted Central (PICC) Catheters inserted via the brachial veins are a promising new method of central venous catheterization that have the same capabilities as traditional central lines, but may be associated with fewer complications. Our institution has gained considerable experience with their insertion under ultrasound guidance by a dedicated vascular access team and have become a national leader in both their use and audit of outcomes in both critical care and hospital wide settings.

**OBJECTIVES.** We report our PICC insertion rate, days and incidence of adverse events and compare this to similar data from traditional CVC placement.

**METHODS.** Data from all PICC or CVC line insertions were prospectively recorded onto dedicated databases between January 2008 and December 2009. No. of central catheters per patient, indication for use, no. of days in situ, adverse events including associated bacteraemia was interrogated for all patients. Rates of bacteraemia were cross checked with microbiological departmental databases on a named patient basis. In addition, time from referral to insertion was recorded for all PICC lines. SPSS version 12 was used for statistical analysis. Difference in means was assessed by Mann Witney U or Student t test depending on normality of data.

**RESULTS.** Over a 2 year period 188 PICC lines and 606 CVC lines were inserted in a general intensive care with an annual throughput of 850 patients. Mean length of time in situ was significantly longer: 18 days for PICC lines and 3.6 days for CVC lines (p 0.004). The bacteraemia rate associated with PICC use compared to CVC was 0.79 versus 0.55 per 1,000 days respectively (p 0.44. Significant adverse events (blockage 4.3%, misplacement 0.5%, leakage 1.1%) occurred in 5.9% of PICCs inserted over this time period. The average time from referral to insertion of PICC was 0.67 days.

**CONCLUSIONS.** PICC lines have a comparable rate of CRBSI with short term traditional CVC line placement despite a longer dwell time.They have a significantly lower rate of other adverse events such as blockage, haemorrhage and malplacement compared to local and published CVC data. PICC placement may avoid multiple short term CVC catheterisations with an associated reduction in infection rate and other adverse events. Overall, Brachial PICC insertion by a dedicated vascular access team is feasible, prompt and at least as safe as CVC insertion. Critical care physicians should consider brachial PICC access as a safe alternative when the need for central access is prolonged, at first line change or on a non-emergent basis.

## 0752

### PROSPECTIVE RANDOMIZED CONTROLLED STUDY COMPARING CONVENTIONAL VENTILATION VERSUS A FULLY CLOSED-LOOP VENTILATION (INTELLIVENT®) IN POST CARDIAC SURGERY ICU PATIENTS

F. Lellouche[1], P.-A. Bouchard[1], T. Laubscher[2], S. Blackburn[1], E. L'Her[3], M. Wysocki[4]

[1]Institut Universitaire de Cardiologie et de Pneumologie de Québec, Québec, Canada, [2]Hamilton Medical, Bonaduz, Switzerland, [3]Hôtel Dieu de Lévis, Lévis, Canada, [4]Hamilton medical, Bonaduz, Switzerland

**INTRODUCTION.** An increasing gap between the number of patients requiring mechanical ventilation and the number of skilled clinicians available is anticipated. Automated ventilation systems provide a potential solution to these problems. IntelliVent has been developed to provide fully closed-loop mechanical ventilation for passive and active breathing patients using a ventilation controler to keep $EtCO_2$ within expert-based ranges and an oxygenation controler to keep $SpO_2$ within predefined ranges.

**OBJECTIVES.** This prospective randomized controlled study was designed to assess safety and potential benefits with IntelliVent as compared to conventional ventilation in post cardiac surgery ICU patients.

**METHOD.** In post surgery and after 15 min of stabilization the patients were connected for 4 h to a G5 ventilator (Hamilton Medical) and randomized to receive a conventional ventilation ($V_T$, RR, $FiO_2$ and PEEP set according to the physician in charge and to the local protocol) or IntelliVent with automatic adjustments. $V_T$, peak pressure, $SpO_2$ and $EtCO_2$ were continuously recorded, arterial blood gas analyzed every hour and periods of optimal, acceptable and not acceptable for $V_T$, PPeak, $EtCO_2$ and $SpO_2$ were a priori defined.

**RESULTS.** 60 patients have been included in the study, 30 were assigned to conventional ventilation and 30 to IntelliVent. Demographic, pre-operative and per-operative data were comparable. All the patients completed the study in both groups. 30/30(100%) versus 4/30 (13%) of the patients required manual changes of the ventilator settings during the 4 h study ($P < 0.001$), corresponding to a total of 148 interventions during conventional ventilation compared to 5 interventions with IntelliVent ($P < 0.001$). The $V_T$/PBW at inclusion was comparable in both groups $10.3 \pm 2.6$ and $10.6 \pm 2.7$ ml/kg and was automatically reduced in the Intellivent group ($8.1 \pm 1.9$ vs. $10.2 \pm 1.5$ ml/kg, $P < 0.001$). 17/30 (57%) and 19/30 (63%) of the patients were ventilated with $V_T$ above 10 ml/kg of PBW at inclusion, in the control group and in the IntelliVent group respectively. After 1 h, the proportion did not change in the control group while all the patients were ventilated with $V_T$ below 10 ml/kg of PBW in the Intellivent group. Percentage of time within optimal, acceptable and not acceptable range for physiologic parameters were 85–12–3% with IntelliVent and 6–73–21% with conventional ventilation. Other outcome data did not differ.

**CONCLUSION.** We conclude that it is possible to safely use this fully automated closed-loop system in the specific population of patients after cardiac surgery. In spite of a reduced number of interventions, the system maintained the patient within predefined target of optimal ventilation. The potential advantages of such system are the reduction of the workload associated with mechanical ventilation management and patient's safety improvement.

ClinicalTrials.gov identifier: NCT01090258.

## 0753

### VALIDATION OF AN ALGORITHM TO DECREASE THE TIDAL VOLUME WITH MAINTENANCE OF THE ALVEOLAR VENTILATION

F. Sava[1], A. Bojmehrani[1], A. Vandershuren[1], L. Erwan[2], F. Lellouche[1]

[1]Institut Universitaire de Cardiologie et ed Pneumologie de Québec, Québec, Canada, [2]Hôtel Dieu de Lévis, Lévis, Canada

**INTRODUCTION.** It is well demonstrated that the use of low tidal volumes, reduces mortality in patients with ARDS [1] and that high tidal volumes is a risk factor for "acquired ARDS" [2]. Also we recently have shown that the use of high tidal volumes after cardiac surgery was associated with organ dysfunction [3]. Some authors propose to provide "protective" ventilation with low tidal volumes for every patient on invasive mechanical ventilation [4[. It is often tedious to calculate dead space fraction (VD/Vt) and the resulting change in alveolar ventilation when lowering tidal volumes (Vt).

**OBJECTIVES.** The aim of this study is to evaluate the accuracy of an algorithm that reduces Vt, while maintaining the alveolar ventilation based on dead space estimation.

**METHODS.** Any mechanically ventilated post-cardiac surgery patient was included if Vt was above 10.5 ml/kg of ideal body weight (IBW). Vt was then reduced to 10 ml/kg IBW while increasing the respiratory rate to target the same alveolar ventilation based on a calculation that accounts for total dead space (physiological and instrumental). Vt, respiratory rate, $FiO_2$, temperature, $EtCO_2$ and arterial blood gases were collected at baseline and 30 min after reduction of Vt. No other respiratory parameters were modified. The primary endpoint was to maintain a stable $PaCO_2$ in comparison with baseline value ($\Delta PaCO_2 \leq 2$ mmHg).

**RESULTS.** We present here the preliminary results for 20 patients. Mean age was $63 \pm 12$ years. Mean Vt at baseline was 11.6 mL/kg IBW (8.6 mL/kg current body weight) and 8 patients had Vt above 12 mL/kg IBW. With reduction of Vt to 10 mL/kg, there was no significant change in $PaCO_2$ ($\Delta PaCO_2 = 0.2$ mmHg, $p = 0.8$).

Interestingly, there was a trend towards a reduction in $PaO_2$ ($\Delta PaO_2 = 24$ mmHg, $p = 0.06$) and among those patients for whom Vt reduction exceeded 2 ml/kg ($n = 8$), there was a significant reduction in $PaO_2$ ($\Delta PaO_2 = 53$ mmHg, $p = 0.02$). The dead space fraction (VD/Vt) estimated by the algorithm was $19\% \pm 2$ compared to $22\% \pm 13$ ($p = 0.6$) when calculated using Bohr equation.

**CONCLUSION.** The use of a simple physiological algorithm seems to accurately estimate dead space in mechanically ventilated patients and could be used to automatically reduce the tidal volumes while maintaining alveolar ventilation. However, a larger population is required to confirm these preliminary results. Moreover, the use of higher PEEP may be required to counterbalance the drop in $PaO_2$ if low tidal volumes are used.

**REFERENCES.** 1. ARMA study, NEJM 2000.
2. Gajic, Crit Care Med 2005.
3. Lellouche ATS 2010.
4. Schultz Anesthesiology 2007.

# Pediatric intensive care: 0754–0767

## 0754

### QUALITY OF LIFE 4 YEARS AFTER NEONATAL COMPLEX HEART SURGERY

G. Garcia Guerra[1], A.R. Joffe[2], C.M.T. Robertson[2], G.Y. Alton[2], I.A. Dinu[3], D. Nicholas[4]

[1]University of Alberta, Pediatrics, Pediatric Intensive Care Unit, Edmonton, Canada, [2]University of Alberta, Pediatrics, Edmonton, Canada, [3]University of Alberta, School of Public Health, Edmonton, Canada, [4]University of Calgary (Edmonton Division), Edmonton, Canada

**INTRODUCTION.** Improved peri-operative care of children with complex congenital heart disease has led to decreased mortality. Increasing attention is now being given to long-term outcomes including health related quality of life (HRQL).

**OBJECTIVES.** (1) To determine the HRQL at 4 years of age in children who had cardiac surgery for congenital heart disease in the neonatal period, and compare with normative data. (2) To compare the HRQL between children with biventricular and single ventricle repairs. (3) To identify peri-operative factors associated with the HRQL.

**METHODS.** We designed a prospective cohort study including all neonates having complex surgery for congenital heart disease between July 2000 and December 2005, excluding patients with chromosomal abnormalities, extracorporeal life support and/or heart transplant. HRQL was assessed using the PedsQL$^{TM}$ 4.0 Generic Core Scales completed by the children's parents at the time of 4-year follow-up. Data from patients with single ventricle and biventricular repairs were compared with published normative values at the same age using t test for independent samples. To identify peri-operative factors associated with HRQL we used multiple linear regression analysis.

**RESULTS.** Two hundred and sixty-five neonates underwent heart surgery during the study period; 48 died, 28 were excluded, 26 parents did not receive the forms, 2 refused to complete the forms, 1 was too ill to be seen, 7 were lost to follow-up, and 23 have not yet been seen, leaving 130 survivors for analysis. There was no significant difference between the Total PedsQL ($P = 0.057$) in children with single ventricle repairs versus biventricular repairs. The only summary score that was significantly different was physical functioning ($P = 0.003$), where the single ventricle patients had a lower score. When compared to normative data, children with biventricular repair had significantly lower Total PedsQL ($P < 0.001$) and Psychosocial Health Summary ($P < 0.001$) scores. When compared to normative data, children with single ventricle repair had significantly lower Total PedsQL ($P < 0.001$), Psychosocial Health Summary ($P = 0.001$) and Physical Health Summary ($P = 0.002$) scores. In the multiple linear regression analysis we found a negative association between both age (in days) at surgery ($P < 0.01$), and the highest lactate level between days 6 to 10 post-operative ($P = 0.017$) and Total PedsQL scores.

**CONCLUSIONS.** At 4 years of age Total PedsQL and Psychosocial Health Summary scores were significantly lower in children who had surgery for congenital heart disease in the neonatal period when compared to normative data. Children with single ventricle repair also had lower Physical Health Summary scores. Older age at surgery and the highest lactate level between days 6 and 10 post-operative are risk factors associated with lower HRQL. These findings invite greater consideration of potential resources fostering HRQL.

## 0755

### SAFE ADMINISTRATION OF MILRINONE INFUSION

G. Garcia Guerra[1], A.R. Joffe[2], C.S. Parshuram[3], A. Senthilselvan[4], D.J. Kutsogiannis[5], C. Sheppard[2], L. Hodson[2], C. Gresiuk[2]

[1]University of Alberta, Pediatrics, Pediatric Intensive Care Unit, Edmonton, Canada, [2]University of Alberta, Pediatrics, Edmonton, Canada, [3]University of Toronto, Pediatrics, Toronto, Canada, [4]University of Alberta, Public Health Sciences, School of Public Health, Edmonton, Canada, [5]University of Alberta, Division of Critical Care Medicine, Edmonton, Canada

**INTRODUCTION.** Milrinone is a potent and potentially toxic vasoactive drug commonly administered to improve cardio-circulatory function in critically ill children. Dosing is intended to achieve therapeutic levels 100–300 ng/ml based on assumptions about drug elimination.

**OBJECTIVES.** (1) To determine the proportion of milrinone blood levels outside the therapeutic range (100–300 ng/mL) during intravenous infusion therapy administered to critically ill children. (2) To determine if drug level variability can be predicted with current pharmacologic knowledge.

**METHODS.** A prospective cohort study was performed. Eligible children were less than 24 months of age, and received milrinone infusion after cardiac surgery with cardiopulmonary bypass. We excluded premature infants and patients receiving extracorporeal life support. Informed consent was signed by patient guardians, and the study was approved by the health research ethics board. For each patient, milrinone blood levels were measured at four time periods after the initiation of the milrinone infusion: 9–12 h (time 1), 20–24 h (time 2), 40–48 h (time 3), and at the end of the infusion (time 4). Milrinone levels were determined with HPLC. Predicted steady state milrinone levels were calculated using the formula of Bailey et al. The primary outcome was the proportion of milrinone levels outside of the therapeutic range. Descriptive methods and binomial exact method was used to test the hypothesis that 25% of the milrinone levels are outside of the therapeutic range. The comparison between measured and predicted milrinone levels was performed with Spearman's rank correlation.

**RESULTS.** Two-hundred and twenty milrinone levels were obtained from 63 patients with a mean age of 4.0 months. Overall 114 (51.8%, 95% CI 45–58%) milrinone blood levels were outside the therapeutic range; 78 (35.5%, 95% CI 29–42%) of the levels were sub-therapeutic, and 36 (16.4%, 95% CI 11–21%) were supra-therapeutic. At each time point the proportion of milrinone levels outside the therapeutic range was statistically significantly higher than 25% (all p values <0.02). The correlation between measured and predicted milrinone levels was weak: time 1 rho = 0.41, time 2 rho = 0.54, time 3 rho = 0.22, and time 4 rho = 0.39.

**CONCLUSIONS.** Non-therapeutic milrinone blood levels are common in children receiving milrinone infusions after cardiac surgery for congenital heart disease, and levels cannot be predicted with published formulae. Information on the clinical impact of milrinone levels outside the therapeutic range and variables that could improve the prediction of these levels require further study. Therapeutic drug monitoring may be required to optimize milrinone therapy.

## 0756

### EFFECTIVENESS AND SAFETY OF THE INTERNAL JUGULAR VEIN CATHETERIZATION IN PEDIATRICS: ULTRASOUND NAVIGATION VS ANATOMICAL LANDMARKS (A PROSPECTIVE, RANDOMIZED, DOUBLE-BLIND STUDY)

A. Ovezov[1], I. Zakirov[2], M. Vishnyakova[1]

[1]The Moscow Regional Research Clinical Institute, Moscow, Russian Federation, [2]Children's Republican Clinical Hospital of Tatarstan, Department of Anesthesiology and Intensive Care, Kazan, Russian Federation

**INTRODUCTION.** Central vein catheterization is a cornerstone of modern intensive care and anesthesiology. It is difficult to overestimate the role of catheterization in pediatric practice. Central venous catheters guarantee a reliable access to the blood stream. For this reason, providing venous access in infants and children is a persistent problem.

**OBJECTIVES.** We performed a comparative analysis of the effectiveness of the internal jugular vein catheterization using ultrasound navigation and anatomical landmarks in the Department of anesthesiology and intensive care of the Children's Republican Clinical Hospital of Tatarstan from 2008 to 2009 years.

**METHODS.** Design of study: a prospective, randomized, double-blind, clinical. Randomization—computer-generated table (http://www.randomization.com, seed 11564). In total, the analysis included data on 209 of the internal jugular vein catheterization. The main group (n = 107): the use of ultrasound real-time guidance in the jugular vein catheterization, control group (n = 102): catheterization vein using anatomical landmarks. The median age of patients undergoing catheterization procedure in the main group—53 months, in the control group—52 months, median weight in the main group—15 kg, in the control group 16.4 kg. All catheterization performed on the well-known Seldinger technique. In the study group, venous catheterization was carried out under direct ultrasound (U.S. navigation in real time, cross-scanning, linear, multisensor 10 MHz), in the control group used the classical technique of catheterization for anatomical landmarks. Quantitative data are expressed with mean and standard deviation, and qualitative data with percentage. Statistical significance was determined using Chi-square and Fisher's exact tests.

**RESULTS.** Successful catheterization was completed in the main group in 99.2%, in control of 65% ($p = 0.00001$). For one reason or another do not remove install central venous catheter in the main group: 2 cases of catheterization, in control group—36. Percentage of successful catheterization from 1 attempts: in the main—82.2% (n = 88), in control—39.2% (n = 40). The average number of attempts it took to execute the procedure was significantly lower in the group of ultrasonic real time guidance: of $1.28 \pm 0.07$, in the group of anatomical landmarks—$2.7 \pm 0.17$ attempts ($p = 0.003$). The median time spent on the implementation of catheterization in the study group was 32 s, in the control group—108 s ($p = 0.005$). The frequency of complications (puncture of the artery) in the main group was 0.9% (n = 1), in the control group 27.4% (n = 28) ($p = 0.00001$).

**CONCLUSIONS.** In order to reduce the frequency of complications, increasing the frequency of successful catheterization of the internal jugular vein catheterization in pediatric practice is advisable to use ultrasonic control.

## 0757

### VALIDATION OF ULTRASOUND DILUTION CARDIAC OUTPUT METHOD IN CHILDREN FOLLOWING CONGENITAL HEART SURGERY

A. Floh[1], P. Bastero-Minon[1], J.Z. Wermelt[1], C. Barbanti[1], V.B. Sivarajan[1], G. La Rotta[2], T. Humpl[1]

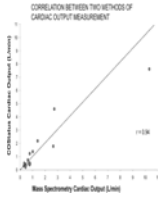
[1]The Hospital for Sick Chilren, Critcal Care Medicine, Toronto, Canada, [2]The Hospital for Sick Children, Labatt Heart Centre, Toronto, Canada

**INTRODUCTION.** Ultrasound dilution (COud) technique determines cardiac output by measuring changes in ultrasound velocity through blood following injection of 0.9% saline warmed to body termperature [1]. This technology has been recently validated in animal and adult models [2–4], however paediatric data remains lacking. The current gold standard for measuring cardiac output in children uses the Fick technique with measured oxygen consumption ($VO_2$). Indirect Fick measurements using dye or thermodilution is available and requires invasive central catheters.

**OBJECTIVES.** To validate a novel method of ultrasound dilution (COstatus©, Transonic Systems Inc., Ithaca, NY, USA) to measure cardiac output in paediatric patients following repair of congenital heart disease.

**METHODS.** Children undergoing biventricular repair of congenital heart disease were prospectively identified. A trans-esophageal echocardiogram was routinely used and all children with significant intracardiac shunts were excluded. Cardiac output was measured by ultrasound dilution and concurrently by Fick method using respiratory mass spectrometer (AMIS2000, Innovision A/S, Denmark) arterial and venous gases.

**RESULTS.** Fifteen patients were recruited for study. Eleven individuals had data sets available for analysis; three patients had incomplete data sets and one patient had a significant residual shunt. Five patients had multiple studies accounting for 16 points comparison. The median age studied was 7 months (range: 6 days–14.5 years) with five neonates. Median weight was 6.7 kg (range: 2.7–80 kg). The median inotropic score was 6.6; all patients were on milrinone, three on epinephrine and two on vasopressin. No complications werde recorded. Pearson correlation between the two methods of cardiac output measurement $r = 0.92$ with tighter correlation at lower cardiac output.



Pearson correlation

**CONCLUSIONS.** Ultrasound dilution method appears to be a safe, straightforward and reliable method for measurement of cardiac output in the postoperative neonatal and paediatric congenital heart disease group.

**REFERENCE(S).** Krivitski NM: Novel method to measure access flow during hemodialysis by ultrasound velocity dilution technique. ASAIO J. 1995;41:M741–5.

Masato Tsutsui M, Matsuoka N, Ikeda T, Sanjo Y, Kazama T. Comparison of a new cardiac output ultrasound dilution method with thermodilution technique in adult patients under general anesthesia. J Cardiothor Vascular Anesth. 2009; 23(6):835–840.

de Boode WP, van Heijst AFJ, Hopman, JCW, Tanke RB, van der Hoeven HG, Liem KD. Cardiac output measurement using an ultrasound dilution method: a validation study in ventilated piglets. Pediatr Crit Care Med. 2010; 11(1):103–108.

**GRANT ACKNOWLEDGEMENT**: Transonic Systems Inc., Ithaca, NY, USA provided the COstatus technology and technical support for the project.

## 0758

### PAEDIATRIC OUTCOMES FROM A GENERAL/ADULT INTENSIVE CARE UNIT OVER A 12 YEAR PERIOD

J.P. Purday[1]

[1]Royal Devon and Exeter Hospital, Intensive Care, Exeter, UK

**INTRODUCTION.** Controversy has surrounded outcomes from paediatric patients admitted to a general/adult intensive care unit (1). In the UK paediatric intensive care became centralised over 10 years ago. In South West England geographical distances have meant that many children are initially managed in general/adult intensive care units (ICUs). These children are then transferred to a central specialist paediatric intensive care (PICU) or remain in the general/adult ICU if stable, and if likely to be discharged within 24 h. Transfer is usually by a centralised specialist service.

**OBJECTIVES.** To assess case mix and outcomes of all children admitted to a general/adult ICU over a 12 year period.

**METHODS.** All children (16 years and under) admitted to ICU from January 1997 to December 2008 were obtained from the Intensive Care National Audit and Research Centre (ICNARC) database. Data was obtained for diagnosis, monitoring, discharge location and mortality. Predicted mortality were obtained using the Paediatric Risk of Mortality (PIM) criteria [2] which has been previously validated for use in a general/adult ICU [3].

**RESULTS.** A total of 497 patients were admitted. 104 (21%) were transferred to a PICU. 12 (2%) died and 485 (98%) survived. Age range was from 3 days to 16 years old (Mean 7.04 years). Average length of stay was 1.39 days. 250 (50%) patients were ventilated. 295 (60%) had arterial lines and 145 (31%) had central lines. 102 (21%) were planned admissions largely for kyphoscoliotic surgery 98 (20%). 395 (79%) admissions were unplanned. Diagnostic groups were epilepsy 25 (5%), broncholitis 25 (5%), brain injury 23 (5%), sepsis 21 (4%), asthma 20 (4%), croup 15 (3%), diabetic ketoacidosis 13 (3%) and septic shock 11 (2%). PIM scoring (for 2001–2008) predicted 8 deaths, but only 3 occurred with a Standardised Mortality Ratio (SMR) of 0.27.

**CONCLUSIONS.** A wide case mix of children are admitted to our general/adult ICU with a broad range of ages from newborn to adult. Despite fears of deskilling from centralisation our outcomes are excellent. The present South West UK model of transferring those children who are seriously ill to the PICU, by use of a specialised transport service, and keeping those children less ill for short periods appears to be performing well. This model may work well in other European geographical areas.

**REFERENCE(S).** 1. Pearson G. et al. Should paediatric intensive care be centralised? Trent versus Victoria. Lancet. 1997;349:1213–7.
2. Shann F et al. Paediatric index of mortality (PIM): a mortality prediction model for children in intensive care. Intensive Care Medicine 1997:23:201–7.
3. Fraser J et al. Evaluation of the Paediatric Index of Mortality in children managed on adult intensive care units. Arch Dis Child. 2004;89:974–6.

## 0759

### PERIOPERATIVE PREVENTION OF EARLY COGNITIVE DYSFUNCTION IN CHILDREN

M. Lobov[1], A. Knyazev[1], A. Ovezov[2], M. Panteleeva[1], P. Myatchin[1], E. Nad'kina[2]

[1]Moscow Regional Research Clinical Institute, Neurology, Moscow, Russian Federation, [2]Moscow Regional Research Clinical Institute, Anesthesiology, Moscow, Russian Federation

**INTRODUCTION.** General anesthesia can cause some side-effects due to direct action of anesthetics on central nervous system (CNS), for example, postoperative cognitive dysfunction (POCD). Pathogenic influence of narcosis to CNS is proven and obvious, therefore prevention of POCD is very relevant, especially in children.

**OBJECTIVES.** The aim of study is to research the possibility of using Mexidol (Pharmasoft, Russia) as mean of perioperative cerebral protection for prevention of POCD in children.

**METHODS.** Design of study: prospective, randomized, clinical. Randomization: envelope method. We examined 40 children (all males) aged from 6 to 16 years old (10.8 $\pm$ 2.8 years), which were under non-urgent surgical treatment with cryptorchidism, varicocele, inguinal hernia. All children received standard total intravenous anesthesia (TIVA): propofol 2–3.5 mg/kg per hour and phentanyl 3.5–5 mg/kg per hour. TIVA lasted from 40 to 180 min (132.7 $\pm$ 7.5 min). Patients were randomized on 2 groups: A ($n = 20$, for preventive cerebral protection Mexidol 100 mg was given i.m. before and 24 h after surgery); B ($n = 20$, without protection). Methods of examination: transcranial ultrasonography, electroencephalography (EEG) and neuropsychological study, included modifyed Bourdon test with calculating of accuracy coefficient and "10 words" test. Free-radical process markers were detected perioperatively. Examination took place day before and 3rd to 5th day after surgery. Quantitative data are expressed with median and standard deviation, and qualitative data with percentage. Statistical significance was determined using nonparametric Wilcockson-Mann–Whitney's criterion (u).

**RESULTS.** Before the operation all data were within normal limits in both groups. Postoperative study showed obvious decrease of line flow velocity, growth of pulsation index in both groups. Growth of low-frequency activity registered in occipital, temporal and central zones during EEG were registered in all patients, and also acute waves in 10% of group B ($p < 0.05$). In group A stabilization of amplitude and frequency parameters of EEG was detected (did not differ significantly from preoperative). In group B obvious decrease of cognitive functions was found in 60% of patients, while in group A—in 20% ($p < 0.05$). Laboratory tests revealed a postoperative increase in free radical processes in group B compared with group A ($p < 0.05$). Postoperative changes of cerebral flow and free-radical process and state of anti-oxidative system in all patients reminded experimental model of ischaemic stroke—"ischemia–reperfusion" syndrome. Thus, oxidative stress and acceleration of apoptosis are probably important for the pathogenesis of POCD.

**CONCLUSIONS.** Results of this study shows some efficiency of perioperative cerebral protection by use of neuroprotective medications with antioxidant action.

**REFERENCE(S).** No.

**GRANT ACKNOWLEDGMENT.** No.

## 0760

### THE EFFECT OF HUMAN RED CELLS STORAGE TIME ON THE MICROCIRCULATION OF PRETERM INFANTS

Z. Mormanova[1,2], K. Schottmeyer[1], O. Genzel-Boroviczény[1]

[1]LMU Munich, Departement of Neonatology, Munich, Germany, [2]Charles University 2. Medical Faculty, Departemen of Pathophysiology, Prague, Czech Republic

**INTRODUCTION.** Red blood cell (RBC) transfusion practices for neonates are controversial, variable, and based on limited scientific information. To decrease donor exposure satellite packs are used leading to the transfusion of older red blood cells. Transfusion of stored RBCs in a hemodiluted animal resulted in significant malperfused and underoxygenated microvasculature that was not detected at the systemic level. Storage of RBCs leads to biochemical and physical changes that hinder their function during transfusion.

**OBJECTIVES.** Does the age of transfused erythrocytes influence functional vessel density (FVD) in the skin in premature infants?

**METHODS.** 17 preterm infants with birth weight < 1500 g received RBC transfusion, 11 infants repeatedly from the same donor. The age of RBCs at repeated transfusions was significant higher than at the first transfusion.

Using Sidestream Dark Field Imaging at the upper right arm, all preterm infants were examined before and 2, 24 and 48 h after transfusion. Images were blinded and analyzed with Microvision Analysis Software.

**RESULTS.** FVD before first and repeated transfusion did not differ. In the 2nd, 24th and 48th hour after the treatment the Functional Vessel Density (FVD) was significantly lower after the repeated transfusion with longer storage time (mean [95% CI]; 2nd: 250 [239 261] vs. 238 [225–251] cm/cm$^2$, $p = 0.045$; 24th: 259 [250 268] vs. 231 [222 240] cm/cm$^2$, $p = 0.001$; 48th: 234 [222 246] vs. 220 [200 232] cm/cm$^2$, $p = 0.035$). The proportion of vessels with altered sluggish blood flow was also significantly higher when older RBCs were transfused (24 h: 0.3% [0–0.7%] vs. 2.5% [1–4%], $p = 0.017$; 48 h: 1% [0.2–1.7%] vs. 3.3% [1.9–4.6%], $p = 0.013$).

**CONCLUSIONS.** Similar to the animal model longer storage of the red blood cells reduces functional vessel density in the skin of premature infants and more vessels display sluggish blood flow. If reduced donor exposition is worth the negative effects on the microcirculation is unknown.

**REFERENCE.** Gonzalez AM, Yazici I et al. (2007). Effects of fresh versus banked blood transfusions on microcirculatory hemodynamics and tissue oxygenation in the rat cremaster model. Surgery 141(5):630–639.

## 0761

### PREDICTIVE VALUE OF PROSPECTIVE BRONCHOSCOPIC ASSESSMENT AFTER INFANT HEART SURGERY

P.P. Nayak[1], J. Sheth[1], P.N. Cox[1], L. Davidson[1], V. Forte[1], C. Manlhiot[1], B.W. McCrindle[1], S.M. Schwartz[1], G.S. Van Arsdell[1], V.B. Sivarajan[1]

[1]University of Toronto, Cardiac Critical Care Unit, Hospital for Sick Children, Toronto, Canada

**AIMS.** Airway evaluation after extubation failure (EF) that follows infant heart surgery (IHS) often reveals evidence of tracheobronchial compression. Although frequently cited as the cause of EF in this population, the existing literature suffers from ascertainment bias.

**METHODS.** A prospective, observational cohort study of infants (age $\leq$ 6 months) after IHS was conducted from March to September 2009. Flexible bronchoscopy (FB) evaluations were obtained using a standardized protocol. The primary endpoint was development of EF (defined as need for invasive or noninvasive mechanical ventilation $\leq$48 h after primary extubation), incidence of significant FB findings and predictive value of FB (presence of compression as well as global assessment) for EF; secondary endpoints included duration of postoperative ventilatory support and readmission rates. Descriptive statistics were generated; FB findings were evaluated for test performance characteristics. Data were analyzed for univariate and multivariable predictors of EF; parameter estimates and 95% confidence intervals were reported.

**RESULTS.** Over the study period 53 patients were enrolled, 30 patients had FB completed. The median (range) age was 78 (0–174) days and weight was 4.2 (2.3–7.9) kg; 9 (17%) were ventilated preoperatively; 13 (25%) patients had single ventricle physiology, 2 were listed for heart transplantation and 11 (21%) had defined genetic syndromes. The patients in whom FB images were obtained were not significantly different than the remaining cohort. Significant airway compression was noted in 24 of 30 (80% [63–90]) FB patients; 17 of the 53 patients (32 [21–45] %) developed EF, of whom 12 had FB. Compression on FB had sensitivity, specificity, positive and negative predictive value (PPV and NPV) of 75, 17, 38 and 50% respectively for EF. The global FB assessment had sensitivity, specificity and PPV and NPV of 50, 56, 43 and 63% respectively for EF. Of the 5 patients who clearly failed from lower airways obstruction, FB was performed in 4 and predicted EF in 3. The single greatest predictor of EF by univariate and multivariable analysis was the need for preoperative ventilation (RR = 2.3 [1.1–4.8], $p = 0.05$). Patients with EF had a longer duration of postoperative ventilation (114 vs. 49 h) which, although clinically significant, did not reach statistical significance ($p = 0.27$). Patients with EF had a greater likelihood of subsequent CCU readmission (RR = 17 [3.2–102], $p < 0.0001$) during the same hospital admission.

**CONCLUSIONS.** Airway compression as characterized by FB is noted frequently after IHS. Overall FB assessment and presence of compression has poor sensitivity, specificity and predictive value for EF in our cohort of infants. Rather than being a causative factor for EF, it is more likely that baseline airway compression represents an additional physiologic burden in the face of comorbidities such as important residual lesions or neuromuscular weakness.

## 0762

### ULTRASOUND VISUALIZATION OF LUNG RECRUITMENT IN PAEDIATRIC ARDS

P. Santuz[1], L. Andaloro[1], P. Bonetti[1], L. Chini[1], M. Gaffuri[1], F. Sacco[1], A. Serra[1], M. Soffiati[1], P. Biban[1]

[1]Azienda Ospedaliera Universitaria Verona, Pediatrics, Verona, Italy

**INTRODUCTION.** In acute respiratory distress syndrome (ARDS), lung recruitment manoeuvres (LMRs) are often required to improve oxygenation [1]. Recently, lung ultrasonography (LUS) have been applied successfully in critical care to obtain reliable and fast information at bedside [2].

**OBJECTIVES.** The aim of this study was to assess if LUS may be useful in correlating lung recruitment and clinical response during a LRM.

**METHODS.** This is a retrospective series of children with ARDS, with a $pO_2/FiO_2$ <200 and a LUS pattern of bilateral consolidation/atelectasis in the dependent zones. A LRM consisting in an incremental PEEP manoeuvre was performed concomitantly with LUS, in order to show the shift to a LUS pattern of lung aeration (i.e. B- and A-lines). Ventilation parameters such as PEEP and $FiO_2$ were registered before and after LRM.

**RESULTS.** Nine children, with a median age of 7 months (range 2.3–18.6), were observed with LUS during a LRM. Overall, PEEP was increased from a median of 6 (range 4–8) to 15 (7–22) $cmH_2O$ and $FiO_2$ from 0.60 (0.40–1) to 0.45 (0.25–0.55). According recruitability, two groups were identified, with a comparable PEEP increase. In the highly recruitable group (6 patients), the shift to a prevalent LUS aeration pattern was associated with a better clinical response ($FiO_2$ reduction 25–55%). In the poorly recruitable group (3 children), a persistent LUS pattern of consolidation/atelectasis was associated with a worse clinical response ($FiO_2$ reduction 5–15%). There were no complications during LRMs.

**CONCLUSIONS.** In this small series of ARDS patients, LUS was able to show the correlation of lung recruitment with clinical response, as indicated by $O_2$ requirement. Prospective studies are needed to better define the role of LUS in guiding titration of PEEP during LRMs in ARDS.

**REFERENCE(S).** 1. Meade MO, Cook DJ, Guyatt GH et al. JAMA. 2008; 299:637–45.
2. Lichtenstein DA. Pediatr Crit Care Med. 2009;10:693–8.

## 0763

### PROLONGED STAY IN THE PICU: PATIENTS CHARACTERISTICS AND ASSOCIATED FACTORS

A. Khaldi[1], A. Bouziri[1], A. Hamdi[1], A. Borgi[1], S. Belhadj[1], K. Menif[1], N. Ben Jaballah[1]

[1]Children's Hospital, Tunis, Tunisia

**OBJECTIVES.** Describe the profile, outcome and associated factors with prolonged PICU stay (longer than 4 weeks) in infants and children.

**METHODS.** One center observational study enrolling all children and infants older than 4 weeks, hospitalized in a tertiary PICU for a period longer than 28 days between 01/01/2002 and 31/12/2009. Data were extracted from patients charts and analyzed by 2 seniors reviewers.

**RESULTS.** A total of 74 patients were enrolled in the study because a length of PICU stay (LOS) >28 days, male were 57%.The median age was 7 months (IQR25-75: 2–18).Close to 65% were younger than 6 months. The median LOS was 46 days (IQR25-75: 35–61). 20% of patients remained in our PICU more than 3 months. The median for length of mechanical ventilation was 37 days (IQR25-75: 27–41) and 6% of patients required more than 3 months of mechanical ventilation.Tracheostomy was performed in 21% of patients close to 39 ± 25 days of PICU stay. The majors causes of Prolonged PICU stay were upper respiratory problem, neuromuscular and central nervous disease. mortality was 40% and was higher than that registered at the same period in all PICU admissions (18%).

**CONCLUSIONS.** In our PICU, prolonged PICU stay is associated with high morbidity and mortality. The great reasons of this problem are in the respiratory and neurological disease and represent a great challenge for our intensivists.

## 0764

### ACUTE ILLNESS IN CHILDREN ADMITTED TO THE PICU WITH NOVEL H1N1 INFLUENZA A: A CASE SERIES

A. Khaldi[1], A. Bouziri[1], A. Hamdi[1], A. Borgi[1], S. Belhadj[1], K. Menif[1], N. Ben Jaballah[1]

[1]Children's Hospital, Tunis, Tunisia

**OBJECTIVES.** To describe the presentation, course and outcome of critically ill children with nH1N1 influenza disease admitted to our PICU.

**METHODS.** A retrospective cases series was made for 16 consecutive patients admitted at a tertiary universitary PICU with a nH1N1 influenzae A disease between October 2009 and February 2010. Charts of all patients with confirmed or suspected nH1N1 influenzae A disease were included to the analyze of epidemiological data, course and outcome. No interventions were made.

**RESULTS.** Sixteen patients (9 male, 7 female), aged from 24 days to 5 years, were found to be infected (15 cases) or highly presumed to be (1 case) with the nH1N1. A severe anterior disease was noted only in 3 cases and 81% of patients were healthy before nH1N1 infection. Direct fluorescent antibody testing had a false negative rate of 43%. The respiratory illness presented were: ARDS: 31.25% of patients, Pneumonia or ALI: 50% patients, atelectasia: 12.5% and bronchoconstriction in 1 case (6.25%). Extra-respiratory illness were especially shock observed in 31.25%. One patient developed a mild rhabdomyolysis and 2 others a moderate elevation of hepatic enzymes. Leucopenia was noted in 43%. 87.5% of patients required mechanical ventilation and 31.25% required inotropic support. Two patients (12.5%) died from multi-organ failure that happened fewer days after an initial ARDS. Median PICU length of stay was 13 days (IQR 25–75: 6–17 days). Comparison of groups of patients with early Oseltamivir treatment (within 48 h of symptoms onset) or late treatment (>48 h) did not show any differences in mortality or duration of PICU stay.

**CONCLUSIONS.** the critical novel H1N1 infection in children seems not to be associated with underlying chronic illness. Alveolar disease are the common respiratory manifestation and is associated with hypoxemic respiratory failure and prolonged mechanical ventilation. Hemodynamic disturbance is frequent. However, the higher rate and severity of the respiratory disease did not result in an increased mortality when compared with seasonal influenza and common bronchiolitis.

## 0765

### SEVERE UPPER AIRWAY OBSTRUCTION IN CHILDREN : REPORT OF 45 CASES

A. Bouziri[1], S. Bel Hadj[1], A. Khaldi[1], K. Menif[1], N. Ben Jaballah[1]

[1]Children's Hospital of Tunis, Tunis, Tunisia

**INTRODUCTION.** Severe upper respiratory airway obstruction in children had several causes and lead frequently to respiratory failure requiring intubation and mechanical ventilation.

**OBJECTIVES.** We aim to describe epidemiological and therapeutic caracteristics of children admitted in a pediatric intensive care unit for upper airway obstruction.

**METHODS.** We conducted a 9 year (1998–2007) retrospective study of the medical records of all children admitted to our pediatric intensive care unit for severe upper respiratory airway obstruction. This diagnosis was retained in every child presenting a respiratory distress caused by the obstruction of the upper airways from nostrils to tracheal bifurcation. Children presenting with airway obstruction complicating intubation were excluded. Demographic and clinical characteristics, cause of airway obstuction, treatment and clinical course were precised.

**RESULTS.** Forty-five children were included (mean age 16.7 ± 19 months). Forty-eight percent of them were aged less than 1 year. The majority of them (93.3%) developed respiratory failure requiring intubation and mechanical ventilation (mean duration = 17 ± 12 days). The obstruction was congenital in 16 patients (35.5%) and acquired in 29 children (64.5%). Acquired causes were dominated by infections (14 patients). Tracheotomy was performed in 6 cases. Surgical treatment was performed in 11 patients. Three patients died (refractory hypoxemia: 2 cases, nosocomial infection: 1 case).

**CONCLUSIONS.** The causes of severe upper respiratory airway obstruction in children are often acquired and dominated by infections. Its management require in the majority of cases admission to the pediatric intensive care unit with intubation and mechanical ventilation.

### 0766

**OPACIFICATION OF HEMITHORAX IN CHEST X-RAY OF INFANTS TREATED AS PNEUMONIA: UNRECOGNIZED ANOMALOUS LEFT CORONARY ARTERY ARISING FROM THE PULMONARY ARTERY (ALCAPA)**

A. Vijayan[1], S. Crowe[2], H. Brotherton[3], R.K. Philip[3]

[1]Mater Misericordiae University Hospital, Anaesthesia and Intensive Care Medicine, Dublin, Ireland, [2]Adelaide and Meath National Children's Hospital, Anaesthesia and Intensive Care Medicine, Dublin, Ireland, [3]University Hospital Limerick, Paediatrics, Limerick, Ireland

**INTRODUCTION.** Anomalous Left coronary artery arising from the Pulmonary artery is a very rare, but serious congenital anomaly. The unilateral homogenous opacity of the hemithorax in the chest X-ray of young infants are commonly of respiratory causes, but rarely could be of cardiac origin.

**OBJECTIVES.** We describe a case series of rare congenital cardiac pathology mimicking severe pneumonia with potential for delayed diagnosis and thus high cardiac morbidity and mortality.

**METHODS.** A retrospective case series from two University centres in Ireland over a 7 year period. Detailed chart review clinical, laboratory and radiological variables.

**RESULTS.**

**CASE. 1** A 5 month old female infant admitted with extensive pneumonia like picture (X-ray chest—white out on the left side), had cardiac arrest later on and never returned to spontaneous cardiac output. Post-mortem revealed a congenital coronary artery anomaly—ALCAPA.

**CASE. 2** 5 month old male infant with extensive pneumonia like picture (X-ray chest—white on left side) and investigations revealed congenital coronary artery anomaly (ALCAPA), which was operated on with good outcome.

**CASE. 3** A 3 month old full term male infant who was treated for repeated bronchiolitis with X-ray chest showing white out of left side had rapid respiratory worsening. Subsequently he was proved to have underlying coronary artery anomaly (ALCAPA), which was operated on and did well. All three cases mimicked extensive lower respiratory tract infections. In case 1 and 2 there were extensive homogenous opacity of the entire hemithorax creating diagnostic difficulties. The case 1 died on reaching cardiac centre, where as case 2 and 3 were operated on with favourable outcome.

**CONCLUSIONS.** ALCAPA is a rare congenital coronary artery anomaly. The incidence of ALCAPA highly variable based on published reports. ALCAPA presenting as opacification of hemithorax on chest X-ray of critically ill infants has not been reported before.

**REFERENCE(S).** 1. Brotherton H, Philip RK. Anomalous Left coronary artery from pulmonary artery in infants: a 5-year review in a defined birth cohort. 1, s.l.: Eur J Paediatr. 2008;167:43–46.
2. Dailey ME, O'Laughlin MP, Smith RJ. Airway compression secondary to left atrial enlargement; increased pulmonary artery pressure. 1, s.l. Int J Pediatr Otorhinolaryngol. 1990; 19:33–44.
3. Kussman BD, Geva T, McGowan FX. Cardiovascular causes of airway compression. 1, s.l. Paediatr Anaesth. 2004;14:60–74.

### 0767

**RSV BRONCHIOLITIS TREATED WITH MECHANICAL VENTILATION: OUTCOME IN A SERIES OF 169 INFANTS**

A. Bouziri[1], A. Hamdi[1], A. Borgi[1], A. Khaldi[1], S. Bel Hadj[1], K. Menif[1], N. Ben Jaballah[1]

[1]Children's Hospital of Tunis, Tunis, Tunisia

**INTRODUCTION.** Respiratory syncitial virus (RSV) bronchiolitis is usually associated with favorable outcome as regard to mortality and morbidity. Only few studies reported severe RSV bronchiolitis requiring mechanical ventilation, and respiratory outcome is not well described.

**OBJECTIVES.** The aim of this study was to determine the outcome and the prognosis factors in infants hospitalized in a pediatric intensive care unit for severe RSV bronchiolitis.

**METHODS.** We conducted a 9 year period (2001–2009) retrospective study in a series of 169 children managed in a single Pediatric Intensive Care Unit (PICU) for severe RSV bronchiolitis requiring mechanical ventilation. Outcome was analysed in terms of length of stay and mortality.

**RESULTS.** At admission, 76.9% of the 169 infants were less than 3 months old. Prematurity at birth, congenital heart disease and antecedents of mechanical ventilation were present in 29.5, 10 and 5% of cases, respectively. Complications were dominated by pulmonary air leak (77.5%) followed by hospital acquired pneumonia (21.3%). Mortality was observed in 12 cases (7.1%). A prolonged length of stay superior to 10 days was observed in 40.2% of cases. In univariate analysis, main factors associated to prolonged length of stay were: congenital heart disease ($p = 0.01$), hypotrophy ($p = 0.02$), antecedents of mechanical ventilation ($p = 0.04$), occurrence of nosocomial infection ($p = 0.000$) and occurrence of pulmonary air leak ($p = 0.015$). Main factors associated to mortality were: occurrence of pulmonary air leak ($p = 0.007$), occurrence of nosocomial infection ($p = 0.001$) and prolonged mechanical ventilation ($p = 0.000$).

**CONCLUSIONS.** RSV bronchiolitis associated with mechanical ventilation is particularly observed in young babies aged less than 3 months. The main factor associated to prolonged length of stay and mortality seems to be the occurrence of complications (nosocomial infection and pulmonary air leak).

## Outcome related to gender, age and obesity: 0768–0781

### 0768

**OBESITY AND OUTCOME IN THE ICU: AN OBSERVATIONAL STUDY**

S. Caroleo[1], O. Bruno[1], D. Vuoto[1], G. Bisurgi[2], M. Pezzi[3], M. Verre[3], B. Amantea[1]

[1]University of Catanzaro, Anesthesia and Reanimation, Catanzaro, Italy, [2]University of Catanzaro, Catanzaro, Italy, [3]Pugliese-Ciaccio Hospital, Anesthesia and Reanimation, Catanzaro, Italy

**INTRODUCTION.** Overweight patients seem to have a poorer outcome and a higher risk of complications during their Intensive Unit Care (ICU) stay [1–4].

**OBJECTIVES.** We conducted a prospective observational study in order to examinate the relationship between Body Mass Index (BMI) with or without Metabolic Syndrome (MetS), ICU lenght of stay (ICU-LOS), duration of mechanical ventilation and mortality among these patients.

**METHODS.**

***DESIGN*:** Prospective observational study.

***SETTING*:** A 10-bed polyvalent ICU.

***PATIENTS*:** All patients hospitalized in the ICU over a period of 1 year and 7 months were included in the study. We divided the studied population into 4 groups by BMI values: group A: BMI between 18.5 and 24.9 ($n = 369$); group B1: BMI between 25 and 39.9 without MetS ($n = 86$); B2 group: BMI between 25 and 39.9 with MetS ($n = 72$); group C: BMI $> 40$ ($n = 42$). Major exclusion criteria were: age $< 18$ years, death or diagnosis of cerebral death within 24 h from ICU admission. Other data collected were demographic and ICU-related data.

***STATISTICS*:** The Chi square test and the variance analysis were used to compare numeric data between groups. Variables that were significantly associated with ICU mortality by univariate analysis were entered in a multiple regression model, allowing the determination of independent predictors.

**RESULTS.** 620 patients were included in the study. These patients had a SOFA score included in an interquartile interval between 8 and 15. Significant differences in ICU-LOS between B1 and B2 subgroups were observed in ICU-LOS ($p < 0.01$), duration of mechanical ventilation ($p < 0.01$) and ICU mortality ($p < 0.01$). Moreover, we found no statistically significant differences in terms of mortality between B2 and C groups, as well as between A and B1 groups (42.34%/45.15% vs. 16.27%/19.07%, respectively). After a multivariate analysis, a BMI $> 25$ associated whit MetS was an independent predictive factor of a lower ICU-LOS and duration of mechanical ventilation and of an higher mortality rate.

**CONCLUSIONS.** In our study a BMI $> 25$ with MetS was significantly associated with an increase in morbidity and mortality in ICU patients.

**REFERENCE(S).** 1. Goulenok C et al. Chest. 2004;125(4):1441–5.
2. Bercault N et al. Crit Care Med. 2004;32(4):998–1003.
3. Nasraway SA et al. Crit Care Med. 2006;34(4):964–70.
4. Tremblay A et al. Chest. 2003;123(4):1202–7.

**GRANT ACKNOWLEDGMENT.** Chiara Longo.

### 0769

**FUNCTIONAL OUTCOME IN PATIENTS AGED 80 OR OVER 6 MONTHS AFTER AN ICU STAY**

C. Magnette[1], I. Michaux[1], S. Bouhon[1], P. Bulpa[1], P. Evrard[1], A.M. Dive[1]

[1]University Hospital UCL Mont-Godinne, Intensive Care Medicine, Yvoir, Belgium

**INTRODUCTION.** The aging process has increased the number of elderly patients admitted in ICU. Few data are available about the functional status of these elderly patients who survive 6 months after ICU admission.

**OBJECTIVES.** We conducted this study to determine and compare functional status of elderly patients before and 6 months after ICU admission.

**METHODS.** After approval from the ethical committee, we performed this prospective observational study. Over a 1-year period, we included all the patients aged 80 or over admitted in our ICU and expected to stay more than 24 h. The functional status was evaluated using the Katz activities of daily living scale (ADLs) [1] and the Lawton–Brody instrumental ADL scale (iADLs) [2]. ADLs consist in 6 self-care tasks: bathing (bath), dressing (dress), toileting (toil), transferring (transf), continence (cont), feeding (feed); 1 point is granted per task executed without help. Interviews of the patients or their relatives took place at ICU admission and 6 months later (phone call). Data are presented as median [interquartile range] and were analysed using Wilcoxon test.

**RESULTS.** Over a 1-year period, 95 elderly patients were recruited. Their ICU length of stay was 3 days [2–4]. Six months after ICU admission, 66 patients were still alive and only 27 patients (41%) had recovered their pre-admission ADLs and iADLs.

**TABLE 1**

| | ICU admission | 6 months | P value |
|---|---|---|---|
| iADLs | 5.5 [4.0–6.0] | 4.0 [2.0–6.0] | 0.0001 |
| ADLs | 6.0 [6.0–6.0] | 6.0 [5.0–6.0] | <0.0001 |
| ADL bath | 1.0 [1.0–1.0] | 1.0 [1.0–1.0] | 0.0156 |
| ADL dress | 1.0 [1.0–1.0] | 1.0 [1.0–1.0] | 0.0068 |
| ADL toil | 1.0 [1.0–1.0] | 1.0 [0.0–1.0] | 0.0020 |
| ADL transf | 1.0 [1.0–1.0] | 1.0 [1.0–1.0] | 0.1250 |
| ADL cont | 1.0 [1.0–1.0] | 1.0 [1.0–1.0] | 0.1094 |
| ADL feed | 1.0 [1.0–1.0] | 1.0 [1.0–1.0] | 1.0000 |

**CONCLUSIONS.** Based on our data, we conclude that 6 months after ICU admission more than the half of the surviving elderly patients do not have recovered their initial functional status. They still need help for bathing, dressing and toileting.

**REFERENCE(S).** 1. Katz et al. (1987) J Am Geriatr Soc. 31:721–727.

2. Lawton et al. (1969) Gerontologist. 9:179–186.

## 0770

### PREDICTORS OF MORTALITY IN PATIENTS ADMITTED TO CRITICAL CARE FOR CANCER

A. Pavon[1], J.-P. Quenot[2], N. Baudouin[1], C. Rabec[1], P. Camus[1]

[1]CHU Dijon, Service de Pneumologie et Réanimation Respiratoire, Dijon, France, [2]University Hospital Dijon, Department of Critical Care, Dijon, France

**INTRODUCTION.** There are no standard procedures for the admission of patients with cancer to critical care.

**OBJECTIVE.** The objective of our study was to identify predictors of mortality in patients suffering from cancer admitted to critical care.

**METHODS.** Single-center, observational study performed between 1 January 2003 and 31 December 2007 in the critical care department of the University Hospital Dijon, France. All patients admitted to critical care and suffering from cancer were eligible for admission. Sociodemographic data, Simplified Acute Physiological Score (SAPS)-II, major organ deficiency, mortality in critical care and in-hospital were collected retrospectively.

**RESULTS.** In total, 137 patients were included. Average age of patients was 64 ± 12 years, median SAPS-II at admission was 32.5. The median length of stay was 8 days. The main types of cancer were: broncho-pulmonary (82.5%), oesophageal (9.2%), ear/nose/throat (5.9%) and prostate (2.4%). The two main histologies were epidermoid carcinoma (40.1%) and adenocarcinoma (23.7%). Among patients with cancer, 83 (54.6%) had metastases. The principal reasons for admission were: acute respiratory insufficiency (n = 52, 34.2%), to undergo rigid bronchoscopy (n = 45, 29.6%), weaning off mechanical ventilation and post-operative care (n = 11, 7.2%), acute cardiac failure (n = 9, 5.9%), hemoptysis (n = 7, 4.6%), acute renal failure (n = 7, 4.6%), sepsis and septic shock (n = 6, 3.9%) and others (n = 15, 10%). In total, 103 (67.7%) patients had respiratory insufficiency, and 37 (24.2%) had failure of at least 2 organs. Non-invasive ventilation was used in 38 (25%) patients, invasive mechanical ventilation in 48 (31.6%), and catecholamines were administered in 23 (15.1%). Mortality rate in critical care was 28.3% (43 patients) and overall in-hospital mortality was 47.4% (72 patients). Multivariate analysis by logistic regression identified the following predictors of death in critical care: use of amines (odds ratio (OR) 6.7, 95% CI 1.7–25.4); invasive ventilation (OR 4.5, 95% CI 1.5–13.2), non-invasive ventilation (OR 3.4, 95% CI 1.27–9.4), failure of 2 or more organs (OR 3.3, 95% CI 1.2–9.1), and SAPS II score (OR 1.1, 95% CI 1.02–1.2).

**CONCLUSION.** Mortality in patients suffering from cancer who are admitted to critical care is mainly influenced by the severity of the initial clinical presentation, rather by the type or stage of cancer. Admission to critical care for such patients should thus be discussed on a case by case basis between oncologists and critical care specialists.

**GRANT ACKNOWLEDGMENT.** No funding to declare.

## 0771

### HOME RETURN PREDICTION MODEL 6 MONTHS AFTER AN INTENSIVE CARE UNIT ADMISSION FOR ELDERLY PATIENTS

M. Conti[1,2], R. Friolet[3], P. Eckert[3], P. Merlani[1,2]

[1]Geneva University Hospitals, Geneva, Switzerland, [2]University of Geneva, Geneva, Switzerland, [3]Centre Hospitalier du Centre du Valais, Hospital of Sion, Sion, Switzerland

**INTRODUCTION.** Home return after critical care is very important to patients and families. To move back home, patients have to fulfill two conditions: survive and have a relatively good functional status. In addition, home return could be considered a low-cost outcome because of the diminished permanent health costs.

**OBJECTIVES.** To determine the factors influencing the home return probability of critically ill elderly patients 6 months after an intensive care unit (ICU) admission.

**METHODS.** We analyzed a cohort of patients aged 65 years or older admitted to an ICU. Demographic and social parameters as well as admission diagnosis, underlying diseases, severity scores, ICU stay parameters and complications were recorded. The final outcome was the place of stay (or death) 180 days after ICU admission. We tried to create a model including only directly and easely avalaible indicators during the hospital and ICU stay.

**RESULTS.** During the inclusion period, among the 1,534 patients admitted in the unit we included 526 patients that were older than 65 years. Among the included patients, 72% were able to return to their home. Among the different variables used to perform a multivariate logistic regression, advanced age (in a non linear way), the length of hospital stay before the ICU admission, the acute illness severity (without age points), the diagnosis category and the complications (especially hemorragic complications and surgical complications) during the ICU stay as well as certain comorbidities, such as the presence of a cardiac pathology or a neoplasias, were independently negatively associated with a home return.

**CONCLUSIONS.** Some interesting factors were identified in this monocenter study. Those factors are easely avalaible and could be considered for a multicenter study to build a universal prediction model for home return. Home return could be used for elderly patients as a surrogate for outcomes that are very important to the elderly but also to health politics.

**GRANT ACKNOWLEDGMENT.** Only departemental sources.

## 0772

### INFLUENCE OF GENDER ON MORBIDITY AND MORTALITY OUTCOMES IN ADULT CARDIAC SURGERY

E. Curiel Balsera[1], V. Olea Jimenez[1], J. Mora Ordoñez[1], M.A. Prieto Palomino[1], M. Alvarez Bueno[1], J.C. Escudero Varela[1], Registro ARIAM Cirugia Cardiaca de Andalucía

[1]Carlos Haya Regional University Hospital, Málaga, Spain

**INTRODUCTION.** There is a great uncertainty regarding the impact ofgender as an independent risk factor for morbidityand mortality following cardiac surgery. Most studies show that women have a higher risk for morbidity and mortality following coronary artery bypass grafting (CABG) procedures than do their male counterparts.

**OBJECTIVES.** To measure the gender impact about morbidity and mortality in ICU from a cohort of patients subjected to cardiac surgery in Andalusian community.

**METHODS.** Multicentre retrospective cohort study from patients subjected to cardiac surgery (CABG or valvular replacement) included in the database ARIAM registry that includes the majority of hospitals with cardiac surgery in Andalusia, from March 2008 until November 2009. We have analyzed according to sex, previous clinical and demographic data, as well as the programmed or urgent character of the surgery, complications during stay in ICU and mortality at discharge from ICU. Quantitative variables are expressed like mean ± standard deviation and qualitative ones as percentages. It has been used the Chi-square test or t-student according to necessity. Multivariate test were performed to identify independent predictor of morbidity and mortality.

**RESULTS.** 2,453 patients (56% men) were analyzed. Surgery was programmed in 88.46%. Some data is shown on Table 1:

**TABLE 1** PREVIOUS MORBIDITY ACORDING TO GENDER

| | Male | Female | P value |
|---|---|---|---|
| No previous cardiovascular disease | 7.8% (115) | 15.2% (145) | 0.0001 |
| Smokers | 24.4% (361) | 5.8% (55) | 0.0001 |
| Diabetes | 31.3% (463) | 32.4% (309) | NS |
| Dislipidemia | 47.5% (702) | 41.5% (396) | 0.004 |
| Hypertension | 59% (871) | 63% (601) | 0.047 |
| Myocardial infarction | 21.5% (301) | 8.5% (78) | 0.0001 |
| Heart failure | 35.1% (493) | 55% (505) | 0.0001 |

Mean age was higher in women than in men (65.23 ± 12 vs. 61.54 ± 12.9, p = 0.0001). Rate of mortality was of 8.2 and 58% suffered some complication, being most frequent: renal failure 29.1%, pleural effusion 19.5%, >1 l bleeding 18.7% and shock 11.8%. In univariate analysis, we found more global complications in women OR 1.38 IC95%, (1.14–1.67) p = 0.001, as well as higher mortality, OR 1.5 IC95% p = 0 (1.12–2),006. After adjusting for age, type of surgery and comorbidities, gender was not shown as an independent predictor of mortality p = 0.28 OR 1.23 IC95%, (0.84–1.8) neither of morbidity p = 0.66 OR 1,056 IC95% (0.82–1.35).

**CONCLUSIONS.** In our serie, gender was not shown as an independent predictor of mortality or morbidity when other risk factors are adjusted.

**GRANT ACKNOWLEDGMENT.** To health counseling of Andalusian Board for the financial support for the maintenance of the registry.

## 0773

### LONG-TERM SURVIVAL AND QUALITY OF LIFE IN PATIENTS AGED 80 OR OVER FOLLOWING ADMISSION TO A MEDICAL INTENSIVE CARE UNIT

A. Roch[1], S. Wiramus[1], V. Pauly[2], J.-M. Forel[1], C. Guervilly[1], M. Gainnier[1], L. Papazian[1]

[1]Hôpitaux Sud, Réanimation Médicale, Marseille, France, [2]Hôpitaux Sud, Information Médicale, Marseille, France

**OBJECTIVES.** To evaluate: factors influencing short- and long-term survival in medical patients aged 80 and over following admission to an intensive care unit; and health-related quality of life in hospital survivors.

**METHODS.** All patients aged 80 years or over and admitted between 2001 and 2006 were included in this study. Survival was evaluated between the time of admission and June 2009; factors associated with mortality were determined. Health-related quality of life was evaluated using Short Form (SF)-36 in long-term survivors and retrospectively by proxy respondents in non-survivors.

**RESULTS.** For the 299 patients included (mean age, 84 ± 4 year), hospital mortality was 55%. In the 133 hospital survivors, median survival time was 710 days (IC 95%, 499–921). Two-year mortality in hospital survivors was 53%, whereas for the same age-group in the general population it was 18%. Mortality at the hospital and within 2 years of discharge was influenced by the severity of illness at admission, but not by functional status prior to admission. SF-36 questionnaires were completed by 24 long-term survivors and by proxy respondents for 55 non-survivors at the time of evaluation. Physical function scores in both categories were poor when compared with reference populations; but scores for pain, emotional well-being and social function were similar.

**CONCLUSIONS.** The severity of acute disease at admission influences mortality at the hospital and following discharge in patients aged 80 or over. Although up to 50% of patients discharged from the hospital were still alive at 2 years, their physical function was greatly altered.

## 0774

### SURVIVING INTENSIVE CARE… ONLY TO DIE ON THE WARD? A REVIEW OF FACTORS CONTRIBUTING TO POST-ICU HOSPITAL MORTALITY IN A UK TEACHING HOSPITAL

L. Garcia[1], D. Monkhouse[1]

[1]The James Cook University Hospital, Critical Care Directorate, Middlesbrough, UK

**INTRODUCTION.** Mortality rates after discharge from intensive care have been reported to range from 6.1 to 27% (1). In The James Cook University Hospital, Middlesbrough, UK, there has been a progressive improvement in ICU mortality for the last 10 years. However, there has been little improvement in post-ICU mortality. There are many recognised determinants of death post ICU discharge, notably advanced age, poor chronic health status, prolonged severity of illness, premature and out of hours discharges (2).

**OBJECTIVES.** The objectives were to investigate the factors contributing to death post-ICU discharge and modify our discharge strategies to minimise patient risk.

**METHODS.** A systematic review of all patients who died in hospital after ICU discharge over a 6 month period was performed. 33 discharge episodes were identified from the Ward Watcher database. Reviewers performed a detailed examination of the patients' case notes. Data collected included demographic details, ICU length of stay, maximum number of organs supported, APACHE II scores, timing of discharge, presence of Do Not Attempt Resuscitation orders, end of life care pathways and follow-up arrangements.

**RESULTS.** 33 ICU discharge episodes culminated in death in hospital. However, 4 patients had multiple admissions to ICU. 26 deaths were identified and 20 sets of notes were retrieved.The average age of patients dying in hospital post-ICU was 70 years. The average length of stay in ICU prior to discharge was 6.7 days with an average of 2.5 organs supported. 30% patients were discharged out-of hours and only 40% of patients were discharged to a high dependency facility. 20% had an end of life care plan in place. 55% of patients had a DNAR order instituted prior to discharge.Follow up visits were performed in only 35% of patients discharged. When clinical deterioration occurred, prompt senior medical review occurred in all cases.

**CONCLUSIONS.** Reasons for high post-ICU mortality appear multi-factorial. The number of unplanned discharges remains unacceptably high. This reflects pressure on critical care beds in our institution where ICU occupancy rates are in excess of 90%. The availability of HDU beds is likely to be a key determinant of discharge location. Daily follow-up may help reduce complications in patients who survive ICU. Readmission rates also remain unacceptably high. There were no major causes for concern regarding ward management post-ICU discharge in this cohort of patients. However, we acknowledge that this small sample may not reflect problems with failure to recognise clinical deterioration on the general wards.

**REFERENCE(S).** 1. Azoulay E, Adrie C, De Lassence A et al. Determinants of post-intensive care unit mortality: A prospective multicenter study. Crit Care Med. 2003;31:428–32.

2. Campbell AJ, Cook JA, Adey G et al. Predicting death and readmission after intensive care discharge. Br J Anaesthesia. 2008;100:656–62.

## 0775

### SURVIVING INTENSIVE CARE: DOES AGE MATTER?

C. Silva[1], E. Nandja[1], J. Resende[1], A. Oliveira[2], P. Fernandes[3], A. Marques[3], P. Castelões[3]

[1]Centro Hospitalar de Vila Nova de Gaia/Espinho, Vila Nova de Gaia, Portugal, [2]Centro Hospitalar de Vila Nova de Gaia/Espinho, Serviço de Medicina Interna, Vila Nova de Gaia, Portugal, [3]Centro Hospitalar de Vila Nova de Gaia/Espinho, Unidade de Cuidados Intensivos Polivalente, Vila Nova de Gaia, Portugal

**INTRODUCTION.** Elderly intensive care unit (ICU) patient admissions were substantially increased in last years. Advanced age is associated with higher mortality and adverse outcomes in ICU. However, some studies, showed that is not age per se, that determinates prognosis, but other factors such as comorbilities and previous functional status before hospitalizations could be more important.

**OBJECTIVES.** The aim of our study is to avaliate if elderly ICU patients admission is correlated with adverse outcomes in ICU.

**METHODS.** In this retrospective study, we analyzed 618 patients admitted to the ICU in the years 2008–2009, and establish 2 groups for comparison: one with the patients under 65 years, and other with ≥65. Data collected included gender, age, type of admission, SAPS II, APACHE II, length of hospitalization, tracheostomy and outcome at discharge from the ICU.

**RESULTS.** The number of patients admitted with ≥65 years accounted for 50% of total admissions, with male predominance on both groups. The cause of hospitalization in the group of patients ≥65 years was medical (62.6%) while in the other group this cause accounts with 50.3% of patients (p value = 0.002). The average length of hospitalization was similar in the two groups (8.8 and 9.6 days for patients with <65 and ≥65 years, respectively), but the elderly group presents higher severity scores, with a mean APACHE II score of 15.5, SAPS II average of 37. 5 (population <65 years had respectively 11.6 and 27.0) and a higher mortality rate (24.8 vs. 14%, p value = 0.001).

In the group ≥65 years tracheostomies were performed in 9.4% of patient (comparative in population <65 years is 5.2%), and were mainly caused by the difficulty in weaning (76%).

**CONCLUSIONS.** The elderly population accounts for 50% of admissions and presents scores of higher severity but hospitalization with overlapping times. It was found that the "outcome" of the elderly population with regard to mortality and morbidity imposed by the necessity of tracheostomy is higher than the younger population.

**REFERENCE(S).** Yu W et al. ICU use and mortality in the elderly. J Gen Intern Med. 2000;15:97–102.

Rooij S et al. Factors that predict outcome of intensive care treatment in very elderly patients: a review. Crit Care 2005;9:R307–14.

## 0776

### EPIDEMIOLOGY AND CLINICAL OUTCOMES OF OCTOGENARIAN PATIENTS IN AN INTENSIVE CARE UNIT FROM A DEVELOPING COUNTRY

M. Granados[1], M. Badiel[2], G. Ospina-Tascon[1], M. Gomez[1], C. Ordoñez[1], F. Rosso[3]

[1]Fundacion Valle del Lili, Intensive Care Unit, Cali, Colombia, [2]Fundacion Valle del Lili, Clinical Research Institute, Cali, Colombia, [3]Fundacion Valle del Lili, Infectious Diseases Service, Cali, Colombia

**INTRODUCTION.** The population proportion of elderly patients has increased around the world wide. Aged patients have a greater chance of requiring critical care but advanced age is a risk associated for ICU death. Limited resources and high costs of critical care needs to identify patients who achieved positive outcomes. It is not clear whether restriction of intensive care opportunities should be based on age.

**OBJECTIVES.** The aim of this study was to describe the characteristics of critically ill octogenarian patients and to evaluate their clinical outcomes

**METHODS.** All patients >80-year admitted to a 40 beds medical-surgical ICU in a University-Affiliated Hospital during the last 10-years were selected. Patients admitted between January 2000 and December 2004 (Period 1, P1) were compared with patients admitted between January 2005 and December 2009 (Period 2, P2). Bivariate and standardized mortality ratio (SMR) analyses were performed.

**RESULTS.** We included patients >80-year, 883/11.607 (7.6%) admissions during P1 and 998/10.215 (9.8%) for P2. APACHE-II mean were 13.5 ± 5.9 versus 16.2 ± 6.2 for P1 and P2, respectively ($p < 0.001$). Mechanical ventilation was similar in both groups (30.3 vs. 31.3%, $p = 0.7$). However, some invasive interventions were lower during P1: central venous catheter, 12.7 versus 25.8% ($p < 0.001$) and intra arterial lines, 25.4 versus 51% ($p < 0.001$), while use of pulmonary artery catheter decreased (11.8 vs. 8.3%, $p = 0.007$). Length of stay (LOS) was lower during P1 (3 vs. 4, $p = 0.06$). Mortality Rate Standardized by APACHE-II was higher for P1 patients: 14.6% (CI 95%, 13.9–15.3) versus 8.5% (CI 95%, 7.99–8.95), $p = 0.0003$.

**CONCLUSIONS.** ICU admissions for Octogenarian patients are becoming more common. Even though a higher severity during the second period was found, mortality rates were significantly lower. Access restrictions to ICU care should not be based on advanced age.

**REFERENCE(S).** 1. Lerolle N, Trinquart L, Bornstain C et al.: Increased intensity of treatment and decreased mortality in elderly patients in an intensive care unit over a decade. Crit Care Med. 2010;38:59–64

2. Garrouste-Orgeas M, Boumendil A, Pateron D et al. Selection of intensive care unit admission criteria for patients aged 80 years and over and compliance of emergency and intensive care unit physicians with the selected criteria: An observational, multicenter, prospective study. Crit Care Med. 2009;37:2919–28
3. Boumendil A, Somme D, Garrouste-Orgeas M et al. Should elderly patients be admitted to the intensive care unit? Intensive Care Med 2007; 33:1252–62
4. Garrouste-Orgeas M, Timsit JF, Montuclard L et al. Decision-making process, outcome, and 1-year quality of life of octogenarians referred for intensive care unit admission. Intensive Care Med 2006;32:1045–51

**GRANT ACKNOWLEDGMENT.** Funded Fundacion Valle del Lili-Clinical Research Institute.

## 0777

### IMPACT OF OBESITY IN THE OUTCOME OF INTENSIVE CARE PATIENTS

A. Martins[1], I. Asseiceira[1], A. Raposo[1], R. Mendes[1], L. Bento[1]

[1]Hospital São José, Unidade Urgência Médica, Amora, Portugal

**INTRODUCTION.** In general population, obesity is related with increased morbidity and mortality. Nearly one-third of intensive care patients are obese, thus, understanding the consequences of obesity on critical illness has great public health importance.

**OBJECTIVES.** The aim of the study was to assess the impact of overweight and obesity in the outcome of a critically ill patient.

**METHODS.** Our study included 130 patients admitted in the intensive care unit of a Portuguese hospital. In order to make the assessment it was used demographic data, *Acute Physiology and Chronic Health Evaluation* II (APACHE II), weight, height, body mass index (BMI), days of mechanical ventilation, nosocomial infections incidence and ICU mortality. The data was collected for each patient during their stay in the ICU. BMI was used to characterize nutritional state, allowing the classification in normal weight, overweight and obesity.

**RESULTS.** We enrolled 84 (64.4%) male patients and 46 (35.6%) female patients with a mean age of 61.6 ± 18.7 years. Thirty-nine percent (n = 51) were normal weight, 38% (n = 49) were overweight and 17% (n = 22) were obese. As for the patients with normal weight, the mean APACHE II was 19.9 ± 8.2, the length of stay was of 14.5 days, the mean number of mechanical ventilation was of 11.0 days, the incidence of nosocomial infection was of 31.4% and mortality in the ICU was of 17.6%. In the overweight patients the mean APACHE II was 21.1 ± 7.8, the mean length of stay was of 14.6 days, the mean mechanical ventilation days was of 8.8 days, the incidence of nosocomial infection was of 22.4% and the ICU mortality was of 18.4%. As for the obese patients, their mean APACHE II was 21.6 ± 7.3, the mean length of stay was of 6.8 days, the mean mechanical ventilation days was of 12.7 days, the incidence of nosocomial infection was of 27.3% and ICU mortality was of 27.3%. In our study we did not verify statistic significance in the different groups when comparing APACHE II score, mechanical ventilation days, length of stay, and incidence of nosocomial infections or ICU mortality.

**CONCLUSIONS.** Obesity is not related with the number of days of mechanical ventilation, prolonged length of stay or ICU mortality. On the present study we did not verify a relationship between obesity and the outcome in critical care patients.

**REFERENCE(S).** 1. Akinnusi M, Pineda L, El Solh A. Effect of obesity on intensive care morbidity and mortality: a meta-analysis. Crit Care Med. 2008;36:151–8.

2. Oliveros H, Villamor E. Obesity and mortality in critically ill adults: a systematic review and meta-analysis. Obesity 2008;16:515–21.
3. Flegal K, Graubard B, Williamson D, Gail M. Excess deaths associated with underweight, overweight, and obesity. J Am Med Assoc 2005;293:1861–7.

**GRANT ACKNOWLEDGMENT.** We are most grateful to the coordinator of Unidade de Urgência Médica, Dr. Luís Bento, for all the support.

## 0778

### ONE YEAR MORTALITY AND RISK FACTORS IN ELDERLY PATIENTS ADMITTED IN AN ONCOLOGIC SURGICAL ICU. DATA FROM PRELIMINARY STUDY

G.L. Spano[1], F. Comin[1], A. Pinna[1], S. Gandini[2], D. Sances[1]

[1]European Institute of Oncology, Division of Anesthesiology and Intensive Care, Milan, Italy, [2]European Institute of Oncology, Division of Epidemiology and Biostat, Milan, Italy

**INTRODUCTION.** The proportion of elderly patients operated for cancer and admitted in ICU is increasing in these years.Few studies are available about mortality and possible factors that predict post surgical outcome on elderly oncologic patients.

**OBJECTIVES.** To define over 80 year patients' surviving rate 1 year after oncologic post - surgical ICU admission, and to identify factors associated to mortality.

**METHODS.** We performed a retrospective study of 59 patients, aged 80 years or older, admitted to the post oncologic surgical ICU between January and December 2008. Median Age 83.5. Males/Females 35/24. ASA2/ASA3: 31/28.Urologicalcancer 6.Abdominal 28.Lung 13.Head and neck 5.Gynecological 3.Other 4.We evaluated the mortality rate after 1 year. We have also investigated the association with age, ASA status, type of malignancy and concomitant patologies.

**RESULTS.** We contacted 59 patients or their relatives (35 males–24 females) admitted in our oncologic postsurgical ICU. Median age was 83.5 year. Mortality rate founded after 1 year was16%.We did not find significant association between age and mortality (survivors' median age 83.12 vs. non survivors' median age83.88) $P = 0.62$. There was also no significant association between ASA status and mortality: mortality for ASA 2 status was 6% versus ASA 3 mortality of 15%: ($P = 0.29$). Mortality rate for pulmonary cancer was 31% whereas mortality rate for urological cancer was 34%. A borderline significant association was found comparing lung cancer versus other cancer sites ($P = 0.09$).

**CONCLUSIONS.** Life expectancy continues to increase in western countries and this is associated with a growing request of ICU admission after oncological surgery. Few studies have been conducted to investigate mortality rates in octogenarians after 1 year from their discharging from ICU. As reported in a well conducted review [1] we found that age seems to be not an independent predictor of mortality. Comorbidity is commonly present in elderly patients but no studies reported correlations on outcome [2], in our study we did not find any significant correspondence between pre-existing ASA status and mortality.On the other hand we have seen in our population a weak association between lung cancer and mortality. Nowadays there are still not validated scores to predict outcomes for the octogenarians and older oncological patients. More studies are needed to find tools able to improve outcome of frail patients.

**REFERENCE(S).** 1. de Rooij SE et al. Crit Care 2005;9(4):R307–14.

2. Johnston JA et al. Med Care 2002;40:929–40.

## 0779

### A TEN YEAR SURVEY OF INTENSIVE CARE PROVISION FOR THE OVER 80S (81–90 YEARS)

T. Lawson[1], C. Ferguson[1]

[1]Derriford Hospital, Department of Intensive Care Medicine, Plymouth, UK

**INTRODUCTION.** There is universal concern about the growth of the elderly population and the demands that it may make of health care provision including Intensive Care. Recent work [1] suggested that admission rates of very old patients (80 years or older) increased by 5.6% per year,translating into a 72.4% increase in demand by 2015.

**OBJECTIVES.** We were interested to discover whether retrospective analysis of our own database replicated these findings and their implications.

**METHODS.** We extracted anonymised information from our clinical database for deciles of age for the 10 calendar years from 2000 to 2009 concerning topics of interest.

**RESULTS.** Our Intensive Care unit provides high dependency and intensive care for medical and surgical patients including neurosurgery.There were 13,200 admissions,from 0 to 103 years, over 10 years,54% of which were surgical. 56 patients of 91 years or above were admitted in 10 years.They were excluded from further analysis as a group since they were considered an insignificant proportion.The overall crude ICU mortality was 16.9% and the hospital mortality 25.4%.

For patients aged 81–90,admissions per annum ranged from 111 to 142 (7.5 to 10.92 of all admissions) with no clear increase over time-numbers were identical in 2000 and 2006.The average APACHE II score for the 10 years varied from 15.4 to 17.0. 13.5–27% (15–34) of patients aged 81–90 received NIPPV, 10.6–17.3 of all NIPPV. 32.9–38.4% (38–53) of patients aged 81–90 received IPPV, 6.8–8.2% of all who received IPPV. 0–5.1% (0–7) of patients aged 81–90 received CAVH, 0–11.1% of all haemofiltration. Mean ICU stay ranged from2.3 to 4.7 days and hospital stay from 10.9 to 21.4 days for patients of 81–90 in different years.ICU mortality ranged from 22.1 to 33.1% and hospital mortality from 33.5 to 48.6%.There were no clear changes over time.

**CONCLUSIONS.** We could find no evidence in our practice of a steady increase in demand for Intensive Care from patients aged 81–90 over the 10 years from January 2000 to December 2009.Approximately similar numbers and proportions presented and received similar treatment over the 10 year period.In the light of the high hospital mortality, the absence of any information on patient morbidity and long term outcome makes judgements of the value of Intensive Care to patients of 81–90 years of age difficult.

**REFERENCE(S).** Bagshaw S et al. Critical Care 2009;13:R45

## 0780

### QUALITY OF LIFE IN PATIENTS OLDER THAN 75 AFTER ICU DISCHARGE

D. Machado[1], E. Guerreiro[1], A. Amaro[1], C. Granja[1]

[1]Pedro Hispano Hospital, Emergency and Intensive Care Department, Matosinhos, Portugal

**INTRODUCTION.** The human lifespan is increasing across the world. Elderly patients represent a growing amount of ICU admissions.

**OBJECTIVES.** Our objective was to evaluate quality of life 6 months after ICU discharge of patients aged 75 years or over.

**METHODS.** Retrospective analysis of all patients aged 75 or over, alive after ICU discharge in the period of April 2004 to June 2009. Patients elected to follow-up consult have more than 48 h of ICU stay, and belong to hospital geographic area. At 6 months after discharge, EQ-5D instrument was applied. EQ-5D includes the report problems in five dimensions (mobility, self care, usual activities, pain/disconfort and anxiety/depression) a visual analogue scale (EQ VAS) and enables the calculation of an index.

**RESULTS.** Patients older than 75 years were 23.8% of the total admitted in this period. Mean age was 80 ± 4 years (range 75–101); at admission, the mean SAPS II score was 48.8 ± 16.31; 65 patients were admitted less than 48 h in the ICU; 29% was the ICU mortality and 211 consecutive patients aged 75 or over were alive at ICU discharge. Total hospital mortality was 45.4%. 38 patients were transferred to residency hospital and 28 were lost to follow-up. At 6 weeks consult two patients have died and six patients at 6 months. The response rate to EQ-5D was 50%. Quality of life evaluations after 6 month showed significantly more problems on mobility; self care, usual activities and pain/disconfort. 39% answered that their quality of life was worse after ICU admission.

**CONCLUSIONS.** Analysis of this subgroup of ICU patients is important because they have increasingly importance in the number of the ICU admissions. It is more difficult to see these patients in the follow-up because they have a higher morbid-mortality rate. This is a retrospective study of a single ICU. Among patients aged 75 or over who were selected to ICU admission, survivors reported significantly more problems only on the physical dimensions. These findings should encourage the admission of elderly patients in the ICU, however the results must be interpreted cautiously due to the small sample of survivors. Some of the conclusions should also be considered after adjustment to a sample of the general population matched on age.

## 0781

### SEX DIFFERENCES IN-HOSPITAL MORTALITY AFTER ACUTE CORONARY SYNDROME

L. Olivencia Peña[1], A. Fernández Carmona[1], J.M. Soto Blanco[1], A. Rayo Bonor[1], A. Bueno Cabanillas[1]

[1]H U San Cecilio, Granada, Spain

**INTRODUCTION.** Gender-related differences in the diagnosis and treatment of acute coronary syndromes (ACS) have important healthcare Implications. Although advances in the diagnosis and treatment of ACS have resulted in a decrease in coronary heart disease mortality during the course of the last decade among men, but not among women.

**OBJECTIVES.** The aim of this study was to determine the influence of gender in hospital outcome in patients with ACS.

**METHODS.** Prospective study of a cohort of patients consecutively admitted to the Coronary Unit of a secondary hospital in the period of 18 months with diagnoses of acute coronary syndrome, both ST elevation and non-ST elevation ACS. Consecutive sample of 396 patients with ACS divided into two groups based on sex: 294 men and 102 women. This groups were also divided into four subgroups based on the diagnosis/clinical presentation: 159 men with a ST elevation myocardial infarction (STEMI), 40 women with a STEMI, 135 men with a non-ST elevation ACS, 62 women with a non-ST elevation ACS. We analyzed the baseline clinical-demographic characteristics, coronary reperfusion, extension of the coronary disease, appearance of heart failure (HF), in-hospital mortality and predictors of mortality in a multivariate model.

**RESULTS.** The women were older (70.92 ± 11.92 vs. 64.48 ± 12.06; $p < 0.001$) and had more comorbidities such as hypertension (70.59 vs. 53.74%; $p = 0.003$) and diabetes (51 vs. 33.33%; $p = 0.003$) than men, while men had greater frequency of smoking (54.42 vs. 13.73%; $p < 0.001$). There were no differences in the presence of hyperlipidemia, previous coronary heart disease and renal disease. Women were less likely to have ST segment elevation (39 vs. 54% for men; $p = 0.010$). Women had a higher incidence of cardiogenic shock (Killip IV) on admission after STEMI. There were no differences in the thrombolysis in patients with STEMI. Women, after adjustment for baseline differences, did not have a different pattern of access to coronary angiography (in both ST elevation and non-ST elevation ACS), but men had greater frequency of percutaneous coronary revascularization (50.87 vs. 34.65%; $p < 0.010$). Normal coronary arteries were much more common in women (20 vs. 5.6% in men; $p = 0.001$). Women were more likely to develop a higher in-hospital HF (32, 67 vs. 25, 94%; $p < 0.05$) and in-hospital mortality (17.64 vs. 4.78%; $p < 0.001$). Mortality at 1 year were similar for women and men (40.48 vs. 33.21%; $p = 0.221$). In the multivariate analyses, female sex and older age continued to be predictors of in-hospital mortality (odds ratios 3.04 and 1.05).

**CONCLUSIONS.** In our study, female gender was an independent predictor of in-hospital mortality in patients with acute coronary syndrome.

**REFERENCE(S).** Gender Disparities in the Diagnosis and Treatment of Non-ST-Segment Elevation ACS. JACC 2005;45(6):832–7.

# ICU organization: 0782–0795

## 0782

### A GOVERNMENT POLICY FOR REORGANIZATION OF INTENSIVE CARE UNIT IN PUBLIC HOSPITALS IN THE STATE OF RIO DE JANEIRO- BRAZIL

R. Goldwasser[1,2], C.M. David[3], A. Fonseca[1], Câmara Técnica de Terapia Intensiva da SESDEC

[1]Secretaria Estadual de Saude e Defesa Civil, Rio de Janeiro, Brazil, [2]Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil, [3]Universidade Federal do Rio de Janeiro, Pós Graduação-Departamento de Clínica Médica, Rio de Janeiro, Brazil

**INTRODUCTION.** Improving the outcome of critically ill patients remains an ideal that every practicing intensivist strives to achieve (The Vienna Declaration). Intensive care units (ICUs) comprise up to 10% of all hospital beds and consume as much as 34% of hospital resources. Planning and distribution of adequate resources for intensive care should be made at a national or state level for guarantee patient safety.

**OBJECTIVES.** The aim of this study is to document the actions taken for the reorganization of intensive care in the last 2 years by the Health Department in the state of Rio de Janeiro.

**METHODS.** A retrospective assessment of actions taken by the Health Department of Rio de Janeiro, in the last 2 years, related to intensive care, in 6 major emergency hospitals (level III) and 4 district hospitals (level II). The historical data of productivity before interventions were reviewed, and compared with actual results. Interventions: (1) resizing and rebuilding ICUs settings following the technical standards of the Brazilian's Health Ministry recommendation; (2) acquisition of new equipments; (3) staff recruitment and training conducted in partnership with the society of intensive care medicine of Rio de Janeiro; (4) establishment of a regulatory policy for allocation of ICU patients based on guidelines (5) organization of a leadership board of intensive care physicians to ensure policies implementation(6) review and standardization of supplies and medications (both quantitative and qualitative) to meet the need of the entire network of ICUs.

**RESULTS.** From January to December 2007 there were 1110 patients admitted to 109 ICU beds (0.85 patients/bed/month). From January 2008 to December 2009 there was an increase of 107 (98%) ICU's beds. During 2009 there were 4601(414%) patients' admissions (1.77 patients/bed/month), $p < 0.00001$. Odds ratio: 2.59; IC95%: 2.06–3.24.

**CONCLUSIONS.** The set of interventions promoted improvement in critical ill patients' care in the State of Rio de Janeiro. It was observed not only the expanding capacities, but, rather, a better use of the resources. It is important to focus on these high-cost areas and reassess the best approach to improving patient care outcomes in the most cost-effective way.

**REFERENCE(S).** Tinker J, Browne DRG, Sibbald W (Eds). Critical Care. Standards, Audit and Ethics. 1996, Arnold Publishing Company, London

**GRANT ACKNOWLEDGMENT.** Secretaria Estadual de Saude e Defesa Civil do Estado do Rio de Janeiro

## 0783

### AUDIT ON REFFERRAL TO INTENSIVE CARE UNIT A DGH EXPERIENCE

C. Chacko[1,2], R. Hirst[3], C. Stenhouse[3]

[1]Burton Hospital Foundation Trust, Burton-on-Trent, UK, [2]Stoke School of Anesthesia, Stoke-on-Trent, UK, [3]Burton Hospital NHS Trust, Department of Anaesthesia, Burton-on-Trent, UK

**INTRODUCTION.** Experience of the intensive care unit team in our hospital suggested an increase in the number of referrals to the unit. The increase in workload for the unit doctors due to the high percentage of inappropriate referrals compromises the quality of patient care for patients in the unit. We would like to report the result of an audit conducted over a 6 week period to assess the referrals made to the unit.

**OBJECTIVES.** The audit was aimed to assess the referrals made to intensive care unit and analyses the data to refine the referral system to the unit to ensure a more efficient working of the unit.

**METHODS.** Prospective audit on unplanned referrals to the unit over 6 weeks. The following data was collected the date/time of referrals/speciality referring/the medical personal referring/whether the referring consultant was informed about the referral/the time when the patient was last reviewed by a consultant/Approprateness of refferral. Inappropriateness was decided on the criteria's of futility of treatment/associated co-morbidities/poor physiological reserves.

**RESULTS.** A total of 54 cases were audited in this time period 28(51.85%) were appropriate while 26 (48.14%)were inappropraiate.The speciality referring were 28 by medicine, 12 by general surgery, 2 by orthopaedics,3 by outreach and 5 others. Our analyses of data showed that of the 26 cases that was deemed inappropriate because in seven (26.9%) patients it was thought treatment would be to futile, seven(26.9%) patients due to their associated co morbidities, and 12 (46.15%) was because of other reasons. The other reasons were mainly in nine cases because maximal ward therapy was not reached, two Coronary Care Unit was the more appropriate one because surgical treatment was more appropriate.

COMPARISON OF DATA ON CONSULTANT WAS INFORMED

| | Inappropriate | Consultant not Informed |
|---|---|---|
| Total 54 | 26 | 29 (52.72) |
| Inappropriate referral. | 26 | 18 (69.23%) |

COMPARISON OF TIMES OF REFERRAL

| Time | Between 8:00–20:30 | Between 20:30–8:00 |
|---|---|---|
| Total Refferals | 25 (46.29%) | 29 (53.7%) |
| Inappropriate referrals | 8 (30.78%) | 18 (69.23%) |

**CONCLUSIONS.** This audit shows a high percentage of inappropriate referrals were made to the unit 26 (48.14%) of 54 cases. The high numbers of referrals made during out of hours. The average time spend on intensive care unit review is 38.8 min (1).This would mean that will be out of the unit for about 11.55 h in a period of 6 weeks dealing with inappropriate workload. The proportion of inappropriate referrals made to the unit which was not discussed with the consultant washigher than average. Therfore a consultant to consultant referral system would reduce the number of inappropriate referrals. This would provide more efficient and safe care to the intensive care unit patients.

**REFERENCE(S).** 1. Analysis of critical care referrals M Dallison, H Jones and P Matthews Morriston Hospital, Swansea, UK, Critical Care 2010;14(Suppl 1)

**GRANT ACKNOWLEDGMENT.** Queens Hospital Burton

## 0784

### LACK OF RELATIONSHIP BETWEEN ICU VOLUME AND SURVIVAL: A SPANISH PROSPECTIVE MULTICENTRE STUDY

R. Fernandez[1,2], A. Tizon[1], J. Gonzalez[1], P. Monedero[1], M. Garcia-Sanchez[1], M. De la Torre[1], P. Ibañez[1], F. Frutos[1], F. Del Nogal[1], M. Gomez[1], A. Marcos[1], V. Gomez-Tello[1], Sabadell Score Group

[1]Fundacio Althaia, Manresa, Spain, [2]CIBERES, Madrid, Spain

**INTRODUCTION.** There is an accepted relationship between hospital volume and survival in some conditions, related to the "practice makes perfect" concept. This concept logically applies to technically demanding cases and is especially relevant in the context of a shortage of specialists; however, healthcare systems like the Spanish one based on wide coverage of intensivists may perform differently.

**OBJECTIVES.** To determine whether ICU volume and survival correlate in the Spanish healthcare system.

**METHODS.** Prospective survey of all patients admitted to 31 ICUs during the 3-month period in which data were collected for the validation of the Sabadell Score. At ICU discharge, we recorded demographic variables, severity score, and specific ICU treatments. Follow-up variables included ICU readmission and hospital survival. Statistics: Univariate and multivariate analyses for hospital mortality. Simple linear correlation between observed/predicted mortality and volume of cases.

**RESULTS.** We admitted 4001 patients (mean age, 61 ± 17 year; mean risk of death, 23% (range: 14–46%). Observed hospital mortality was 19% (range: 11–35%), resulting in a ratio observed/predicted (SMR) mortality of 0.81 (range: 0.5–1.35). Among patients needing mechanical ventilation (n = 1923, 48% of the total), the predicted risk of death was 32% (range: 14–60%) and observed hospital mortality was 30% (range: 12–61%), resulting in an SMR of 0.96 (range: 0.5–1.7). We found no correlation between SMR and ICU volume in the whole population or in the group of patients under mechanical ventilation.

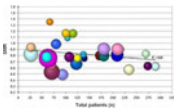


Figure 1

**CONCLUSIONS.** We confirm the wide variability in outcome among hospitals even after adjusting for severity, but found no relationship between ICU volume and outcome. The universal intensivist coverage in our healthcare system may explain these results.

## 0785

### DEPRIVATION INDEX DOES NOT INFLUENCE THE DECISION TO DISCHARGE OR WITHDRAW TREATMENT FROM PATIENTS IN THE ICU

T. Whitehouse[1], S. Damery[2], M. Afzal[3], I. Mackenzie[1], B. Tunnicliffe[1], D. Ray[3], D. Rosser[4]

[1]University Hospital Birmingham, Department of Anaesthesia and Critical Care, Birmingham, UK, [2]University of Birmingham, Department of Primary Care Clinical Sciences, Birmingham, UK, [3]University Hospital Birmingham, Department of Informatics, Birmingham, UK, [4]University Hospital Birmingham, Trust Headquarters, Birmingham, UK

**INTRODUCTION.** Studies examining social status and mortality matched APACHE with outcome. Welch reported data from a UK national database (ICNARC) suggesting increased mortality with increasing deprivation in general ICU [1] and elective surgery [2]. Latour [3] explained his findings of excess mortality in the socially disadvantaged because they were sicker. Triggers for ICU admission are beyond the control of the intensivist. In order to assess social prejudice *within the ICU itself*, we examined SOFA scores on discharge or death as unlike APACHE scoring, SOFA provides 'sickness' data throughout a patients ICU stay.

**OBJECTIVES.** To examine whether prejudice exists in our ICU by testing whether patients from poorer backgrounds have different SOFA scores upon discharge or death.

**METHODS.** We examined 9,740 admissions (>3 days) between April 2000 and August 2009. In addition to admission and discharge SOFA, we examined age, sex, LOS, admission type (elective, emergency or transfer). The Carstairs index is a measure of social deprivation divided by postcode. For ease of analysis, Carstairs data were grouped into quintiles (1 = patients from poorest background). Data were analysed using Generalised Estimated Equations as there is interdependency between factors.

**RESULTS.**

SUMMARY DATA

| | | Outcome | | ICU Mortality | SOFA | |
|---|---|---|---|---|---|---|
| | | Survived | Died | | Survived | Died |
| | | n | n | % | Mean ±SEM | Mean ±SEM |
| CARSTAIRS QUINTILE | 1 | 1162 | 115 | 9 | 1.96 ± 0.058 | 5.97 ± 0.317 |
| | 2 | 1416 | 163 | 10.3 | 2.04 ± 0.053 | 5.09 ± 0.209 |
| | 3 | 1655 | 221 | 11.8 | 1.97 ± 0.049 | 5.71 ± 0.233 |
| | 4 | 1709 | 253 | 12.9 | 1.89 ± 0.047 | 5.69 ± 0.209 |
| | 5 | 2686 | 360 | 11.8 | 1.88 ± 0.039 | 5.37 ± 0.170 |

| | | SEX | | % Male | Admission Type | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | M | | Elective | | Emerg | | X-fer | |
| | | n | n | | n | % | n | % | n | % |
| CARSTAIRS QUINTILE | 1 | 414 | 863 | 67.6 | 617 | 6.3 | 439 | 4.5 | 221 | 2.3 |
| | 2 | 524 | 1055 | 66.6 | 749 | 7.7 | 581 | 6.0 | 249 | 2.6 |
| | 3 | 670 | 1206 | 64.3 | 826 | 8.5 | 796 | 8.2 | 254 | 2.6 |
| | 4 | 727 | 1235 | 62.9 | 809 | 8.3 | 898 | 9.2 | 255 | 2.6 |
| | 5 | 1098 | 1948 | 64.0 | 1011 | 10.4 | 1598 | 16.4 | 437 | 4.5 |

Factors associated with changes in SOFA were admission type ($p < 0.001$), LOS ($p < 0.001$), age ($p = 0.017$) and admission SOFA ($p < 0.001$). Sex and Carstairs quintile were not significant. There was no difference between the group of patients who died and the patients who survived. Although raw mortality rates were lowest in Carstairs Quintile 1 and 2, these were not statistically significant once other factors had been considered (OR 0.95, CI = 0.85 to 1.1, $p = 0.87$)

**CONCLUSIONS.** Our data suggest that social status does not influence withdrawal of therapy or discharge. Patients were more likely to have a higher SOFA score on discharge if they had had elective surgery and were younger.

**REFERENCE(S).** 1. Welch CA, Harrison DA, Hutchings A, Rowan K (2010) J Crit Care. S0883–9441. 2. Hutchings A, Raine R, Brady A, Wildman M, Rowan K (2004) Med Care 42:943–951. 3. Latour J, Lopez V, Rodriguez M, Nolasco A, Alvarez-Dardet C (1991) J Clin Epidemiol 44:889–894.

**GRANT ACKNOWLEDGMENT.** An unrestricted educational grant was provided by Astra Zeneca Ltd, Luton, Bedfordshire, UK. The study was initiated and conducted independently by the named authors.

## 0786

### SETTING THE TIME: AN ASSESSMENT OF INTERVENTION TO IMPROVE THE ACCURACY OF CLOCKS IN ACUTE AND CRITICAL CARE AREAS: OUTCOME OF AN AUDIT PERFORMED IN A DISTRICT GENERAL HOSPITAL IN NORTHERN ENGLAND

U. Franke[1], R. Hixson[2]

[1]James Cook University Hospital, Middlesbrough, UK, [2]Darlington Memorial Hospital, Darlington, UK

**INTRODUCTION.** The recording of date and accurate time for entries in patient case notes is an essential part of documentation with implications for ongoing medical interventions, case note reviews, audits and not least for medico-legal proceedings. Time accuracy is even more important in acutely ill patients where a great number of medical interventions are carried out in a short space of time with effective treatment dependent on delivery at exact points. The timing of critical procedures is often subject to intense scrutiny to assure delivery of the highest standard of care. The recognition of the role of hand hygiene in the reduction of hospital acquired infections resulted in a ban of wristwatches for medical staff in England. Teams delivering medical care for critically ill patients therefore rely on the accurate time being displayed by wall mounted clocks and monitors.

**OBJECTIVES.** Three audit cycles were undertaken to assess the efficacy of intervention to improve the accuracy of clocks present along the pathway traced by critically ill patients through an acute hospital.

**METHODS.** An audit of 84 clocks displayed in acute and critical care areas was undertaken to assess baseline accuracy. A gold standard of an accuracy of ±30 s from Greenwich Mean Time was defined. A second audit was undertaken 36 h after the transition from British Summer to Greenwich Mean Time when all hospital clocks should have been reset to 1 h earlier. Written communication to key members of staff within the relevant clinical areas regarding time accuracy and the requirement to ensure clocks displayed the correct time was followed by a third audit and then installation of radio controlled clocks.

**RESULTS.** Baseline results showed that 18% of the audited clocks were accurate within ±30 s and 7% had a time deviation of more than 20 min. Following the 'time change' 8% were within the gold standard and 50% showed an absolute time discrepancy of more than 20 min. After the written instruction to staff to set all clocks 15% of the time pieces reached the gold standard with 15% showing inaccuracies of more than 20 min. The installation of radio controlled clocks improved accuracy with 100% of the wall mounted clocks showed the exact time.

**CONCLUSIONS.** Conservative passive and active interventions such as clock setting at the end of summer time or staff reminders failed to improve the accuracy of the time displayed in acute and critical care areas. The installation of radio controlled wall mounted clocks led to an improvement of accuracy of the time displayed.

**REFERENCES.** Kaye W, Mancini ME et al. When minutes count–the fallacy of accurate time documentation during in-hospital resuscitation. Resuscitation 2005;65:285–90.

Ferguson EA, Bayer CR et al. Time out! Is timepiece variability a factor in critical care? Am J Crit Care 2005;14:113–20.

**GRANT ACKNOWLEDGMENT.** The authors report no potential conflict of interests or financial supports.

## 0787

### POSTOPERATIVE NALOXONE RESCUE FOLLOWING PARENTERAL OPIOIDS AFTER ABDOMINAL SURGERY: INCIDENCE AND COHORT MORBIDITY AND MORTALITY

J.D. Bloom[1], M. Lu[2], J. Sigl[2], D.M. Hansell[1,3]

[1]Covidien, Boulder, USA, [2]Covidien, Norwood, USA, [3]Massachusetts General Hospital, Department of Anesthesia, Critical Care, and Pain Medicine, Boston, USA

**INTRODUCTION.** Postoperative analgesia regimens commonly employ opioid analgesics, which often result in varying degrees of respiratory depression and sedation. Clinically worrisome respiratory depression or sedation owing to opioid therapy is typically reversed with intravenous naloxone. While the use of naloxone rescue has been examined in a number of small studies, there is no current national estimate of its incidence or associated outcomes. We hypothesize that the use of naloxone rescue after abdominal surgery is uncommon but associated with adverse outcomes and resource use.

**OBJECTIVES.** The objectives of this study are to estimate the burden of postoperative respiratory depression and sedation following abdominal surgery.

**METHODS.** We selected patients undergoing intra-abdominal surgery from the Premier Perspective database between 2005 and 2008 using Clinical Classification Software (CCS) codes[1]. Data extracted included demographic characteristics, International Classification of Disease ver. 9 (ICD-9) codes, discharge disposition, length of stay, and total hospital patient cost. Administration of parenteral opioids and naloxone rescue was determined for each admission using hospital charge codes. Incidence of noninvasive ventilation (NIV) was identified using ICD-9 code 93.90. Comparison of means and proportions were determined using independent-samples T tests and Pearson's Chi-square test, respectively.

**RESULTS.** There were 894,076 surgical discharges after abdominal surgery, 809,340 (90.5%) of which received parenteral opioids during their stay. The incidence of naloxone rescue in this cohort was 3.7% (30.244). Inhospital mortality for the naloxone group compared to the non-naloxone group was 8.4 vs. 3.3%, respectively ($p < 0.001$). Incidence of noninvasive ventilation (2.69 vs. 0.96%, $p < 0.001$), mean hospital length of stay (16 vs. 8, $p < 0.001$), and mean hospital cost ($37,293 vs. $18,971, $p < 0.001$) varied similarly.

**CONCLUSIONS.** Postoperative naloxone rescue following paraenteral opioids after abdominal surgery is surprisingly common (3.7%) and is associated with significant increases in mortality, hospital length of stay, resource use, and use of ventilatory support. Strategies aimed at earlier detection of respiratory distress, prior to the need for rescue, may lead to greatly improved outcomes and substantial savings.

**REFERENCE(S).** 1. Thompson et al. Clinical and economic outcomes of hospital acquired pneumonia in intra-abdominal surgery patients. Ann Surg. 2006;243(4):547–52.

**GRANT ACKNOWLEDGMENT.** Study funded by Covidien.

## 0788

### MEDICAL RADIATION EXPOSURE IN CRITICALLY ILL PATIENTS AT THE INTENSIVE CARE UNIT

A. Karabinis[1], P. Spirou[1], K. Tsironas[1], X. Petsa[1], G. Koukoulitsios[1], M. Mpouzika[1,2], D. Karakitsos[1]

[1]General Hospital of Athens, Intensive Care Unit, Athens, Greece, [2]National and Kapodistrian University of Athens, Faculty of Nursing, Athens, Greece

**INTRODUCTION.** Critically ill patients undergo imaging studies used in the diagnosis management.

**OBJECTIVES.** The purpose of this study was to estimate the cumulative effective dose (CED) of radiation resulting from computed tomography, (CT), X-rays and others radiologic studies in critically ill patients.

**METHODS.** This was a prospective study describing radiation exposure associated with all types of diagnostic studies performed on 102 consecutive adult patients, with diverse admission diagnosis, at 12 bed Intensive Care Unit (ICU) of a large metropolitan hospital in Athens, between 1 November 2009 and March 30 2010. The study period was from the admission until the exit from the ICU.

**RESULTS.** Sixty-seven of the subjects (65.68%) were males, the mean age was 56.38 ± 7.22 years and the mean length of stay were 39.2 ± 17.3 days. Disease severity was assessed by the MOF (mean score: 5.3 ± 1.4), MODS (mean score: 8.4 ± 2.3) APACHE II (mean score: 19.2 ± 7.3) and GCS (mean score: 5.4 ± 1.4) scoring systems. We indentified a total of 956 imaging procedures associated with radiation exposure with a mean number of 13.3 ± 6.0 plain X-rays, 1.3 ± 0.5 CT of the head or brain, 0.7 ± 0.3 CT of the abdomen and of the chest and 0.09 ± 0.04 CT angiography, performed, per patient respectively. The mean CED was 0.9 ± 0.3 millisieverts (mSv) per patients and the mean time period for equivalent effective dose from natural background radiation were 298.9 ± 220.3 days.

**CONCLUSIONS.** Ionizing radiation needs to be considered in the light of total radiation risk to the patients over their lifetime. At this time, risk to benefit ratios of suggested radiologic techniques has yet to be established.

**REFERENCE(S).** 1. Wall BF, Hart D. Revised radiation doses for typical X-ray examinations. Br J Radiol. 1997;70:437–439.

2. RADAR Medical Procedure Radiation Dose Calculator. http://www.doseinfo-radar.com/RADARDoseRiskCalc.html, Accessed 23 February 2006.

3. Brenner DJ. Medical imaging in the 21st century-getting the best bang for the rad. N Engl J Med. 2010;362(10)943–5.

## 0789

### COMPARISON OF PLANNED VERSUS ACTUAL LEVEL OF CARE PROVISION FOR ADULT PATIENTS IN ACCORDANCE WITH CURRENT NATIONAL GUIDANCE WITHIN A UK UNIVERSITY TEACHING HOSPITALS TRUST

P. Davoudian[1], N.J. Flint[1]

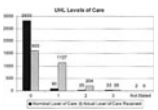
[1]Leicester Royal Infirmary, University Hospitals of Leicester NHS Trust, Critical Care, Leicester, UK

**INTRODUCTION.** There has been a recent emphasis for healthcare organisations to allocate levels of care to patients according to individual clinical need rather than location or other traditional factors [1]. This has in part been responsible for a revision of the Intensive Care Society guideline: Levels of Critical Care for Adult Patients [2]. Previous work has shown that patients managed in closed units have lower mortality, fewer complications and shorter ICU and hospital stays [3, 4]. To our knowledge this is the first report based on the new ICS guideline.

**OBJECTIVES.** To determine any differences that may exist between planned and actual level of care provided to our adult patients, using the ICS guideline as our standard.

**METHODS.** A proforma was designed to collect data in keeping with the ICS guideline. On 2 separate days data was collected on all adult patients, with the exceptions of cardiac intensive care and ECMO patients, across the three hospitals within Leicester University Hospitals NHS Trust. The level of care was determined retrospectively using the ICS guideline.

**RESULTS.** A total of 2,970 patients received care on the days of data collection. The allocated levels of care within the trust for this period were: 95% level 0, 3% level 1, 1% level 2, 1% level 3; compared with actual level of care of 54, 38, 7 and 1%, respectively.



Graph 1

**CONCLUSIONS.** We have demonstrated a discrepancy between planned and actual level of care, with a deficit of level 2 critical care provision. There is also marked difference at level 1 care, this may have a knock on effect for critical care bed demand. These shortfalls have implications with regards to the structure, development and finance of future critical care services.

**REFERENCE(S).** 1. High Quality Care for All: NHS Next Stage Review. Department of Health. June 2008.

2. Levels of Critical Care for Adult Patients. Intensive Care Society. 2009.
3. Provonost PJ et al. Physician staffing patterns and outcomes in critically ill patients: a systematic review. J Am Med Assoc 2002 288;(17):2151–62.
4. Carson SS et al. Effects of organizational change in the medical intensive care unit of a teaching hospital: a comparison of 'open' and 'closed' formats. JAMA 1996; 276(4):322.

## 0790

### ANALYSIS OF THE IMPACT OF PANDEMIC INFLUENZA 2009 A H1N1 OUTBREAK ON INTENSIVE CARE IN A TERTIARY CARE HOSPITAL

I. Zykova[1,2], P. Švancar[1], J. Prattingerová[3], P. Sedlák[1], Z. Krejzar[1], P. Remeta[1], J. Škantárová[1], L. Žihlová[1], D. Morman[1]

[1]Regional Hospital Liberec, Anaesthesia and Intensive Care Department, Liberec, Czech Republic, [2]Regional Hospital Liberec, Medical ICU, Department of Medicine, Liberec, Czech Republic, [3]Regional Department of Public Health, Liberec, Czech Republic

**INTRODUCTION.** The outbreak of influenza 2009 A H1N1 had influenced intensive care units all over the world. We describe the characteristics of patients with confirmed A H1N1 influenza requiring admission to intensive care in Regional Hospital Liberec and analyse the impact on intensive care in a tertiary care hospital.

**METHODS.** We retrospectively rewieved medical data from all patients admitted to ICU with a positive RT-PCR for pandemic influenza A H1N1.

**RESULTS.** Our hospital is a tertiary care hospital with 800 beds. The estimated population covered for the influenza outbreak was around 250,000 inhabitants. Patients were admitted to a mixed/medical intensive care unit with 16 beds. All patients with a suspicion of influenza A H1N1 were tested on admission by RT-PCR and started on oseltamivir. RT-PCR was performed from nasopharyngeal smear or bronchoalveolar lavage (BAL). As several patients tested negative from nasopharyngeal smear and positive from BAL and not every patient with a suspected A H1N1 infection had BAL performed, a certain percentage of patients probably went undetected. From November 1st 2009 until February 28th 2010 13 patients required admission to intensive care in Regional Hospital Liberec. All except one were adults, one was a child admitted to a pediatric ICU. Median age was 60, 9 patients were under 65 years of age (69%). Ten patients required intubation, one was only on non invasive ventilation, two did not require ventilation. One patient was pregnant. One patient required ECMO. Three patients died, none from respiratory failure (mortality rate 23%). Median duration of ICU stay was 31 days, median duration of ventilation was 30 days. The median APACHE II score was 20.5. Total number of ICU bed-days in our hospital was 286, total number of days on ventilator in our hospital was 223 days.

PATIENTS WITH A H1N1 INFUENZA

| Gender, age | Admission to ICU | Admission to hospital | APACHE II | ICU days | Ventilator days | Risk factor | Other | Outcome |
|---|---|---|---|---|---|---|---|---|
| Male, 27 | 14.11.2009 | – | 30 | 45 | 42 | Obesity-BMI 43 | | Survived, discharged |
| Female, 59 | 7.12.2009 | 4.12.2009 | 18 | 3 | 1(non invasive) | Pulmonary | | Survived, discharged |
| Female, 65 | 9.12.2009 | – | 17 | 11 | 3 | Cardiac, diabetes | | Survived, discharged |
| Female, 25 | 14.12.2009 | – | 27 | 50(14+36) transfer | 33(14+19) transfer | Pregnant | Transfer to ECMO centre | Survived, discharged |
| Female, 43 | 19.12.2009 | 8.12.2009 | 9 | 77 | 51 | Pulmonary | Nosocomial transmission | Survived |
| Female, 72 | 27.12.2009 | – | 25 | 27 | 22 | Pulmonary | | Survived, discharged |
| Female, 50 | 29.12.2009 | 30.11.2009 | 27 | 41(19+22) transfer | 41(19+22) transfer | None | Transfer from district hospital | Died, sepsis |
| Female, 62 | 31.12.2009 | 27.12.2009 | 21 | 10 | 0 | Cardiac | | Survived, discharged |

PATIENTS WITH A H1N1 INFUENZA

| Gender, age | Admission to ICU | Admission to hospital | APACHE II | ICU days | Ventilator days | Risk factor | Other | Outcome |
|---|---|---|---|---|---|---|---|---|
| Male,78 | 8.01.2010 | 7.01.2010 | 33 | 44 | 44 | Cardiac, renal | | Died, cardiac failure |
| Male,90 | 15.01.2010 | – | 20 | 31(6+25) transfer | 25(6+19) transfer | | Transfer to district hospital | Died, cardiac failure |
| Female,6 | 19.1.2010 | 17.1.2010 | | 15(2+13) | 0 | | Transfer to pediatric centre | Survived, discharged |
| Female,66 | 21.01.2010 | – | 16 | 40(21+19) transfer | 30(21+9) transfer | Obesity-BMI 44 | Transfer to district hospital | Survived, discharged |
| Male,60 | 5.02.2010 | 4.02.2010 | 18 | 7 | 6 | Pulmonary | | Survived, discharged |

**CONCLUSIONS.** Compared to already published data our sample of patients appears to be older with a higher proportion of ventilated patients and a longer ICU stay. 14.9% of a total number of ICU bed-days were in a given period between November 1st 2009 and February 28th 2010 occupied by patients with A H1N1 infection.

## 0791

### THE EFFECT OF A GOAL-DIRECTED PATHWAY ON HOSPITAL AND CRITICAL CARE LENGTH OF STAY, IN ELECTIVE ABDOMINAL AORTIC ANEURYSM PATIENTS

A.H. Raithatha[1], K. Chakrabarti[1], R. Porter[1], A. Strachan[1]

[1]Doncaster Royal Infirmary, Critical Care Department, Doncaster, UK

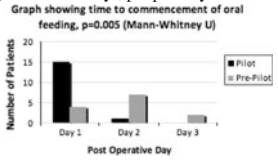
**INTRODUCTION.** Goal-directed care pathways have been shown to reduce length of stay (LOS) in elective abdominal aortic aneurysm (AAA) patients [1]. We report the effect of introducing post-operative goal-directed critical care guidelines for open elective AAA repair.

**OBJECTIVES.**

(1) To determine the effect of a nurse-led care pathway on hospital and critical care length of stay.
(2) To identify quality of care markers such as, length of time to first enteral feeding and duration of epidural catheter placement.

**METHODS.** A goal-directed and nurse-led proforma was formulated for critical care provision in patients undergoing elective infra-renal open AAA repair, following mutlidisciplinary consultation. Data was collected during a 28-week period using a prospective proforma and by review of the patients' notes. Patients were excluded if the consultant intraoperative team did not agree that the patient was suitable for the pathway. Comparison was made with 13 patients who had undergone the same procedure, prior to introduction of the proforma.

**RESULTS.** 16 patients entered into the pathway, 1 patient was excluded. The mean age was 70 (range 54–81), 13 were male (81%). 5 patients (31%) were smokers. All 16 patients survived to hospital discharge. The median length of hospital stay post-pathway was 10.5 days (range 6–20), pre-pathway it was 13 (range 5–19). Critical care stay was a median of 5 days both pre and post introduction of the pathway. Comparison with historic LOS data in our unit showed median LOS 15 days compared to 10.5 days post-pathway, (NS) $p = 0.12$ (Mann–Whitney U). 57% of patients post pathway had the epidural catheter in situ for greater than 3 days, pre-pathway it was 7 out of 13 (54%).




Graph showing time to commencement of oral feeding

**CONCLUSIONS.** A goal-directed pathway appears to decrease hospital LOS for our patients undergoing elective open infra-renal AAA repair, although not critical care LOS. The pathway appeared advantageous in reducing time to feeding.

**REFERENCE(S).** 1. Murphy MA, Richards T, Atkinson C, Perkins J, Hands LJ (2007) Fast track open aortic surgery: reduced post operative stay with a goal directed pathway. Eur J Vasc Endovasc Surg 34:274–8.

## 0792

### THE BURDEN OF 2009 H1N1 PANDEMIC FLU ON A TERTIARY CENTER

F. Mojoli[1,2], M. Belliato[3], G. Tavazzi[2], B. Pistone[3], A. Lotteria[2], F. Esposito[2], L. Carnevale[3], M. Zanierato[2], G.A. Iotti[3], A. Braschi[1,2]

[1]Università degli Studi di Pavia, Dipartimento di Scienze Chirurgiche, Rianimatorie, Riabilitative e dei Trapianti d'Organo, Pavia, Italy, [2]Fondazione IRCCS Policlinico S. Matteo, Servizio di Anestesia e Rianimazione I, Pavia, Italy, [3]Fondazione IRCCS Policlinico S. Matteo, Servizio di Anestesia e Rianimazione II, Pavia, Italy

**OBJECTIVES.** To evaluate the burden on a tertiary center due to 2009 H1N1 pandemic flu.

**RESULTS.** Between October and December 2009, 13 patients were admitted to our departments due to H1N1-infection, 8 (61.5%) from peripheral hospitals. Mean age was 37 ± 16 years (9–60). Mean time of admittance in ICU was 5 ± 3 days (1–13) since the appearance of symptoms. 4 patients required non-invasive ventilation (NIV) and 9 invasive mechanical ventilation (IMV). Six patients presented refractory hypoxemia and/or severe respiratory acidosis during optimal invasive ventilatory support and thus required veno-venous membrane oxygenation (ECMO). In three cases ECMO was started in other hospitals and then the patients were transferred to our center. Between October and December, H1N1-patients occupied 12% of total available ICU beds in our center corresponding to 14% of actually occupied beds; in November the same values were 21 and 24% respectively, with peak values of 35 and 41%, respectively. Overall these patients required 67 days of ECMO, 142 days of IMV and 64 days of NIV. All 13 patients survived; discharge from ICU occurred after 6 ± 2 days (4–13) in patients that did not require ECMO and 28 ± 9 days (17–40) in the other ones; they were discharged from hospital after 23 ± 3 days (12–50) and 50 ± 10 days (29–62), respectively.

**CONCLUSIONS.** The burden of Influenza A on our center was substantial: H1N1-patients required a high-intensity level of care; their admissions occurred in a short length of time; at the peak, they occupied more than 1/3 of our ICU resources.

## 0793

### DURATION OF HOSPITAL STAY POST ICU ADMISSION AT THE GLASGOW ROYAL INFIRMARY (GRI)-A DEMOGRAPHIC SURVEY

B.M. Daly[1], A.J. Baker[1], T. Quasim[1]

[1]University Department of Anaesthesia, Critical Care and Pain, Glasgow Royal Infirmary, Glasgow, UK

**INTRODUCTION.** Admission to an intensive care unit(ICU) is expensive, costing upwards of £1800 per day. (http://www.isdscotland.org/isd/files/0708ScotTariffs.xls). After ICU discharge there are still increased costs incurred in 'step down' care and many factors will affect the duration of hospital stay post ICU [1, 2]. As the West of Scotland tertiary referral centre for pancreatic and burns surgery, we were particularly interested in determining whether length of hospital stay (LOS) post ICU discharge was correlated with admission diagnosis, age, severity of illness or a combination of these factors.

**OBJECTIVES.** To determine the LOS post ICU discharge and elicit any factors that predict prolonged hospital admission

**METHODS.** All patients admitted to the ICU of GRI from the 1st August 08 to the 1st August 09, were identified from Wardwatcher(Critical Care Audit Ltd). Patients who did not survive or those without a hospital discharge date were excluded. Only the initial event was included in those patients with readmissions during the same hospital stay. Statistical analysis was performed using SPSS version 15.0 for Windows(SPSS Inc, Chicago, IL, USA).

**RESULTS.** A total of 418 patients were admitted during the study period. After excluding deaths during ICU, readmissions and those with missing data, 293 patients were included in the data analysis. The patients' characteristics are shown in Table 1.

**TABLE 1**

| | Age (years) | ICU LOS (days) | APACHE II | Pred mortality | Hospital LOS (days) | Post ICU LOS(days) |
|---|---|---|---|---|---|---|
| All (n=293) | 52 (37–68) | 2 (1–6) | 17 (15–21) | 18 (7–32) | 21 (9–42) | 12 (5–27) |
| Surgical (n=65) | 68 (51–74) | 2 (1–4) | 16 (12–22) | 27 (15–50) | 29 (15–44) | 19 (10–33) |
| Pancreatitis (n=13) | 52 (31–59) | 9 (4–22) | 16 (11–22) | 32 (11–55) | 76 (47–155) | 37 (20–59) |
| Burns (n=7) | 25 (18–55) | 9 (1–41) | N/A | N/A | 28 (5–162) | 7 (5–93) |

The post ICU LOS was associated with age (≥65 years, $p = 0.007$), APACHE II (≥25, $p = 0.023$) and the admission diagnosis($p < 0.001$). On binary logistic regression analysis of these factors against the LOS post ICU, only the ICU admission diagnosis was independently associated with LOS post ICU (OR 1.39, 95% CI 1.21–1.6). In particular, pancreatitis was associated with a long post ICU LOS.

**CONCLUSIONS.** In most healthcare models, there is an increased desire to reduce the length of hospital stay, and discharge patients to their own environment. The UK NICE guidelines have highlighted need for rehabilitation post Intensive Care. The results of the present study show that the main determinant of the length of stay post ICU is the admission diagnosis. This emphasises the importance of case mix when trying to implement a rehabilitation programme. Further work is required to see if post ICU length of hospital stay and therefore hospital costs could be reduced by redirecting currently available resources.

**REFERENCE(S).** 1. Williams TA et al. Effect of length of stay in intensive care unit on hospital and long-term mortality of critically ill adult patients. BJA 2010;104(4):459–64.

2. Wright SE et al. Quality of life and functional outcome at 3, 6 and 12 months after acute necrotising pancreatitis. Intensive Care Med 2009;35(11):1974–8.

## 0794

### INTERMEDIATE CARE UNITS SHOULD BE "STEP DOWN UNITS" IN SEPTIC PATIENTS

M. Granados[1], M. Badiel[2], G. Ospina-Tascon[1], M. Vargas[1], C. Ordoñez[1], F. Rosso[3]

[1]Fundacion Valle del Lili, Intensive Care Unit, Cali, Colombia, [2]Fundacion Valle del Lili, Clinical Research Institute, Cali, Colombia, [3]Fundacion Valle del Lili, Infectious Diseases Service, Cali, Colombia

**INTRODUCTION.** In developing countries, the high costs and lack of availability of Intensive care units (ICUs) has resulted in strategies of ruling out low-risk patients by developing intermediate care units (IMCs). However, the quality of care provided in those units could be altered.

**OBJECTIVES.** The aim of this study was to compare the outcomes of septic patients when they were admitted directly to ICU or to IMC and then to ICU.

**METHODS.** Prospective cohort study on patient data attained during intensive care unit stays. All patients with diagnosis of sepsis or septic shock admitted to a surgical-medical 40 beds ICU in a University affiliated Hospital from January 2000 to December 2009 were included. Bivariate and standardized mortality ratio (SMR) analyses were performed.

**RESULTS.** 21,819 patients were admitted to the ICU during the study period, and 2,313 (10.3%) were septic. Of those, 57% were admitted from Emergency room (ER), 18.9% from IMC, 14.7% Medical wards, and 9.2% from Operating room. Compared the admitted patients from IMC and ER, the APACHE score were higher ($18.16 \pm 7.26$ vs. $17.18 \pm 6.91$, $p = 0.01$), and mortality risk was higher as well ($OR_{M\text{-}H} = 1.21$; 95% CI 1.01–1.47, $p = 0.042$). Median of length of stay was higher when patients were admitted from IMC than Emergency room, 4 vs. 3 days.

**CONCLUSIONS.** Septic patients admitted from IMC had higher mortality than those admitted directly to ICU. Delay in the intensive management could be deleterious for septic patients and length of stay is increased. IMCs cannot replace the ICUs in the initial management of septic patients.

**REFERENCE(S).** 1. Solberg B, Dirksen C, Nieman F et al. Changes in hospital costs after introducing an intermediate care unit: a comparative observational study. Crit Care 2008;12:R68

2. Eachempati S, Hydo L, Barie P et al. The Effect of an Intermediate Care Unit on the Demographics and Outcomes of a Surgical Intensive Care Unit Population. Arch Surg. 2004;139:315–9
3. Heras A, Abizanda R, Belenguer A et al. Unidades de Cuidados Intermedios. Consecuencias asistenciales en un hospital de referencia. Med Intensiva. 2007;31(7):353–60
4. Rivers E, Coba V, Visbal A et al. Management of sepsis: early resuscitation. Clin Chest Med. 2008;29:689–704

**GRANT ACKNOWLEDGMENT.** Funded Fundacion Valle del Lili-Clinical Research Institute

## 0795

### IMPROVING INTENSIVE CARE PERFORMANCE: INTRODUCING LEAN THINKING IN THE ICU

A. Ersson[1], I. Didriksson[1], K. Skoog[1], A. Olsson[1], S. Ekeroth[1], J. Rydén[1], M. Werner[1], L. Övferbäck[1], K. Mijdema[1], C. Simonsen[1]

[1]Skane University Hospital, Department of Intensive Care Medicine, Malmo, Sweden

**INTRODUCTION.** There is compelling data to suggest that intensive care given by dedicated intensivists makes an impact on outcome (1–4) and that reducing working hours is beneficial to enhance individual performance and to reduce medical errors (5). Since intensive care is extremely resource demanding, and often coupled with chronic bed and staff shortages, it is paramount that these limited resources are used effectively.

**OBJECTIVES.** To optimize medical and human resource utilization in the ICU, we introduced LEAN concept thinking (LC) in ICU and investigated its effects on outcome parameters and working conditions.

**METHODS.** Performance goals and standards of professional conduct were formulated and implemented in seminars and workshops with all staff. Using the LC, daily tasks were organized using "value stream mapping" and implemented over a 90 day period. All staff, including intensivists, was organized in multi-professional teams with synchronized working hours. Nightshifts were reduced from 16 to 9 h and a three shift work schedule for doctors was applied. Evaluations were done at 90 day and 1 year using unit performance data and questionnaires. The outcome parameters assessed were

1. Unit performance
2. Resource utilization
3. Adherence to departmental guidelines and staff satisfaction.

**RESULTS.** Unit performance showed improved risk adjusted outcome pre versus post intervention (Standard mortality ratio, SMR). This was also seen during weeknights and weekends admissions where risk adjusted outcome improved and reached the same result as daytime admissions. In the same time, time on mechanical ventilation decreased and no change in night discharges, LOS or re-admission rates were seen. No change in demography were seen during the observation period. Work environmernt evaluation index (WEEI) improved and overall adherence to routines was good. As longitudinal risk adjusted outcome improved simultaneously with the reduction of cost per admission in high risk groups and survivors, we interpret this as improved cost effectiveness. Thus, resource utilization improved as well as work satisfaction among all personnel. At the same time, the LC allowed us to utilize 24% of working hours for R&D activities, increased capacity for 4 HDU beds and extended outreach services without additional funding.

**CONCLUSIONS.** In our ICU, introduction of the LC improved unit performance, resource utilization, staff satisfaction and adherence to guidelines.

**REFERENCE(S).** 1. Pronovost P. CCM 2004;32(6):1247–53.

2. Carlos A. Cur Opin Crit Care. 2009;15 308–13.
3. Gallesio A. Cur Opin Crit Care. 2008;14 700–07
4. Arabi Y. CCM.2006;34(3):605–11
5. Landrigan CP. NEJM.2004;351(18):1838–48

# Prognostic scores: 0796–0809

## 0796

### THE EVALUATION OF LOGISTIC-EUROSCORE FOR MORTALITY PREDICTION: IN IRANAN CARDIAC SURGERY PATIENTS

S.M.R.R. Hashemian[1,2], Y. Mehrabi[1], G. Radmand[1], A.A. Khadem Maboudi[1], H. Jamaati[1], M. Chitsazan[1], Z.H. Ahmadi[1], M. Malekmohammad[1], K. Noorizadeh[1], F. Shahsavari[1], M. Masjedi[1], A.A. Velayati[1]

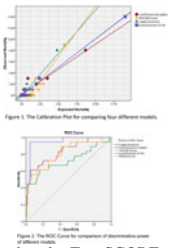
[1]NRITLD/SBMU, Critical Care Medicine, Tehran, Iran, Islamic Republic of, [2]Tracheal Disease Research Center, Tehran, Iran, Republic of Islami

**INTRODUCTION.** The European System for Cardiac Operative Risk Evaluation (EuroSCORE), was developed to predict the outcome for adults, after cardiac operation.

**OBJECTIVES.** But these scoring systems need to be evaluated before using in new populations. We studied the performance of EuroSCORE on a group of Iranian population.

**METHODS.** In a cohort study, a group of patients who had cardiac surgery and then referred to the Intensive Care Unit (ICU), from Jan 2009 to March 2010 in Masih Daneshvari Hospital were followed and the hospital mortality was registered for them. The probability of death according to the logistic-EuroSCORE and APACHE II (Acute Physiology and Chronic Health Evaluation II) score for first day of ICU admission were calculated. The coefficients of EuroSCORE variables were re-estimated on this group as two local EuroSCORE models, with Logistic Regression and SVM (Support Vector Machines) and the discriminative power and calibration of these models were compared.

**RESULTS.** A total of 148 patients were included in this study. The overall mortality rate was 12.2% (18 patients). The Accuracy of mortality prediction in the Logistic-EuroSCORE was 89.1%; in APACHE II model was 89.1%; in the local EuroSCORE (Logistic) was 91.89%; and in the local EuroSCORE (SVM) was 98.6%. The Area Under Curve (AUC) for ROC (Receiver Operating Characteristics) curve, was 0.724 (95% CI: 0.57–0.88) for Logistic EuroSCORE; 0.836 (95% CI: 0.731–0.942) for local EuroSCORE (Logistic); 0.978(95% CI: 0.937–1) for local EuroSCORE (SVM); and 0.832 (95% CI: 0.723–0.941) for APACHE II model. The Hosmer–Lemeshow goodness of fit test showed good calibration for the local EuroSCORE (SVM), APACHE II model and local EuroSCORE (logistic) ($P = 0.823$, $P = 0.748$ and $P = 0.06$ respectively); but there was a significant difference between expected and observed mortality according to EuroSCORE model ($P = 0.033$).



**CONCLUSION.** The results show that the EuroSCORE model is insufficient for predicting the risk of mortality in our population in comparison with logistic or SVM Local EuroSCORE and APACHE II models. It needs to be calibrated before using in a new population. Also it seems that SVM method works dramatically better than Logistic, in prediction of mortality.

**REFERENCE(S).** Michel P, Roques F, Nashef SAM. The EuroSCORE Project Group. Logistic or additive EuroSCORE for high-risk patients? Eur J Cardiothorac Surg 2003;23:684–7.

Nashef SA, Roques F, Michel P, Gauducheau E, Lemeshow S, Salamon R. European system for cardiac operative risk evaluation (EuroSCORE). Eur J Cardiothorac Surg 1999;16:9–13.

## 0797

### COMPARISON OF NEWER SCORING SYSTEMS WITH TRADITIONAL SCORING SYSTEMS IN GENERAL INTENSIVE CARE POPULATION: A CASE OF OLD WINE IN A NEW BOTTLE?

D. Juneja[1], Y. Javeri[1], O. Singh[1], P. Bajaj[1], N. Garg[1], S. Saxena[1], N. Malhotra[1], R. Dang[1]

[1]Max Super Speciality Hospital, Critical Care Medicine, New Delhi, India

**INTRODUCTION.** The past decade has seen the development of next generation of scoring systems which include Acute Physiology and Chronic Health Evaluation (APACHE) IV, Simplified Acute Physiology Score (SAPS) III and Mortality Probability Model (MPM) $III_0$. Whether these systems offer any advantage over the traditionally used systems, in terms of increased accuracy in predicting intensive care unit (ICU) mortality, is not known.

**OBJECTIVES.** To assess the efficacy of these newer scoring systems in predicting mortality in a multi-disciplinary ICU and compare it to that of already validated tools like APACHE II, III, SAPS II, MPM $II_0$ and Sequential Organ Failure Assessment (SOFA) score.

**METHODS.** Retrospective analysis of data for all consecutive patients admitted to a medical ICU over a 15 months period. Data related to patient demographics, and that necessary to compute various scores were recorded. Predicted mortality was calculated using original regression formulas. Standardized mortality ratio (SMR) was computed with 95% confidence intervals (CI). Calibration was assessed by Lemeshow-Hosmer goodness-of-fit test. Discrimination was evaluated by calculating the Area Under the Receiver Operating Characteristic Curves (AUROC). Primary outcome measure was ICU mortality.

**RESULTS.** Mortality predicted by APACHE IV score was closest to that of actual mortality (15.8%) with a SMR of 0.868 followed by that of MPM $III_0$ (0.794) and SAPS III (0.763) scores. APACHE III ($\chi^2 = 3.674$), with $P = 0,885$ had the best calibration followed by APACHE II ($\chi^2 = 7.959$; $p = 0.438$) and SOFA scores ($\chi^2 = 8.369$; $p = 0.301$). All the scores tested had good efficacy and even though there was no statistically significant difference between the AUROCs of the various scores, MPM $III_0$ (AUROC = 0.947) performed the best followed closely by APACHE IV (AUROC = 0.928) and MPM $II_0$ (AUROC = 0.928).

COMPARISON OF THE ACTUAL AND PREDICTED MORTALITY

| Variable | Actual mortality | Predicted mortality | SMR | 95% CI |
|---|---|---|---|---|
| APACHE II | 0.158 | 0.25 | 0.632 | 0.52–0.76 |
| APACHE IV | 0.158 | 0.182 | 0.868 | 0.714–1.044 |
| SAPS II | 0.158 | 0.295 | 0.536 | 0.441–0.644 |
| SAPS III | 0.158 | 0.207 | 0.763 | 0.628–0.918 |
| MPM II0 | 0.158 | 0.297 | 0.532 | 0.438–0.64 |
| MPM III0 | 0.158 | 0.199 | 0.794 | 0.653–0.955 |

AREA UNDER CURVE FOR PREDICTING ICU MORTALITY

| Scoring system | AUC | 95% CI | Cut-off | Sensitivity (%) | Specificity (%) |
|---|---|---|---|---|---|
| APACHE II | 0.894 | 0.864–0.925 | >20.5 | 74.8 | 84.9 |
| APACHE III | 0.922 | 0.894–0.949 | >73 | 78.6 | 86 |
| APACHE IV | 0.928 | 0.903–0.953 | >12.5 | 93.2 | 66.9 |
| SAPS II | 0.899 | 0.870–0.928 | >47.5 | 83.5 | 83.5 |
| SAPS III | 0.901 | 0.871–0.932 | >56.5 | 76.7 | 84.7 |
| MPM II0 | 0.928 | 0.904–0.952 | >27 | 95.1 | 68.2 |
| MPM III0 | 0.947 | 0.927–0.967 | >19 | 94.2 | 80.2 |
| SOFA score | 0.893 | 0.857–0.929 | >7.5 | 71.8 | 88.5 |

**CONCLUSIONS.** Overall, the newer scoring systems performed better than their older counterparts and were more accurate. Nevertheless, the difference in efficacy was not statistically significant and the choice of scoring system may depend on the ease of use and local preferences.

## 0798

### THE SIMPLE TRIAGE SCORING SYSTEM (STSS) SUCCESSFULLY PREDICTS MORTALITY AND CRITICAL CARE RESOURCE UTILISATION IN H1N1 PANDEMIC FLU

K. Adeniji[1], R. Cusack[1], K. Golder[1]

[1]Southampton General Hospital, Critical Care, Southampton, UK

**INTRODUCTION.** The UK Department of Health's surge capacity plan [1] recommended using the staged Sequential Organ Failure Assessment score as described by Christian et al. to triage critical care admissions and discharges [2]. When applied retrospectively to a cohort of H1N1 patients admitted to an intensive care unit in the UK it would have led to the consideration of treatment withdrawal in 5/8 patients who survived [3]. The STSS was designed for use in patients presenting with suspected infection. It utilises age, shock index (HR > BP), respiratory rate, oxygen saturation and altered mental state: all parameters readily available at initial presentation. It has been proposed as a potential alternative triage tool in predicting death and the utilisation of critical care resources during epidemics.

**OBJECTIVES.** To retrospectively review the performance of the STSS as an indicator of the utilisation of hospital resources in adult patients with confirmed H1N1 admitted to a University Teaching Hospital.

**RESULTS.** Between July 2009 and February 2010, 62 patients (35 male) with a mean age (range) of 41 (18–71) years were admitted to the hospital. 40 had either a single or multiple documented comorbidities (25 respiratory), 3 were morbidly obese and 3 pregnant. 27 had either a broncho or lobar pneumonia confirmed on their admission CXR. 19 patients all with an STSS >2 were admitted to the intensive care unit where three required only supplementary oxygen, 11 were managed with NIV and 5 required mechanical ventilation (MV). There were 3 deaths (2 COPD patients, 1 patient without comorbidity). One of the STSS score 2 patients with COPD survived his acute viral illness and died later of his cardiovascular comorbity. The mean number of level 2 and level 3 critical care bed days used over the study period were 7.8 and 21.8 days/patient respectively.

PREDICTIVE DISCRIMINATION OF THE STSS SCORE

| | Mortality (%) | | Need for ICU (%) | | | Need for MV (%) | |
|---|---|---|---|---|---|---|---|
| STSS Score | Derivation Group | Study Group | Derivation Group | Study Group | Mean Bed Days | Derivation Group | Study Group |
| 0 | 5/1144 (0.4) | 0/19 (0) | 61/1144 (5.3) | 1/19 (5.3) | 4 | 18/1144 (1.6) | 0/19 (0) |
| 1 | 45/1257 (3.6) | 0/21 (0) | 124/1257 (9.9) | 2/21 (9.5) | 3 | 37/1257 (2.9) | 0/21 (0) |
| 2 | 54/617 (8.8) | 2/13 (15.3) | 140/617 (23) | 7/13 (53.8) | 19 | 43/617 (7) | 1/13 (7.7) |
| ≥ 3 | 47/188 (25) | 1/9 (11.1) | 68/188 (36) | 8/9 (88.8) | 9 | 25/188 (13) | 4/9 (44.4) |

**CONCLUSIONS.** The four groupings of the STSS accurately risk stratify patients in this cohort according to their risk of death; predict the likelihood of admission to critical care and the requirement for MV in line with the derivation population. Its single point in time accuracy and easily collected component variables commend it as an alternative reproducible system to facilitate the triage and treatment of patients in any future influenza pandemic.

**REFERENCE(S).** 1. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_098769

2. CMAJ. 2006 Nov 21;175(11):1377–81.

3. Anaesthesia. 2009;64(12):1283–8.

4. Crit Care Med. 2007;35(5):1251–6.

## 0799

### THE INTENSIVE CARE NATIONAL AUDIT AND RESEARCH CENTRE MODEL FOR THE PREDICTION OF 1-MONTH MORTALITY IN EMERGENCY INTENSIVE CARE UNIT PATIENTS OF SOUTH KOREA

K.S. Kim[1], G.J. Suh[1], W.Y. Kwon[1], M.H. Park[1]

[1]Seoul National University Hospital, Department of Emergency Medicine, Seoul, Korea, Republic of

**INTRODUCTION.** Intensive Care National Audit & Research Centre (ICNARC) model was recently developed. However, no studies have evaluated the performance of ICNARC model outside UK.

**OBJECTIVES.** The aims of this study were to evaluate the performance of ICNARC model for predicting 1-month mortality in patients of an emergency intensive care unit (ICU) in South Korea and to compare it with those of Acute Physiology and Chronic Health Evaluation (APACHE) II, adjusted APACHE (adj-APACHE) II, and Simplified Acute Physiology Score (SAPS) II.

**METHODS.** We retrospectively reviewed all admissions during 1-year period and analyzed 661 patients after excluding patients younger than 16 years (n = 7) and with inadequate data (n = 10). Performance of models for predicting 1-month mortality was assessed in terms of discrimination (area under receiver operating characteristics curve (AUC)) and calibration (Hosmer–Lemeshow goodness-of-fit test). Customization was performed in patients (n = 324) randomly selected. Then, corresponding probability of mortality was calculated for customized models (C-ICNARC, C-APACHE II, C-adj-APACHE II, and C-SAPS II). Performance of customized models was evaluated in patients (n = 337) not included in customization process.

**RESULTS.** The observed 1-month mortality was 25.6% (169/661). The AUCs of ICNARC, APACHE II, adj-APACHE II, and SAPS II were 0.849, 0.845, 0.822, and 0.859, respectively. The AUC of adj-APACHE II was significantly smaller than those of others ($p < 0.05$). All original models had poor calibrations ($p < 0.05$). After customization, the AUCs of C-ICNARC, C-APACHE II, C-adjusted APACHE II, and C-SAPS II were 0.852, 0.849, 0.821, and 0.878, respectively. C-ICNARC and C-adj-APACHE II had perfect calibrations ($p = 0.251$ and $p = 0.074$), but C-APACHE II and C-SAPS II had poor calibrations ($p < 0.05$).

**CONCLUSIONS.** Considering discrimination and calibration, ICNARC model showed good performance for the prediction of 1-month mortality in patients of an emergency ICU in South Korea.

**REFERENCE(S).** 1. Harrison DA, Parry GJ, Carpenter JR et al.: A new risk prediction model for critical care: the Intensive Care National Audit & Research Centre (ICNARC) model. Crit Care Med. 2007;35:1091–8

2. Harrison DA, Rowan KM: Outcome prediction in critical care: the ICNARC model. Curr Opin Crit Care. 2008;14:506–12

## 0800

### A PROSPECTIVE MULTICENTER COMPARISON OF THREE MODERN PROGNOSTIC SCORES

A.P. Nassar Junior[1], A.O. Mocelin[2], A.L. Nunes[2], F.P. Giannini[3], L. Brauer[1], F.M. Andrade[4], C.A. Dias[2,4]

[1]Hospital e Maternidade São Camilo, Pompeia, São Paulo, Brazil, [2]Hospital São Luiz, Anália Franco, São Paulo, Brazil, [3]Hospital e Maternidade São Camilo, Santana, São Paulo, Brazil, [4]Hospital e Maternidade São Camilo, São Paulo, Brazil

**INTRODUCTION.** The major role of ICU is to provide the best care to critically ill patients. Prognosis varies according to diagnosis, previous health status, physiologic alterations and care provided. Prognostic scores have been developed aiming to estimate mortality and to compare results of different ICUs. However, these scores may not be well calibrated or accurate in other populations than those in which they were described.

**OBJECTIVES.** To evaluate calibration and discrimination of three recently developed general risk scores (SAPS 3, APACHE IV and MPM III) in a population admitted to three mixed medical-surgical Brazilian private ICUs.

**METHODS.** All patients admitted from July 2008 to December 2009 were evaluated for inclusion in the study. Exclusion criteria were: patients under 18 years of age, admission diagnosis of acute coronary syndrome, readmission to the ICU during the same hospital stay or loss of follow-up due to transfer to other hospital. Data were prospectively collected according to standard methodologies for each model. We used the global equation for calculation of SAPS3 predicted risk. Standardized mortality ratios (SMR) and 95% confidence intervals (95% CI) were calculated for all scores. Calibration was assessed by the Hosmer–Lemeshow (H–L) goodness-of-fit test. Discrimination was evaluated using area under the receiver operator curve (AUROC). Comparison of areas was made with De Long method.

**RESULTS.** A total of 5780 patients (52.7% female, mean age 62.4 years) were included in the analysis. Hospital mortality was 9.1%. Calibration for all scores was poor, with all scores overestimating hospital mortality, but discrimination was excellent for all. Predicted mortalities, SMR, H–L Statistics and AUROC are shown in Table 1. APACHE IV discriminated significantly better than the other two scores ($p < 0.001$ for both). SAPS 3 was also superior in discrimination to MPM III ($p = 0.043$).

**TABLE 1** PERFORMANCE OF THE SCORES

| Score | Predicted mortality (%) | SMR (95% CI) | H–L Statistic | P | AUROC (95% CI) |
|---|---|---|---|---|---|
| APACHE IV | 9.7 | 0.79 (0.60–0.98) | 53.7 | <0.001 | 0.883 (0.874–0.891) |
| MPM III | 12.1 | 0.61 (0.53–0.70) | 134.2 | <0.001 | 0.840 (0.830–0.849) |
| SAPS 3 | 15.4 | 0.46 (0.37–0.54) | 226.6 | <0.001 | 0.855 (0.846–0.864) |

**CONCLUSION.** In this sample, the three scores calibrated poorly, overestimating hospital mortality. However, all three showed excellent discrimination. APACHE IV had the most suitable, although still inadequate, calibration and the best discrimination.

**REFERENCE(S).**1. Zimmerman JE. Crit Care Med 2006;34(5):1297–1310.

2. Metnitz PG. Intensive Care Med 2005;31(10):1336–1344.

3. Higgins TL. Crit Care Med 2007; 35(3):827–835.

## 0801

### COMBINING ILLNESS SEVERITY SCORES IMPROVES THEIR MORTALITY PREDICTIVE VALUE

H.M. Soliman[1], J.L. Vincent[1]

[1]Erasme Hospital, Université Libre de Bruxelles, Department of Intensive Care, Brussels, Belgium

**INTRODUCTION.** The APACHE II and the SOFA score can both predict mortality in critically ill patients. Combining them may improve their prognostic value.

**OBJECTIVE.** To study the effect on mortality prediction of combining the APACHE II and the admission SOFA score in critically ill patients.

**METHOD.** We reviewed all 422 (181 medical and 241 surgical) adult patients admitted for more than 1 day to our 35 bed medico-surgical Department of Intensive Care over a 3 month period. Data were analysed with a logistic regression model, using a MedCalc. statistical program (version 11.2.1, copyright 2010).

**RESULTS.** Receiver-operating characteristic (ROC) curves for mortality prediction were highly significant for APACHE II, admission SOFA, and the combined scores ($P < 0.001$) in all patients and in medical and surgical subgroups. In all patients, the combination of APACHE II and admission SOFA scores had a larger area under the curve (AUC 0.87, 95% CI 0.84–0.90) than APACHE II (AUC 0.84, 95% CI 0.79–0.90) or admission SOFA (AUC 0.83, 95% CI 0.78-0.89) scores alone ($P < 0.05$). [Fig. 1].

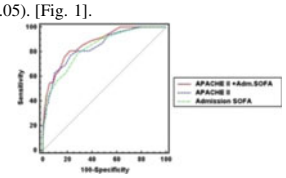



Fig. 1
In medical patients, the combination of APACHE II and admission SOFA scores had a non-significantly larger AUC (AUC 0.80, 95% CI 0.73 to 0.85) than APACHE II (AUC 0.76, 95% CI 0.68–0.84) or admission SOFA (AUC 0.76, 95% CI 0.69–0.84) alone. In surgical patients, the combination of APACHE II and admission SOFA scores had a larger AUC than the admission SOFA score (AUC 0.92, 95% CI 0.88–0.95 vs. 0.86, CI 0.77–0.96, $P < 0.05$) but there was no difference between the combination AUC and the AUC for the APACHE II score (0.91, 95% CI 0.84–0.99). In all patients, and in the medical and surgical subgroups, an admission SOFA cutoff value of 4 had greatest accuracy (maximum sensitivity and specificity) for mortality prediction. An APACHE II cutoff value of 13 had greatest mortality prediction accuracy in all patients and in surgical patients but a cut-off value of 16 was more accurate in medical patients [Table 1].

**TABLE 1**

| | Cutoff | Sensitivity | Specificity | +PV | −PV |
|---|---|---|---|---|---|
| APACHE II, total, n 422 | 13 | 77.4 | 77.5 | 37.2 | 95.2 |
| Admission SOFA, total, n 422 | 4 | 79.0 | 71.4 | 32.2 | 95.2 |
| APACHE II, medical, n 181 | 16 | 63.0 | 79.3 | 50.9 | 86.3 |
| Admission SOFA, medical, n 181 | 4 | 78.3 | 58.5 | 39.1 | 88.8 |
| APACHE II, surgical, n 241 | 13 | 81.3 | 88.0 | 32.5 | 98.5 |
| Admission SOFA, surgical, n 241 | 4 | 75.0 | 79.1 | 20.3 | 97.8 |

**CONCLUSION.** The combination of admission SOFA with APACHE II has marginally better prognostic value than either score alone.

## 0802

### THE RIFLE SCORE IN ARF: A UNICENTER OBSERVATIONAL STUDY ON THE OUTCOME OF ARF IN THE CRITICALLY ILL POPULATION

S. Nagamani[1], M.P. Vinodh[1], R.V. Shoma[1]

[1]Christian Medical College, Surgical Intensive Care Unit, Vellore Tamil Nadu, India

**INTRODUCTION.** Acute renal failure (ARF) in critically ill patients is associated with a high mortality rate. Despite improvements in intensive care and renal replacement therapy, there have not been significant improvements in patient survival over the past few decades.

**OBJECTIVES.** In our study we aim to assess the ability to identify the severity of ARF in the surgical intensive care unit in a tertiary care teaching hospital, using a criteria called the RIFLE score (Risk, Injury, Failure, Loss and End stage renal disease), and the effects of early identification of the vulnerable population on the outcome and mortality.

**METHODS.** Unicenter observational prospective cohort study. The duration of the study was a 6 month period from February 2006 to July 2006 (6 months). All patients >14 years admitted to the surgical intensive care unit, fulfilling any of the components RIFLE criteria for classifying Renal failure.

**RESULTS.** 97 out of the 422 patients admitted to the surgical intensive care unit during the study period met the RIFLE criteria for acute renal failure with an incidence of ARF 22.7%. The mortality rate was 47%($n = 46$). The leading cause of mortality were sepsis with a case fatality rate of 62% ($p < 0.01$) and ARF due to polytrauma ($p < 0.05$). Analysis of variance for the APACHE II and the SOFA scores for the three groups (R,I,F) and was significant statistically ($p < 0.001$).There was significance between survivors and non survivors for mean duration of mechanical ventilation also ($p = 0.016$), admission values for mean arterial pressures ($p = 0.00$), pH ($p < 0.001$), 24 hourly urine output ($p = 0.00$) and random blood sugar levels ($p = 0.001$). There is no significance for admission creatinine, arterial lactate, bilirubin and central venous pressures between survivors and non survivors. There was statistical significance between the groups for use of diuretics and RRT. There was no significance for mechanical ventilation between the three groups. High blood sugar values >190 mg% (OR 8.58, 2.0–33.2, P value 0.003) and use of diuretics (OR 5.20, CI 1.6–23.3, P value 0.031) were found to associated with mortality. Hosmer and lemeshow for goodness of fit test showed a p value of 0.604 with an over all percentage of 77.3%. The use of diuretics, ionotropes, need for RRT, mechanical ventilation was significantly higher in the non survivors. At an APACHE II score of 19.5 the test was seen to show a sensitivity of 80% and a specifity of 78%. For SOFA at a value of 8.5 the test was 70% sensitve and 70% specific.The area under the curve(AUC) for the APACHE ($0.890 \pm 0.033$ p value 0.000) and for the SOFA was $0.801 \pm 0.044$ p value 0.000.

**CONCLUSIONS.** The Rifle score had good relation with the outcome of patients admitted to the SICU with Acute renal failure and can be used as a good measure to categorise patients on the basis of renal parameters at admission.

## 0803

### HOLLOW VISCUS PERFORATION: A SIMPLE SCORING SYSTEM (HVP SCORE) TO PREDICT RE-OPERATION AND POSTOPERATIVE MORTALITY

R.V. Shoma[1], M.P. Vinodh[1], S. Nagamani[1], S.T. Jayanth[1]

[1]Christian Medical College Vellore, Surgical Intensive Care Unit, Vellore Tamil Nadu, India

**INTRODUCTION.** There are currently many scoring systems which use surgical outcomes and parameters to study patients with hollow viscus perforation.

**OBJECTIVES.** The purpose of this study was to develop a scoring system to predict the morbidity and mortality of patients presenting with a hollow viscus perforation and to evaluate the accuracy of this scoring system when compared to The APACHE II in predicting mortality.

**METHODS.** We carried out a retrospective study of patients admitted in the Surgical intensive care unit undergoing emergency surgery for hollow viscus perforation between September 2008 and September 2009 in a tertiary care hospital in South India. Clinical presentations and surgical outcomes were analyzed. They were scored with the HVP score (0 to 8) which included the duration of abdominal pain, history of NSAID intake and presence of features of sepsis and dehydration. Adjusted odds ratio (OR) of each score on mortality rate and reoperation was compared with zero risk score. Receiver-operating characteristic curve analysis was used to compare the predictive ability between this score and APACHE II.

**RESULTS.** The study included 59 patients with average age of 48 years (range: 17 to 73 years), and 77% ($n = 44$) were male. The commonest type of perforation was duodenal ulcer 68%($n = 40$) Primary closure and omental graft was the most common procedure performed. Overall mortality rate was 30.5% and the reoperation rate was 22%.Among those who had a reoperation the case fatality rate was 77%.The mortality rate and reoperation rate increased progressively with increasing numbers of the score. Elevated levels of arterial lactate at admission is significantly ($p < 0.05$) associated with higher reoperation and mortality. The higher the score at admission the greater the duration of mechanical ventilation and the stay in ICU. The ability of the APACHE II score and HVP score in predicting mortality in this group were compared using ROC curves. The APACHE II (AUC $0.781 \pm 0.064$, $p = 0.001$, at a value of 12 there was 68% specificity and 70% sensitivity) was found to predict mortality accurately while the HVP score (AUC $0.515 \pm 0.078$ $p = 0.84$) did not, in this group of patients.

**CONCLUSIONS.** Perforated peptic ulcer is associated with high rates of mortality and morbidity. The bowel perforation score serves as a simple predictor for postoperative mortality and risk of re-perforation. Higher lactates are associated with a higher risk of reoperation and mortality. Aggressive fluid resuscitation plays an important role in reducing the risk of reoperation and indirectly the mortality

**REFERENCE(S).** Perforated Peptic Ulcer: Lohsiriwat et al. Clinical presentation, surgical outcomes, and the accuracy of the boey scoring system in predicting postoperative morbidity and mortality.World J Surg 2009;33:80–5

## 0804

### MODIFIED SOFA BASED ON AKI CLASSIFICATION: A PROGNOSTIC SCORING SYSTEM FOR MORTALITY IN ELDERLY PATIENTS UNDERGOING EMERGENCY SURGERY FOR COLORECTAL PERFORATION

H. Okamoto[1], T. Tsujimoto[1], K. Fujii[2], M. Kawamura[1], M. Kubo[1], S. Matsushima[1], K. Kubo[1], T. Chisiro[1]

[1]Japanese Red Cross Society Wakayama Medical Center, Emergency and Intensive Care Medicine, Wakayama, Japan, [2]Japanese Red Cross Society Wakayama Medical Center, Anesthesiology, Wakayama, Japan

**INTRODUCTION.** In recent studies, acute kidney injury (AKI) scoring has been shown to correlate well with mortality in the intensive care unit (ICU) 1. Although both Sequential Organ Failure Assessment(SOFA) and the Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity(POSSUM) scores are known to predict mortality in patients undergoing emergency surgery for colorectal perforation (CP), their renal evaluation was not based on AKI classification. Modified SOFA and POSSUM scores based on AKI classification were expected to increase the sensitivity for predicting mortality.

**OBJECTIVES.** To evaluate the accuracy of these scores based on AKI scoring for the prediction of hospital mortality in elderly patients requiring emergency surgery for CP.

**METHODS.** This retrospective analysis included 43 patients aged 75 years and older who underwent emergency operation for CP and were admitted to our ICU from 2004 to 2009. We correlated AKI points to these scoring systems as shown in Table 1 below. After SOFA and POSSUM scores were obtained on admission to the ICU, AKI points were added instead of the original renal criteria in the SOFA and POSSUM scores. Accuracy was assessed by area under the receiver operating characteristic curve (AUC), and the follow-up period was 1 year.

**RESULTS.** The median patient age was 82 (77–92) years, and 48.8% were female. Duration of mechanical ventilation, length of ICU and length of hospital stay were 4 (2–7) days, 6 (3–8) days and 33 (25–47.5) days, respectively. The 28-day mortality and overall hospital mortality were 9.3% (4 patients) and 20.9% (9 patients). The SOFA and POSSUM scores were 6 points (4–7) and $51 \pm 9$ points. As shown in Table 2 below, modified SOFA increase the sensitivity for predicting mortality than SOFA score. The modified POSSUM, however, did not. Data were shown as mean $\pm$ SD or median (interquartile range).

**CONCLUSION.** Compared with the modified POSSUM score, the modified SOFA score was more simple and useful for predicting hospital mortality in elderly patients requiring emergency surgery for CP.

**REFERENCE(S).** 1. Critical Care 2008,12:R144

**GRANT ACKNOWLEDGMENT.** No conflict of interest.

**TABLE 1**

| AKI | – | Stage1 | Stage2 | Stage3 |
|---|---|---|---|---|
| For POSSUM (points) | 1 | 2 | 4 | 8 |
| For SOFA (points) | 0 | 1 | 2 | 3 |

**TABLE 2**

| | AUC | 95% Confidence interval | P value |
|---|---|---|---|
| SOFA | 0.86 | 0.74-0.98 | 0.001 |
| Modified SOFA | 0.89 | 0.78-0.99 | <0.001 |
| POSSUM | 0.78 | 0.62-0.94 | 0.009 |
| Modified POSSUM | 0.79 | 0.63-0.96 | 0.008 |

## 0805

### EVIDENCE OF DATA DISCREPANCY IN DR FOSTER HOSPITAL STANDARDISED MORTALITY RATIO(HSMR) AS A QUALITY MARKER FOR INTENSIVE CARE UNITS

R. Rahman West[1], J. Moreno Cuesta[1], R. Baumber[1], A. Chan[1]

[1]North Middlesex University Hospital, Intensive Care Unit, London, UK

**INTRODUCTION.** HSMR account for differences in-patient case mix between Intensive Care Units (ICUs) and therefore is being used to compare the performance of individual ICUs. In several countries including England, USA, Canada, and Sweden, the publication of league tables of HSMR has guided hospitals in the measurement of their quality of health care. In these countries the HSMR have been derived with methods heavily influenced by the Dr Foster Unit methodology.

**OBJECTIVES.** To examine whether the spell derived by Dr Foster's tool is a good reflection of actual hospital admission, hence actual HSMR for ICU at some major hospitals in London.

**METHODS.** Dr Foster data analysis tool is used to derive spells for ICU in London from January 2009 to December 2009. We used spells as an indication of predicted admission rate for the individual hospital. To obtain the spells we use Practice and Provider Monitor tools. Under admission option (admitted) we were given few criteria to select. From the options given we select Inpatient Specialties/All for the basket criteria followed by Episodes for the outcome criteria, Critical Care Medicine for the specialty options and select all for other headings including activity mode, chapter, subgroup, department, team, admission type, sex, deprivation and age range. The result were then organised under peer Strategic Health Authority.We then look into each individual ICU yearly admission rate under individual published hospital website and published individual ICU report. From this we calculate the ratio of spell to true admission for 1-year period for each of the ICU.

**RESULTS.** Spells of 14 NHS trust in London were identified from Dr Foster, only 10 of these trust had a published ICU admission rate. The total numbers of admissions for all of the hospitals as predicted by Dr Foster for the 1-year duration were 1977. The actual total numbers of admissions for this duration were 10.620. The sensitivity of Dr Foster's tool is calculated to be 18.8%. The predicted number of admission for each hospital ICU ranged from 3 admissions to 767 per year. Whereas actual admissions ranged from 410 to 2,500 per year. The ratio of predicted admission to actual admission rate ranged from 0.3 to 114%, where in one hospital the Dr Foster tool actually over predicted the admission. The mean predicted admission rate was 26.8% of the actual rate.

**CONCLUSIONS.** The evidence of huge discrepancy between Dr Foster's spell and actual hospital ICU admission rate suggest a lack of validation of data used by Dr Foster for ICU patients. This lack of accuracy renders HSMR for ICU using Dr Foster's tool meaningless for majority of London hospital. We believe that the lack of completeness (coding of procedure and diagnosis, co-morbilities) and the quality of the data acquired by Dr Foster could cause unexpected departmental stigma and unnecessary concern to patients.

**REFERENCE(S).** 1. Mohammed MA et al. BMJ 2009;338:b780.

2. https://da.drfoster.co.uk

## 0806

### GRACE, SAPS 3 OR APACHE IV: WHICH SCORE TO USE FOR ACUTE CORONARY SYNDROME PATIENTS IN ICU? A BRAZILIAN MULTICENTER STUDY

A.P. Nassar Junior[1], A.O. Mocelin[2], F.M. Andrade[1], L. Brauer[1], F.P. Giannini[3], A.L. Nunes[4], C.A. Dias[4,5]

[1]Hospital e Maternidade São Camilo, Pompeia, São Paulo, Brazil, [2]Hospital São Luiz, Analia Franco, São Paulo, Brazil, [3]Hospital e Maternidade São Camilo, Santana, São Paulo, Brazil, [4]Hospital São Luiz, Anália Franco, São Paulo, Brazil, [5]Hospital e Maternidade São Camilo, São Paulo, Brazil

**INTRODUCTION.** Acute coronary syndromes (ACS) are common causes of intensive care unit (ICU) admission. However, patient profile and ICU resources utilization vary worldwide. This makes crude morbidity and mortality comparisons between patients or different ICUs difficult. Prognostic models are necessary to accurately predict patients' outcomes, as benchmark for ICUs performance and for comparisons between units. Nowadays there are two kinds of prognostic models: "non-specific" models, like APACHE and SAPS, which were developed in a wide variety of patients, including those with ACS, and "specific" models, like GRACE, which was developed exclusively in a large cohort of ACS patients.

**OBJECTIVES.** To evaluate the performance of two non-specific models (SAPS 3 and APACHE IV) and of GRACE risk model to predict in-hospital mortality in a population with ACS in three private general ICUs in Brazil.

**METHODS.** All patients admitted with ACS from July 2008 to December 2009 were considered for inclusion in the study. Patients under 18 years, readmitted to the ICU during the same hospitalization or transferred to another hospital were excluded. Data were prospectively collected according to standard methodologies for each model. Standardized mortality ratios (SMR) and 95% confidence intervals (95% CI) were calculated for all models. Calibration was assessed the Hosmer–Lemeshow (H–L) goodness-of-fit test. Discrimination was determined using area under the receiver operator curve (AUROC)and 95% confidence intervals (95% CI). Comparison of areas was made with De Long method.

**RESULTS.** A total of 1065 patients (59.6% male, mean age 62.2 years) were included in the final analysis. In-hospital mortality was 2.4%. Predicted mortalities, SMR, H–L Statistics and AUROC are shown in Table 1. Calibration was adequate for APACHE IV and GRACE and poor for SAPS 3. Discrimination was similar among models (APACHE IV vs. GRACE, $p = 0.955$, APACHE IV vs. SAPS 3, $p = 0.135$ and GRACE vs. SAPS 3, $p = 0.282$).

PERFORMANCE OF THE MODELS

| Score | Predicted mortality | SMR (95% CI) | H–L Statistic | p | AUROC (95% CI) |
|---|---|---|---|---|---|
| APACHE IV | 3.2% | 0.77 (0.46–1.07) | 12.5 | 0.27 | 0.860 (0.838–0.880) |
| GRACE | 3.1% | 0.77 (0.47–1.08) | 11.0 | 0.25 | 0.862 (0.840–0.883) |
| SAPS 3 | 7.9% | 0.31 (0.11–0.50) | 51.8 | <0.001 | 0.804 (0.779–0.828) |

**CONCLUSIONS.** In this Brazilian population of ACS patients admitted to ICU, APACHE IV and GRACE were adequately calibrated, but SAPS 3 was not. All three models have an excellent discrimination. As GRACE requires less data and time to calculate than APACHE IV, our results support its usage for risk stratification of ACS patients.

**REFERENCES.** 1. Granger CB. Arch Intern Med 2003;163:2345–53.

2. Zimmerman JE. Crit Care Med 2006; 34(5):1297–310.

3. Metnitz PG. Intensive Care Med 2005; 31(10):1336–44.

## 0807

### THE PIRO CONCEPT: PREDISPOSING CONDITIONS FOR COMMUNITY-ACQUIRED SEVERE SEPSIS AND SEPTIC SHOCK RELATED-MORTALITY (RESULTS FROM THE SACIUCI STUDY)

N. Cortesão[1], C. Granja[1,2], A. Teixeira-Pinto[2]

[1]Serviço de Medicina Intensiva, Hospital Pedro Hispano, Matosinhos, Portugal, [2]Porto Medical Faculty, Biostatistics and Medical Informatics Department, Porto, Portugal

**INTRODUCTION.** Patients' predisposing factors influences sepsis-associated mortality risk. This hypothesis, a part of the PIRO concept, has been addressed in several studies.

**OBJECTIVES.** To identify predisposition conditions associated with hospital mortality in ICU patients admitted with community-acquired sepsis.

**METHODS.** Severe sepsis and septic shock patients were systematically selected from the Portuguese ICU-admitted community-acquired sepsis prospective cohort study (SACiUCI). Predisposition variables potentially affecting the interest outcome (hospital mortality) were described and included in hypothesis tests (Chi-square tests for categorical and Mann–Whitney tests for continuous variables). A multiple logistic regression was used to obtain the best prediction of hospital mortality. Variables with $p < 0.2$ in the univariate analysis were candidates for the final model and were kept in the model if $p < 0.1$. Interactions were tested with the final group of variables but none was found to contribute significantly. PASW (SPSS)® software 18.0 was used for the statistical analysis.

**RESULTS.** 808 patients were included (severe sepsis/septic shock = 358/450) in the study. Hospital mortality rate was 40% (321). Univariate analysis found a statistical association between mortality and gender (43% in men vs. 35% in women; $p = 0.033$), age (OR = 1.025, $p < 0.001$), chemotherapy (OR = 1.9, $p = 0.046$), chronic liver disease (OR = 1.9, $p = 0.010$), hematological disease (OR = 3.4, $p = 0.015$) and neoplastic disease (OR = 2.6, $p = 0.002$). No association was found for season ($p = 0.990$), chronic corticotherapy ($p = 0.479$), radiotherapy ($p = 0.319$), HIV infection ($p = 0.506$), AIDS ($p = 0.555$), cardiovascular disease ($p = 0.249$), renal disease ($p = 0.113$), respiratory disease ($p = 0.682$). Gender (OR = 1.4, $p = 0.022$), age (< 39=ref | 40–59 OR = 2.4, $p = 0.002$ | 60-69 OR = 1.9, $p = 0.029$ | 70–74 OR = 3.3, $p < 0.001$ | 75–79 OR = 4.5, $p < 0.001$ | > 80 OR = 6.7, $p < 0.001$), liver disease (OR = 2.1, $p = 0.004$), renal disease (OR = 2.0, $p = 0.024$), hematological disease (OR = 2.7, $p = 0.063$), and neoplastic disease (OR = 2.5, $p = 0.007$), were found to be the best predictors of death with a AUC-ROC 0.68 (CI95% [0.65, 0.72]) and a test of goodness-of-fit (Hosmer and Lemeshow) of $p = 0.368$.

**CONCLUSIONS.** This study, based on a large prospective cohort, showed a group of easily identifiable pre-existing conditions associated with hospital mortality, in a clinically homogeneous sample that included exclusively patients with community-acquired sepsis. It also explored hospital mortality instead of 28-day mortality, which may further enhance our understanding on sepsis-related mortality. Finally, these findings may add to our knowledge concerning predisposing conditions for severe sepsis and septic shock related-mortality, according to PIRO concept.

**REFERENCE(S).** Predisposition, insult/infection, response, and organ dysfunction: A new model for staging severe sepsis. Rubulotta F et al. Crit Care Med 2009;37(4)

## 0808

### COULD THE ABBREVIATED INJURY SCORE PREDICT THE LONG TERM QUALITY OF LIFE ON SEVERE POLITRAUMA PATIENTS?

R. Martinez Rodríguez[1], I. Otero Quintana[1], P. García Segura[1], A. Mauro[1], E. Bassas[1], M. Lacambra Basil[1], M. Koo[1], A. Sabaté Pes[1]

[1]Hospital Universitario de Bellvitge, Anesthesiology, L'Hospitalet de Llobregat, Spain

**INTRODUCTION.** The long term quality of life (QoL) and its measure has became and important endpoint on severe politrauma patients, besides the mortality, but it remains unclear on the available data. We wonder if an anatomical scoring system like the A.I.S. could be a good predictor of the quality of life on these patients [1, 2].

**OBJECTIVES.** To compare the scores of the A.I.S on the different anatomical regions with the postinjury QoL to establish a predictor of the long term QoL on these patients.

**METHODS.** We selected from our hospital traumatic database all the patients who suffered injury on the years 2006, 2007 and 2008 with an Injury Severity Score $\geq 15$ who were alive at discharge. We calculated the scoring of the A.I.S. on the different body regions and got demographic data from all the patients; after we performed the SF-12 questionnaire as well as the HAQ-DI, obtaining their scores using the established norms. After we categorized the mental and physical components of the SF-12 and the HAQ-DI results according to disability. We analyzed the correlation of the scorings using the Spearman coefficient with the SPSS-WIN 15.0 software.

**RESULTS.** From the 274 patients initially selected for the study we got 74 replied questionnaires. We found no significance on the differences between the patients who replied the questionnaires compared with those who did not reply. The statistical analysis showed a significant correlation between the scores of the "extremities- pelvis" component with the Physical Component Summary ($p < 0.01$) and with the categorized PCS and HAQ ($p < 0.05$). The "external" component showed a correlation with PCS, HAQ, categorized PCS and categorized HAQ as well ($p < 0.01$).

**CONCLUSIONS.** The results suggest that extremities, pelvic and external injuries are correlated with long term QoL, however not all A.I.S body regions are related with it. Significance was not found between the anatomical scores of A.I.S and the mental component SF-12. We should investigate if it exists clinical implications of these relationship. Further studies with bigger samples should be done to support the correlation found on our study.

**REFERENCE(S).** 1. Holtslag, H. R., Post, M. W., Lindeman, E., Van der Werken, C. (2007). Long-term functional health status of severely injured patients. *Injury, 38*(3), 280–289.
2. Ulvik, A., Kvale, R., Wentzel-Larsen, T., Flaatten, H. (2008). Quality of life 2–7 years after major trauma. *Acta Anaesthesiologica Scandinavica, 52*(2), 195–201.

## 0809

### ORGAN FAILURE SEVERITY AS AN OUTCOME MARKER IN CRITICALLY ILL RHEUMATOLOGIC PATIENTS

O.T. Ranzani[1], L.C. Battaini[1], C.E. Moraes[1], L.F. Prada[1], J.V. Pinaffi[1], A.T. Maciel[1], F.P. Giannini[1], L.C.P. Azevedo[1], S.K. Shinjo[2], M. Park[1]

[1]Hospital das Clínicas, Faculdade de Medicina da Universidade de São Paulo, Emergency Department, Intensive Care Unit, Sao Paulo, Brazil, [2]Hospital das Clínicas, Faculdade de Medicina da Universidade de São Paulo, Division of Rheumatology, São Paulo, Brazil

**INTRODUCTION.** Rheumatologic patients are frequently admitted in the ICU, mainly because of the activity of the underlying disease and/or infection associated to immunosuppression. The outcome relevance of organ failure in such clinical situation has not yet been investigated.

**OBJECTIVES.** We analyzed if the organ failure severity at the admission and/or the organ failure severity worsening during ICU stay are associated with in-Hospital mortality.

**METHODS.** 116 patients were retrieved from prospective database from 2003 to 2009. The Sequential Organ Failure Assessment (SOFA) score was used. A multivariate analysis based on a backward-LR binary logistic regression model was used with in-Hospital mortality as a dependent variable and age, APACHE II, emergency room admission, sepsis, disease activity, needing for mechanical ventilation (MV), needing for renal replacement therapy (RRT), use vasoactive drugs and total SOFA at admission or maximum SOFA were used as independent variables. Two different models were built: (a) using total SOFA (evaluating the impact of organ failure at admission on the in-Hospital mortality); (b) using the maximum SOFA (evaluating the impact of organ failure evolution on the in-Hospital mortality).

**RESULTS.** The average age was $40.5 \pm 16.7$ years old, APACHE II was $18.6 \pm 8.0$, total SOFA at admission was $5.5 \pm 4.7$ and maximum SOFA was $7.4 \pm 5.4$. The in-Hospital mortality was 36% (42 out 116), median for Hospital LOS was 15 [11–30] days and the ICU LOS was 6 [3–8] days. When the total SOFA at admission was included: age (OR 1.05; 95% CI 1.02–1.11, $p = 0.002$), emergency room admission (OR 0.24; 95% CI 0.08–0.75, $p = 0.014$), needing for MV (OR 6.94; 95% CI 2.43–19.84, $p < 0.001$) and needing for RRT (OR 2.82; 95% CI 0.90–8.80, $p = 0.075$) were associated with in-Hospital mortality. However, when the maximum SOFA was included: age (OR 1.05; 95% CI 1.02–1.11, $p = 0.002$), emergency room admission (OR 0.18; 95% CI 0.05–0.63, $p = 0.007$) and maximum SOFA (OR 1.39; 95% CI 1.22–1.59, $p < 0.001$) were independently associated with in-Hospital mortality.

**CONCLUSIONS.** : In critically ill rheumatologic patients, the organ failure severity at admission measured through the total SOFA score and the severity of disease, measured through the APACHEII score, were not associated with in-Hospital mortality. However the organ failure worsing during the ICU stay was associated independently with in-Hospital mortality.

**REFERENCE(S).** Moreels M et al. Intensive Care Med 2005;31:591–3.

# Basic research in sepsis: Pathophysiology 1: 0810–0823

## 0810

### BIPHASIC PROGRESS OF ENDOTOXIN TOLERANCE OVER TIME: ASSOCIATION WITH THE DEVELOPMENT OF A HYPERDYNAMIC CIRCULATION

M. Carlsson[1,2], M. Lipcsey[3], A. Larsson[4], J. Sjölin[2]

[1]Eskilstuna County Hospital/Mälarsjukhuset, Anesthesia and Intensive Care, Eskilstuna, Sweden, [2]Uppsala University, Infectious Diseases, Uppsala, Sweden, [3]Uppsala University, Anesthesia and Intensive Care, Uppsala, Sweden, [4]Uppsala University, Clinical Chemistry, Uppsala, Sweden

**INTRODUCTION.** Endotoxin tolerance (ET) is a well-known phenomena, defined as a reduced responsiveness to endotoxin challenge following a first encounter with endotoxin. Not much is known on the temporal development of ET. The presence of ET reduces mortality and morbidity in animal studies. However, in patients with acute respiratory distress syndrome, levels of endotoxemia and ET correlate to the severity of the disease [1].

**OBJECTIVES.** To study how the attenuation of the cytokine response develops during a continuous 24 h-endotoxin infusion and to investigate whether the level of ET correlates to outcome in terms of organ dysfunction.

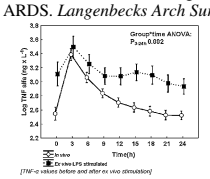
**METHODS.** Eighteen pigs were subjected to an endotoxin infusion for 24 h. Blood samples for cytokine analyses were taken and physiological variables registered every third hour. Endotoxin was also added to blood samples to a concentration of 10 ng $mL^{-1}$ and incubated at 39°C for 2 h. TNF-α was later analysed in plasma. ΔTNF-α was then calculated for all time points, where lower ΔTNF-α value were interpreted as a higher degree of ET. Repeated measures ANOVA and Wilcoxon matched pairs test were used to analyze the temporal development of ET. Spearman correlations were calculated between ΔTNF-α levels at 6 h and physiological variables at 24 h.

**RESULTS.** TNF-α values before and after *ex vivo* LPS stimulation had different temporal dynamics during 0-24 h, Fig. 1. ΔTNF-α was lowest at 6 h, followed by a gradual increase. ΔTNF-α was higher at 0 h than at all other time points except for 15–21 h. ΔTNF-α levels at 6 h correlated positively to MAP and SVRI, and negatively to cardiac index and $SvO_2$ at 24 h. ΔTNF-α did not correlate to $PaO_2/FiO_2$ ratio, pulmonary compliance, base excess or creatinine clearance at 24 h.

**CONCLUSIONS.** In contrast to the hypothesis that the continuous endotoxin load would have suppressed ΔTNF-α uniformly during the experiment, there was a biphasic course where the level of endotoxin tolerance decreased continuously from the peak at 6 h. At the time point of the peak of endotoxin tolerance, the individual level of endotoxin tolerance seems to be associated to a more hyperdynamic circulatory state with lower blood pressure and higher cardiac index at the end of the experiment.

TNF-α values before and after ex vivo stimulation

**REFERENCE(S).** 1. Buttenschoen K, Kornmann M, Berger D et al. Endotoxemia and endotoxin tolerance in patients with ARDS. *Langenbecks Arch Surg* 2008; 393:473–478.



[TNF-α values before and after ex vivo stimulation]

**GRANT ACKNOWLEDGMENT.** The R&D fund of Sörmland County Council, Sweden.

## 0811

### EXPERIMENTAL INTRA-ABDOMINAL HYPERTENSION AND ABDOMINAL COMPARTMENT SYNDROME IN TWO DIFFERENT PORCINE MODELS

M. Moller[1,2], U.K. Kjerkegaard[3], J.R. Larsen[4], A. Obukhau[5], H.B. Sorensen[2], L.B. Stolle[2]

[1]Aarhus University, Institute of Clinical Medicine, Aarhus N, Denmark, [2]Aarhus University Hospital, Department of Plastic Surgery, Aarhus C, Denmark, [3]Aarhus University, Aarhus C, Denmark, [4]Aarhus University Hospital, Department of Anesthesiology-Intensive Care, Aarhus C, Denmark, [5]Aarhus University Hospita, University Institute of Pathology, Aarhus C, Denmark

**INTRODUCTION.** Observational studies have found intra-abdominal hypertension (IAH) in up to 59% of critically ill patients in intensive care units [1]. These patients have higher mortality than non-IAH patients, especially when IAH evolves into abdominal compartment syndrome (ACS) [2]. To further investigate the pathophysiologic mechanisms that accompany IAH and ACS, development of an in vivo model is necessary.

**OBJECTIVES.** The aim of this study was to develop and compare 2 different modes of inducing IAH and ACS in pigs.

**METHODS.** 24 pigs were allocated to 3 groups; two IAH-intervention groups and one sham group. In one IAH-intervention group IAH was induced by laparoscopic carbon dioxide ($CO_2$) insufflations causing pneumoperitoneum (n=8). In the second IAH-intervention group IAH was developed by placing 7 one-liter saline plastic bags intra-abdominally to elevate intra-abdominal pressure (IAP) (n=8). A sham group (n=8) was operated without introducing IAH; four with insertion of Veress cannula without insufflations, and 4 with empty saline bags placed intra-abdominally. IAH was maintained for 12 h in the intervention groups. Invasive blood pressures, diuresis, and metabolic blood samples were monitored throughout the experiment. Organ tissue biopsies were obtained post mortem from lungs, liver, small intestine, rectus muscle and kidneys for histological examination.

**RESULTS.** In both IAH groups, the pigs fulfilled the ACS criteria with bladder pressure above 20 mmHg and new injury in several organs. Organ injury in the IAH pigs was demonstrated by anuria together with an elevation of central venous pressure and the parameters: S-potassium and S-creatinine. Organ injury could not be seen by histological examination. In the $CO_2$ group, arterial $PCO_2$ was significantly increased due to absorption of $CO_2$ from pneumoperitoneum, causing a systemic acidosis.

**CONCLUSIONS.** Both IAH-intervention models effectively imitate IAH and ACS. The only significant difference between the two modes of generating IAH was systemic acidosis found in the $CO_2$ pneumoperitoneum group.

**REFERENCE(S).** 1. Malbrain ML, Chiumello D, Pelosi P, Wilmer A, Brienza N, Malcangi V et al. Prevalence of intra-abdominal hypertension in critically ill patients: A multicentre epidemiological study. Intensive Care Med. 2004;30(5):822–9.

2. Vidal MG, Ruiz Weisser J, Gonzalez F, Toro MA, Loudet C, Balasini C et al. Incidence and clinical effects of intra-abdominal hypertension in critically ill patients. Crit Care Med. 2008;36(6):1823–31.

## 0812

### EFFECT OF INTRAABDOMINAL PRESSURE INCREASE ON INTESTINAL ISCHEMIA AND BACTERIAL TRANSLOCATION IN EXPERIMENTAL SEPSIS MODEL

U. Kesici[1], S. Kesici[2], E. Polat[3], B. Ağca[1], A. Türkmen[2], D. Özcan[4], K. Sarı[1]

[1]Ministry of Health, Okmeydani Training and Research Hospital, Third Department of General Surgery, Istanbul, Turkey, [2]Ministry of Health, Okmeydani Training and Research Hospital, Department of Anaesthesiology and Reanimation, Istanbul, Turkey, [3]University of Istanbul, Cerrahpasa Faculty of Medicine, Department of Microbiology and Clinical Microbiology, Istanbul, Turkey, [4]Ministry of Health, Okmeydani Training and Research Hospital, Department of Pathology, Istanbul, Turkey

Nowadays, laparoscopic surgical approaches took the place of conventional approaches in the diagnosis and treatment of many diseases.However, laparoscopic approaches are constrained in acute peritonitis related sepsis because pneumoperitoneum increases intestinal ischemia and bacterial translocation.We aimed to observe the effects that could develop with pneumoperitoneum by taking tissue and blood samples in order to reveal intestinal ischemia and bacterial translocation in acute peritonitis related sepsis model.

**METHOD.** Wistar-Albino,adult 32 female rats were used.Rats were divided in 4 groups,each consisting of 8 rats.Intraabdominal sepsis was developed by intraperitoneal (ip) 1 mL ($10^9$ CFU/mL) *Escherichia coli* (*E. coli*) injection and pneumoperitoneum was developed by $CO_2$ insufflation at 8 mmHg pressure for 1 h. All the interventional operations on rats were done under anesthesia.1 mL ip isotonic saline to Group I; 1 mL ip saline+pneumoperitoneum to Group II; ip E.coli to Group III and ip *E. coli*+pneumoperitoneum to Goup IV were administered. Rectal temperature+leukocyte values of all rats were measured 2 h after ip injection. Pneumoperitoneum was formed after rectal temperature, leukocyte values of rats were measured in Group II+IV. Blood and tissue samples(from liver,spleen,mesenteric lymph node) for microbiological evaluation and tissue samples from small intestine for histopathological evaluation were collected from rats by thoracotomy and laparotomy performed after 6 to 8 h. 1 and above were evaluated as necrosis (+) according to Modified Chiu's Score(MCS) system in histopathological evaluation.Reproduction in any of the tissue or blood cultures was assessed as 'reproduction (+)' and no reproduction in any of the cultures was assessed as 'reproduction (−)'.

**RESULT.** Temperature,leukocyte values measured at the end of 2 h were found significantly higher in Group III and IV compared to Group I and II ($p < 0.01$).Intraabdominal related sepsis was demonstrated in groups III and IV because the reproduction rate of *E. coli* strain injected was determined as 0% in Group I and Group II and as 100% in Group III and IV.Bacterial translocation was not determined in any of the groups.While intestinal ischemia was not determined in any of the rats in Group I and II,it was detected in 2 rats in both Group III and IV. However a significant difference wasn't detected statistically in the comparison made between intestinal ischemia rates of groups. MCS of all the rats in Group III and IV with intestinal ischemia was determined to be 1.

**CONCLUSION.** In case of intraabdominal sepsis, no difference was determined in terms of intestinal ischemia and bacterial translocation when pneumoperitoneum was developed at 8 mmHg for 1 h, in our study.Therefore we consider that laparoscopic operations with low pressure can be used securely for both diagnosis and treatment in the event of intraabdominal related sepsis requiring emergency action but this study must be supported with clinical trials.

## 0813

### PROTEOMIC ANALYSIS OF ALTERED PROTEIN EXPRESSION IN PLATELET OF RATS WITH EARLY SEPSIS

N. Li[1], J.-B. Li[1], X.-M. Deng[1]

[1]Second Military Medical University, Department of Anaesthesia, Changhai Hospital, Shanghai, China

**INTRODUCTION AND OBJECTIVES.** Platelet dysfunction and thrombocytopenia are common phenomenon in early sepsis, but the contribution of platelet to the pathophysiology of early sepsis remains poorly understood. The aim of the present study was to investigate the potential response of the platelet proteome to early sepsis, in order to obtain a better understanding of the role of platelets in the pathophysiology underlying early sepsis.

**METHODS.** We applied proteomic technology to analyze platelet samples of rats with early sepsis. Rats were divided into sham group and cecal ligation and puncture (CLP) group. Platelet samples were collected from Surviving rats 12 h after surgery in each group, and platelet proteins were separated with two-dimensional electrophoresis (2-DE). Differentially expressed proteins were identified by mass spectrometry (MS).

**RESULTS.** Using proteome analysis, a differential platelet protein expression was discovered between sham group and CLP group. 20 spots showed statistically significant differences, and a total of 12 spots were successfully identified. The significant changes in the differential proteins were confirmed by Western blotting analysis.

**CONCLUSIONS.** By applying proteomics to a clinically relevant rat model of early sepsis we identified several platelet proteins that changed in abundance associated with platelet activation, acute phase proteins, cytoskeleton structure and energy production. Our results showed that proteomic analysis may bring us closer to achieve a comprehensive platelet bioinformation profiling in early sepsis.

## 0814

### EFFECT OF EPINEPHRINE ON OXIDATIVE STRESS AND CELLULAR ENERGY BALANCE IN HUMAN PULMONARY MICROVASCULAR CELLS SUBMITTED TO ISCHEMIA REPERFUSION

A. Harrois[1,2], L. Dupic[2], S. Lecart[3], O. Huet[1,2], E. Vicaut[2], M.-P. Fontaine-Aupart[3], J. Duranteau[1,2]

[1]Bicêtre Hospital, Anesthesiology and Intensive Care, Le Kremlin Bicetre, France, [2]Microcirculation, Energy, Inflammation, Circulatory Failure Laboratory, Paris VII-XI-XIII University, Paris, France, [3]Biophotonic Team from Orsay Molecular Sciences Institute (ISMO) and Photonic Biomedical Center from Paris-Sud-Orsay University, Orsay, France

**INTRODUCTION.** Endothelial cell is a front-rank target during ischemia–reperfusion (I/R) phenomenons that occur during shock states. Ischemic phase leads to energetic failure whereas reperfusion phase involves burst of reactive oxygen species (ROS) that may be deleterious for cellular integrity. Epinephrine is frequently administered during shock state and could worsen I/R injuries due to its capacity to enhance metabolism while oxygen is lacking. We aimed at exploring in vitro effect of epinephrine on energy balance and intracellular ROS production in a model of endothelial cells submitted to I/R.

**OBJECTIVES.** What are the effects of epinephrine on energy balance and ROS production in a model of endothelial cells submitted to ischemia–reperfusion?

**METHODS.** Pulmonary microvascular endothelial cells were grown to confluence on glass coverslips that were placed in a perfusion chamber mounted on an inverted confocal microscope. Cells were submitted to a 40 min equilibrium period during which they were perfused with Krebs containing glucose and oxygen (mesured $PO_2$=140 ± 5 mmHg). Cells were then submitted to one hour ischemia in hypoxic Krebs (measured $PO_2$ = 4.8 ± 2 mmHg) without glucose (and containing glycolysis inhibitor : 2-deoxyglucose). Reperfusion takes place during one hour in Krebs medium similar to equilibrium phase. Epinephrine was added at a concentraiton of 100 microM. 4 cells group were constituted: control group without I/R (CL), a group with I/R (I/R), a control goup with epinephrine ($CL_{epi}$) and a group I/R with epinephrine ($I/R_{epi}$). Cellular energy balance was explored with NAD(P)H autofluorescence ($Wavelength_{exc}$/$Wavelength_{em}$=364/400–550 nm). Intracellular ROS production during reperfusion was explored thanks to fluorescent probe MitoSOX ($Wavelength_{exc}$/$Wavelength_{em}$ = 514/570–630 nm).

**RESULTS.** In I/R group, ischemia led to a significant decrease in NAD(P)H autofluorescence intensity (expressed in % of autofluorescence value at the end of equilibrium period) : 60 ± 2 versus 97 ± 4% in CL. During reperfusion, a partial increase of NAD(P)H autofluorescence signal was observed (80 ± 2 vs. 98 ± 8% in CL) ($p < 0.0001$ ANOVA). Epinephrine didn't modify NAD(P)H fluorescence variation in $CL_{epi}$ and $I/R_{epi}$ in comparison with CL and I/R respectively. During reperfusion, ROS production as judged by MitoSOX fluorescence was significantly increased in I/R group (145 ± 18 faU vs. 64 ± 9 faU in CL). Epinephrine significantly decreased ROS production as judged by MitoSOX fluorescence during reperfusion (71 ± 13 afU in $I/R_{epi}$) ($p < 0.05$ ANOVA).

**CONCLUSIONS.** Epinephrine do not worsen energy inbalance as judged by NAD(P)H autofluorescence in endothelial cells submitted to I/R. Moreover epinephrine has an antioxydant effect during reperfusion that deserves complementary mechanistical exploration.

## 0815

### C5A MEDIATED NEUTROPHIL DYSFUNCTION PRECEDES AND PREDICTS NOSOCOMIAL INFECTION IN CRITICAL ILLNESS

A. Conway Morris[1], J. Antonelli[2], M. Brittan[1], C. McCulloch[2], I. Laurenson[3], D.G. Swann[4], A. Hay[4], T.S. Walsh[4], A.J. Simpson[1]

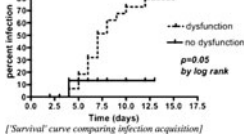
[1]University of Edinburgh, Centre for Inflammation Research, Edinburgh, UK, [2]Royal Infirmary of Edinburgh, Clinical Research Facility, Edinburgh, UK, [3]Royal Infirmary of Edinburgh, Clinical Microbiology, Edinburgh, UK, [4]Royal Infirmary of Edinburgh, Critical Care, Edinburgh, UK

**INTRODUCTION.** Nosocomial infection commonly occurs amongst patients in ICU [1], and has a significant impact on morbidity and mortality. It is thought to reflect underlying immune dysfunction. Our group had previously demonstrated that neutrophil dysfunction in ICU patients was mediated by the anaphylotoxin C5a [2].

**OBJECTIVES.** To test the hypothesis that C5a mediated neutrophil dysfunction would predict those patients at increased risk of nosocomial infection.

**METHODS.** Critically ill patients (patients requiring support of 1 or more organ systems for at least 48 h) admitted to ICU were recruited within 48 h of admission. Serial blood samples were analysed for neutrophil CD88, a cell surface marker reflecting C5a exposure which correlates strongly with neutrophil dysfunction [2]. Infection was determined by pre-defined criteria. Patient data were censored from 48 h before nosocomial infection occurred to reduce the risk of infection itself causing the effect seen. Patients were stratified into neutrophil dysfunction (low CD88, high C5a exposure) and no neutrophil dysfunction (high CD88, low C5a exposure) subgroups and the effects on acquisition of infection determined.

**RESULTS.** 60 patients were recruited, C5a mediated neutrophil dysfunction was common occurring in 65% of patients. 21 patients (35%) developed nosocomial infection (8 pneumonias, 6 blood stream infections, 3 urinary tract infections, 4 soft tissue/intra-abdominal infections). Of note, clinical factors such as severity of illness scores and demographic factors failed to predict those who would acquire infection. In contrast, C5a mediated neutrophil dysfunction was a strong predictor, neutrophil dysfunction conferred a 5.75 times greater risk of infection compared to no dysfunction (95% CI 1.5–22, P=0.0008). The effect persisted when accounting for time effects by survival analysis (Hazard ratio 3.6 95% CI 1.0–7.6),




'Survival' curve comparing infection acquisition

**CONCLUSIONS.** This work demonstrates that C5a mediated neutrophil dysfunction is a predictor of those who will go onto develop nosocomial infection in ICU. Also CD88 can act as a biomarker of dysfunction, allowing risk stratification and targeted therapy. Further work is required to determine optimum therapies to modulate C5a mediated neutrophil dysfunction and reduce the risk of infection.

**REFERENCE(S).** 1. Vincent JL et al. JAMA. 2009;302:2323–9
2. Conway Morris A et al. AJRCCM. 2009;180:19–28

**GRANT ACKNOWLEDGMENT.** Chief Scientist Office, NHS Scotland Grant **CAF/08/13.**

## 0816

### INFLAMMATORY RESPONSE IN A RENAL I/R IN A TWO HIT MODEL

A.C. Brøchner[1], F. Dagnæs-Hansen[2], J.H. Holm[1], P. Toft[1]

[1]Odense University Hospital, Department of Anesthesiology and Intensive Care Medicine, Odense, Denmark, [2]University of Århus, Medical microbiology and immunology, Århus, Denmark

**INTRODUCTION.** Animal models of renal failure are often only single hit models. In order to try to mimic the circumstances during renal i/r in sepsis, we made a study with a 2-hit model. In our study one hit was i/r, or other surgery of relevance and the second hit was the administration of LPS.

**OBJECTIVES.** Our hypothesis was that renal i/r creates a larger inflammatory response in distant organ and a higher cytokine levels in the blood, than for example i/r of the hind legs.

**METHODS.** 40 mice in 5 groups. The mice were subjected to following operations; A) i/r of both kidneys + LPS, B) i/r of both hind legs + LPS, C) sham (no LPS), D) LPS only, E) nefrectomy + LPS. I/r time was identical in group A and B. All mice where kept alive for 24 h and then sacrificed. Il-1, 6, 10 and TNF -α was measured in blood. The activity of myeloperoxidase (MPO) in lungs, kidneys and liver was evaluated as an indirect measurement of accumulation of granulocytes.

**RESULTS.** In this study renal i/r showed elevated levels of IL-1 and IL-6 (34004, $p < 0.05$) as compared to the four other groups. As for MPO there was a higher activity in kidney and in liver (1212 ng/ml) as compared to hind leg i/r. The highest levels of MPO were found in the lungs and liver of the groups with LPS only and in the group with nefrectomy + LPS.

**CONCLUSIONS.** With a two-hit model renal i/r attenuates the inflammatory response more profoundly than hind leg i/r. The high levels of MPO in nefrectomized mice might be explained by a reduced clearing of inflammatory mediators in the kidney.

## 0817

### OBESITY AGGRAVATES MICROVASCULAR ENDOTHELIAL DYSFUNCTION IN SEPSIS THROUGH ADIPOCYTE-ENDOTHELIAL CROSSTALK

M. van Meurs[1], P. Castro[1], N.I. Shapiro[1], S. Lu[1], M. Yano[1], W.C. Aird[2], K. Yano[1]

[1]Beth Israel Deaconess Medical Center/Harvard Medical School, Center for Vascular Biology Research and Department of Emergency Medicine, Boston, USA, [2]Beth Israel Deaconess Medical Center/Harvard Medical School, Center for Vascular Biology Research and Division of Molecular and Vascular Medicine Department of Medicine, Boston, USA

**INTRODUCTION.** Previous studies suggest that obesity is associated with inferior outcome in septic patients [1], and that the microvascular endothelial responses play a key role in mediating sepsis morbidity and mortality [2, 3]. Furthermore, crosstalk between adipoyctes and endothelial cells is an important determinant of endothelial behavior in metabolic studies in mice.

**OBJECTIVES.** Study the role of obesity and adipocyte-endothelial cell interactions in sepsis using a murine model.

**METHODS.** 12 week-old C57Bl/6 male diet-induced obese (DIO) mice (60% fat diet) and age-matched lean littermates (10% fat diet) were injected intraperitoneally with E. coli lipopolysaccharide (LPS) (8 mg/kg). Sixteen hours after LPS injection, mice were anesthetized, blood was withdrawn via cardiac puncture, and animals were perfused with PBS. All major organs, including inguinal fat were harvested and snap frozen. In a subset of mice survival experiments after LPS injection were performed. In vitro experiments were carried out using human endothelial cells (HUVEC) and conditioned media (CM) from an adipocyte cell line (3T3-L1) incubated with or without LPS.

**RESULTS.** Compared with lean mice, endotoxemia in obese mice resulted in significantly higher circulating levels of leptin (1.9-fold, $p < 0.01$), sVEGFR1 (1.5-fold, $p < 0.05$) and IL-6 (3.8-fold, $p < 0.05$) at 24 h. Endotoxemia in obese mice increased the induction of vascular bed-specific endothelial inflammatory gene expression. For instance, in obese mice P-selectin levels were significantly higher in the liver (1.7-fold), kidney (1.4-fold) and lung (1.2-fold) ($p < 0.05$), but not in fat tissue, compared to their lean littermates. Endotoxemia resulted in increased mortality in DIO mice ($p < 0.02$). Incubation of HUVEC with CM from LPS-treated adipocytes significantly up-regulated ICAM-1 (5.1-fold), VCAM-1 (6.1-fold), and E-selectin (5.8-fold) ($p < 0.0001$) compared with CM from control treated adipocytes. Pre-conditioning of endothelial cells with 10 microM Bay11-7082, a pharmacological NF-kB inhibitor, completely abolished adipocyte-mediated endothelial activation.

**CONCLUSIONS.** These data suggest that obesity increases sepsis morbidity and mortality in a mouse model. This increase is associated with endothelial activation, which is mediated at least in part, via adipocyte induced endothelial NF-kB activation.

**REFERENCE(S).** 1. N. Bercault et al. Crit Care Med. 32, 998 (2004).
2. K. Yano et al. J Exp Med. 203, 1447 (2006).
3. K. Yano et al. J Exp Med. 205, 2623 (2008).

**GRANT ACKNOWLEDGMENT.** This project was funded by National Institute of Health grants: R01HL091757, P50GM076659 and R01HL093234-01 (NIS) and by a Dutch Kidney Foundation grant, KSBP.09.013 (MvM).

## 0818

### A 2-STEP CELL CULTURE MODEL: INFLUENCE OF UNKNOWN FACTORS IN ENDOTOXICEMIA

D. Schwanzer-Pfeiffer[1], E. Roßmanith[1], D. Falkenhagen[1]

[1]Danube University Krems, Krems, Austria

**INTRODUCTION.** Activation of the endothelium and the recruitment of blood cells are some major events in endotoxicemia. Microarray analysis of stimulated THP-1 monocytes and endothelial cells identified some interesting factors, which are so far unknown in endotoxicemia.

**OBJECTIVES.** Aim of this work was to investigate the function of these unknown factors in a 2-step cell culture model of endotoxicemia.

**METHODS.** Lipopolysaccharide (LPS) was used as a stimulant for THP-1 monocytes [4 h] to produce a conditioned medium in a first step. In a second step this conditioned medium was used for the stimulation of human umbilical vein endothelial cells (HUVECs) [16 h] and changes in gene expression of stimulated THP-1 monocytes and HUVECs were analyzed by microarray analysis. SVEP-1, SRPUL and KIAA, were selected for further analysis due to their different expression pattern after stimulation. Pro- and anti-inflammatory cytokines and complement factors were investigated after transfection of HUVECs with complementary siRNAs.

**RESULTS.** Soluble E-selectin revealed a significant increase after transient gene silencing of SVEP-1 and SRPUL transfection of 19 and 14% respectively. Additionally, soluble ICAM-1 showed a slightly increased expression of about 10 and 11% in KIAA and SRPUL transfected cells. No differences were investigated in IL-6, IL-8, sVCAM-1, C3a and C5a concentrations compared to the untransfected control. To confirm aforementioned results we performed quantitative RT-PCR and FACS analysis.

**CONCLUSIONS.** In conclusion, SVEP-1 and SRPUL seemed to be involved in the inhibition of ICAM and E-selectin shedding, since the concentration of soluble factors of ICAM and E-selectin increased in the absence of either SVEP-1 or SRPUL.

## 0819

### PLASMA FROM PATIENTS WITH SEPSIS CARRIES A HIGH OPSONIC ACTIVITY, ENHANCING BACTERIAL PHAGOCYTOSIS BY NEUTROPHILS

C.R.A. Oliveira[1], V. Nobre[1], I. Dunn-Siegrist[2], F. Botoni[1], J. Pugin[2]

[1]School of Medicine, Universidade Federal de Minas Gerais, Internal Medicine Division and Intensive Care Service, Belo Horizonte, Brazil, [2]University Hospitals of Geneva, Intensive Care Service, Geneve, Switzerland

**INTRODUCTION.** Innate immune responses to bacteria are altered during sepsis. Little is known however as to which aspects of this response are impaired. In particular, the capacity of septic plasma to support phagocytosis remained to be determined in comparison to other groups of patients.

**OBJECTIVES.** We sought to investigate the opsonic activity of plasma from different groups of ICU patients, in an assay using neutrophil-like target phagocytes, DMSO-differentiated HL-60 cells. The assay was carried out with plasma from

(1) Septic patients;
(2) Patients with non-infectious SIRS; and
(3) Patients without SIRS.

**METHODS.** Heparinized blood was obtained in adult ICU patients at the time of admission. Opsonophagocytosis tests were performed by adding decomplemented plasma to neutrophil-like HL-60 cells together with fluorescent *E. coli* bacteria. The phagocytic index was measured by flow cytometry after 20 and 50 min of incubation.

**RESULTS.** 65 patients were included (mean age 50 ± 19 years, 64% males), sepsis (n=30), non-infectious SIRS (n=24), and non-SIRS (n=11). The phagocytic activity of neutrophils at 20 and 50 min was significantly higher with plasma obtained from septic patients as compared to that observed when plasma from non-infectious SIRS and non-SIRS patients were used (p=0.009 and p=0.03, respectively).This difference remained significant at 20 min in the analysis restricted to patients with SIRS (n=54; p=0.016). Considering the entire set of patients, the 28-day mortality was higher in patients with plasma supporting higher opsonic activity at 20 and 50 min (p=0.025 and p=0.015, respectively) and at 50 min in the analysis including only patients with SIRS (p=0.048).

**CONCLUSIONS.** Using an in vitro model, the phagocytic activity of human neutrophil-like cells was increased by plasma from septic patients as compared with plasma from SIRS and non-SIRS controls. Moreover, in a population of critically ill patients with SIRS, a higher plasma opsonic activity was associated with higher mortality.

**REFERENCES.** Cohen J: The immunopathogenesis of sepsis. Nature 420:885–891, 2002; Underhill DM, Ozinsky A: Phagocytosis of microbes: complexity in action. Annu Rev Immunol. 20:825–852, 2002.

Blair OC, Carbone R, Sartorelli, AC: Differentiation of HL-60 promyelocytic leukemia cells: simultaneous determination of phagocytic activity and cell cycle distribution by flow cytometry. Cytometry 7: 171–177, 1986.

Kaufmann I, Hoelzl A, Schliephake F, Hummel T, Chouker A, Peter K, Thiel M: Polymorphonuclear leucocyte dysfunction syndrome in patients with increasing sepsis severity. Shock 26: 254–261, 2006.

**GRANT ACKNOWLEDGMENT.** We gratefully thank the Swiss National Science Foundation that supported JP and FAPEMIG that contributes with this study.

## 0820

### TISSUE PGC-1*A* MRNA LEVELS IN A RODENT MODEL OF SEPSIS

R. Nash[1], J.E. Carré[1], A. Dyson[1], M. Singer[1]

[1]University College London, Bloomsbury Institute for Intensive Care Medicine, London, UK

**INTRODUCTION.** Mitochondrial dysfunction is associated with poor outcome in septic patients [1]. Mitochondrial biogenesis maintains mitochondrial function and is mediated in part by transcription factors and the transcriptional co-activator PGC-1α, a marker of mitochondrial biogenesis. Muscle PGC-1α levels were significantly higher in survivors of critical illness [2]. In a rodent model of sepsis we thus investigated the relationship between severity of outcome and transcript levels of PGC-1α.

**OBJECTIVES.** To determine PGC-1α mRNA levels in different organs and timepoints in a rodent model of sepsis.

**METHODS.** Liver, kidney and skeletal muscle were taken from a fluid-resuscitated rat model of sepsis; animals were divided into predicted survivors and non-survivors at 72 h based on echocardiography-derived stroke volumes [submitted for publication]. mRNA levels for PGC-1α were determined by qPCR and standardised to ActB mRNA. Data were analysed for significance using two-way ANOVA and tested for normality (Kolmogorov–Smirnov). Independent t tests were used to compare samples between groups.

**RESULTS.**

ARBITRARY LEVELS OF PGC-1A/ß-ACTIN MRNA

| | Liver | | Kidney | | Muscle |
|---|---|---|---|---|---|
| | 6 h * | 24 h * | 6 h * | 24 h | 24 h * |
| Sham | 0.67 (0.81) | 1.44 (1.24) | 0.91 (0.55) | 0.92 (0.47) | 0.70 (0.29) |
| Survivor | 0.32 (0.29) | 7.54 (6.00)[a, c] | 0.78 (0.21) | 0.67 (0.12) | 0.42 (0.47) |
| Non-survivor | 0.57 (0.77) | 6.14 (1.53)[b, d] | 0.64 (0.13) | 0.69 (0.24) | 0.08 (0.08)[a] |

n=5–6. Mean (standard deviation). Naïve values: Liver: 1.05 (0.08), kidney 1.60 (0.51), muscle 0.75 (0.26)· [a] $p < 0.05$ versus sham [b] $p < 0.005$ versus sham [c] $p < 0.05$ versus 6 h [d] $p < 0.005$ versus 6 h. * ANOVA significance.

PGC-1α levels fell in all septic groups at 6 h. At 24 h, levels increased significantly in liver but remained low in skeletal muscle, particularly in eventual non-survivors. No change was observed in kidney.

**CONCLUSIONS.** PGC-1α levels change during sepsis, however this varies between different organ beds. Further markers of the biogenesis response, and at later timepoints, need to be assessed.

**REFERENCE(S).** 1. Brealey D et al. Lancet 2002; 360:219–23

2. Carre et al. Am J Resp Crit Care Med 2010 (in press)

**GRANT ACKNOWLEDGMENT.** Biotechnology and Biological Sciences Research Council, UK.

## 0821

### TIME TO RESUSCITATION IN SEPSIS AND OUTCOME: A PRELIMINARY EVALUATION OF CLINICAL PATTERN, INCIDENCE OF ORGAN DYSFUNCTION AND MORTALITY IN A PORCINE MODEL OF FECAL PERITONITIS

T.D. Correa[1], A. Reintam[1], J. Takala[1], D. Siamak[1], M. Vuda[1], M. Dünser[1], S.M. Jakob[1]

[1]University Hospital Bern (Inselspital), Department of Intensive Care Medicine, Bern, Switzerland

**INTRODUCTION.** Severe sepsis and septic shock are leading causes of death in critically ill patients. Early treatment may improve outcome but the critical length of the delay from onset to treatment is not known [1].

**OBJECTIVES.** To describe the evolution of organ failure and influence of treatment on the outcome of experimental sepsis depending on the time delay between onset of sepsis and start of resuscitation.

**METHODS.** 24 anesthetized pigs [40.1 ± 4.1 kg] were randomly assigned (n=6 per group) to a non-septic control group (CG) or one of three groups in which resuscitation was initiated 6 (ΔT-6 h), 12 (ΔT-12 h) or 24 (ΔT-24 h) hours after induction of fecal peritonitis (instillation of 2 g/kg autologous feces). In the treatment groups resuscitation was performed for 48 h according to the Surviving Sepsis Campaign. During the study, all animals received a basal infusion (3 mL/kg/h) of Ringer's Lactate (RL) and glucose 50%. Additionally, bolus of 150 mL RL and 6% hydroxyethyl starch (130/0.4), norepinephrine and dobutamine were administered when necessary to reach a mean arterial pressure (MAP) ≥60 mmHg, mixed venous oxygen saturation ≥50%, urine output ≥0.5 mL/kg/h and arterial lactate level < 2.0 mmol/L. Cardiovascular dysfunction was defined as MAP < 60 mmHg or norepinephrine or dobutamine used in any dose. Pulmonary ($paO_2/FiO_2$), renal (creatinine), hepatic (bilirubin), and haematological (platelets) dysfunctions were defined as >25% deviation from the highest or lowest baseline value of the current study population.

**RESULTS.** Two of six animals in both the ΔT-12 h and the ΔT-24 h group died during the study. Allocation to groups ΔT-12 h and ΔT-24 h was associated with a higher incidence of new organ dysfunction during the study period and higher arterial lactate concentrations (Table 1). Pigs in the ΔT-12 h and ΔT-24 h group tended to received more fluids, norepinephrine and dobutamine than those in the CG and ΔT-6 h group (Table 2).

**CONCLUSIONS.** These preliminary data suggest that 6 h from onset of sepsis to start of resuscitation may be the critical limit for prevention of organ dysfunction and mortality during the following 48 h.

**REFERENCE.** 1. Rivers E. Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Engl J Med 2001;345:1368–77.

**TABLE 1**

| New organ dysfunction [mean (SD)] | Baseline | Time 0 h | Time 0 h-24 h | End | p value (t-g interaction) |
|---|---|---|---|---|---|
| CG | 0 (0) | 0 (1) | 1 (1) | 1 (1) | 0.007 |
| ΔT-6 h | 0 (0) | 0 (0) | 1 (1) | 2 (1) | |
| ΔT-12 h | 0 (0) | 0 (1) | 2 (1) | 3 (1) | |
| ΔT-24 h | 0 (0) | 1 (1) | 3 (1) | 3 (2) | |
| Arterial lactate [mean (SD)] | | | | | |
| CG | 0.8 (0.2) | 0.4 (0.1) | 0.4 (0.1) | 0.4 (0.1) | 0.008 |
| ΔT-6 h | 0.8 (0.3) | 1.0 (0.2) | 0.8 (0.2) | 0.9 (0.2) | |
| ΔT-12 h | 0.8 (0.2) | 1.1 (0.2) | 1.2 (0.5) | 1.8 (1.9) | |
| ΔT-24 h | 0.9 (0.2) | 2.3 (1.3) | 1.3 (0.6) | 2.5 (3.2) | |

**TABLE 2**

| Variable [Mean (SD)]/Group | CG | ΔT-6 h | ΔT-12 h | ΔT-24 h | p value |
|---|---|---|---|---|---|
| Fluid bolus (ml/kg/h) | 0.4 (0.5) | 0.6 (0.4) | 1.6 (1.1) | 3.4 (4.0) | 0.16 |
| Norepinephrine (mcg/kg/min) | 0.0 (0.0) | 0.02 (0.0) | 0.07 (0.1) | 0.10 (0.1) | 0.32 |
| Dobutamine (mcg/kg/min) | 0.2 (0.5) | 0.0 (0.0) | 0.3 (0.3) | 0.6 (1.3) | 0.12 |

## 0822

### FLUID LOSS FROM INTRAVASCULAR SPACE OCCURS EARLY IN SEPSIS: PRELIMINARY RESULTS IN EXPERIMENTAL PORCINE PERITONITIS

A. Reintam Blaser[1], T.D. Correa[1], J. Takala[1], S. Djafarzadeh[1], M. Vuda[1], M. Dünser[1], S.M. Jakob[1]

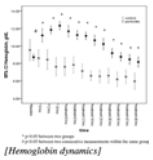
[1]Inselspital, Bern, Switzerland

**INTRODUCTION.** Fluid loss from intravascular space in sepsis is a well-known phenomenon, but the time course and extent of this process have not been studied in detail.

**OBJECTIVES.** To evaluate the speed and extent of fluid shift from intravascular space, assessed through the development of hemoconcentration, in a porcine model of sepsis.

**METHODS.** Twenty-four anaesthetized pigs [40.1 ± 4.1 kg (mean, SD)] were randomly assigned (n=6 per group) to a non-septic control group or one of three septic groups in which the pigs were observed for 6, 12 or 24 h after induction of faecal peritonitis (instillation of 2 g/kg autologous faeces). Following the observation time, resuscitation was performed for 48 h based on the Surviving Sepsis Campaign guidelines. Pigs allocated to the control group were observed for 72 h. Before induction of peritonitis (baseline), all pigs received 500 mL of Ringer's Lactate (RL). During the whole study all animals received a basal infusion at 3 mL/kg/h (RL and glucose 50%). Alternating boluses of 150 mL RL or 6% hydroxyethyl starch (130/0.4) were added to reach preset hemodynamic targets during the resuscitation period in septic animals and during the entire study period in controls. Hemoglobin (Hb) levels were measured at 6 h intervals. Hematocrit (Hct) was calculated as 3× Hb (g/dL) and normal blood volume (BV) as 67 mL/kg. BV at 6 h was calculated as normal BV x (Hct at Baseline/Hct at 6 h). Repeated measurements ANOVA and Student's *t* test were used for comparisons between groups.

**RESULTS.** Hb dynamics differed significantly between groups (group-time interaction: $p < 0.001$). Mean Hb levels at baseline did not differ between the control and septic groups (p=0.155). During the first 6 h, mean Hb levels decreased in control animals, while they increased in septic animals ($p < 0.001$). The mean calculated plasma deficit during the first 6 h after induction of sepsis was 577 (250) mL accounting for 21.8 (9.2) % of normal BV. Two control pigs received fluid boli (450 and 750 mL, respectively) during the first 6 h. Urine output was comparable in control and septic animals during the first 24 h. No remarkable blood loss occurred in any study animal.




Hemoglobin dynamics

**CONCLUSIONS.** Significant hemoconcentration develops during sepsis compared to non-septic controls with equal intravenous fluid administration. These results suggest that major fluid sequestration from intravascular space occurs already during the first 6 h of sepsis.

## 0823

### VENTILATOR-INDUCED LUNG INJURY IS MEDIATED BY THE NLRP3 INFLAMMASOME

M.T. Kuipers[1,2,3,4], H. Aslami[1,2], T. van der Poll[3,4], M.J. Schultz[1,2], C.W. Wieland[1,2]

[1]Academic Medical Center at the University of Amsterdam, Laboratory of Experimental Intensive Care and Anaesthesiology (L.E.I.C.A), Amsterdam, Netherlands, [2]Academic Medical Center at the University of Amsterdam, Intensive Care Medicine, Amsterdam, Netherlands, [3]Academic Medical Center at the University of Amsterdam, Center of Experimental and Molecular Medicine, Amsterdam, Netherlands, [4]Academic Medical Center at the University of Amsterdam, Center of Infection and Immunity, Amsterdam, Netherlands

**INTRODUCTION.** Mechanical ventilation (MV) is an indispensable tool in the treatment of patients with acute respiratory failure. However, despite its life-saving support MV may cause additional lung injury and pulmonary inflammation. The exact mechanism by which MV initiates inflammation is still not completely understood. The caspase-1 activating NLRP3 inflammasome is an intracellular danger sensor of the innate immune system known to mediate sterile inflammatory responses in different diseases.

**OBJECTIVES.** To analyze the involvement of the NLRP3 inflammasome in ventilator-induced lung injury (VILI).

**METHODS.** Wild-type (WT) C57BL/6, NLRP3 knockout (KO) and apoptosis-associated speck-like protein (ASC) KO mice were tracheotomized and ventilated for 5 h with a high tidal volume ($V_T \sim 15$ ml/kg), known to cause VILI. Spontaneously breathing mice served as controls. In addition, mice were treated with the NLRP3 inflammasome blocker glibenclamide (500 mg/kg i.p.) or vehicle (10% DMSO) 1 h before MV. NLRP3 inflammasome gene expression in lung tissue and the presence of NLRP3 inflammasome ligands in bronchoalveolar lavage fluid (BALF) were analyzed. Endpoints of VILI were relative lung weights, neutrophil influx, total protein in BALF and pulmonary and plasma cyto- and chemokine levels.

**RESULTS.** Uric acid, an important ligand for the NLRP3 inflammasome was released in BALF of mechanically ventilated mice. mRNA of NLRP3 and ASC, both proteins of the NLRP3 inflammasome complex, were upregulated due to MV. After 5 h of MV, NLRP3 and ASC KO mice displayed significantly lower relative lung weights, neutrophil influx and pulmonary and plasma IL-6 levels when compared to WT mice. In line, NLRP3 inflammasome blockage with glibenclamide resulted in reduced relative lung weights, neutrophil influx, total protein and IL-6 levels in BALF when compared to the vehicle treated group.

**CONCLUSIONS.** Ventilator-induced lung injury is mediated by the NLRP3 inflammasome and blockage of NLRP3 inflammasome activation attenuates lung inflammation induced by MV.

**GRANT ACKNOWLEDGMENT.** C.W.Wieland was sponsored by The Netherlands Organization for Scientific Research (NWO).

# Renal replacement therapy: 0824–0836

## 0824

### EXTERNAL VALIDATION AND COMPARISON OF THREE SCORES TO PREDICT THE NEED FOR RENAL REPLACEMENT THERAPY AFTER CARDIAC SURGERY: A MULTICENTER COHORT

M. Vives[1], P. Monedero[1], J.R. Pérez Valdivieso[1], N. Garcia Fernández[2], J. Lavilla[2], J. Herreros[3], M. Bes Rastrollo[4], GEDRCC (Grupo Español de Disfunción Renal en Cirugía Cardiaca)

[1]Clinica Universidad de Navarra, Anaesthesia and Critical Care, Pamplona, Spain, [2]Clinica Universidad de Navarra, Nephrology, Pamplona, Spain, [3]Clinica Universidad de Navarra, Cardiovascular Surgery, Pamplona, Spain, [4]Clinica Universidad de Navarra, Epidemiology and Public Health, Pamplona, Spain

**INTRODUCTION.** Cardiac surgery-associated acute kidney injury requiring renal replacement therapy (RRT) is associated with high morbidity and mortality. Several risk scores have been developed to predict the need for RRT after cardiac surgery from pre-operative risk factors.

**OBJECTIVES.** The aim of this study was to compare and verify the external validity of the three main available scores for RRT prediction: the Thakar score (TS), the Mehta tool (MT) and the Simplified Renal Index (SRI), in a regional European cohort.

**METHODS.** In a cohort of 1,084 adult patients who underwent open-heart surgery in 24 Spanish hospitals in 2007, postoperative RRT was necessary in 248 patients. Data on pre-operative risk factors for all patients were obtained retrospectively from hospital databases and medical records. For each patient, the risk scores were calculated on the basis of the original publications.

**RESULTS.** The predictive indices had areas under the receiver operating characteristic curve in TS, MT and SRI of 0.82, 0.76 and 0.79, respectively. After probability calculation, the three scoring systems had significantly reduced tested values, suggesting they were poorly calibrated, they tended to underestimate the actual RRT need.

**CONCLUSIONS.** Using a multicenter cohort of open-heart surgery patients, we have externally validated three scoring systems for the prediction of postoperative RRT. TS and SRI discriminated well between low- and high-risk patients in our cohort, and both outperformed MT. In addition to preoperative renal function, heart failure, reoperation and emergent surgery are important variables to consider whenassessing RRT risk.

**REFERENCE(S).** 1. Rosner MH, Okusa MD. Acute kidney injury associated with cardiac surgery. Clin J Am Soc Nephrol. 2006;1:19–32.3.

2. Lassnigg A, Schmidlin D, Mouhieddine M et al. Minimal changes of serum creatinine predict prognosis in patients after cardiothoracic surgery: a prospective cohort study. J Am Soc Nephrol. 2004;15:1597–605.3.

3. Mehta RH, Grab JD, O'Brien SM et al. Bedside tool for predicting the risk of postoperative dialysis in patients undergoing cardiac surgery. Circulation 2006;114:2208–16.4.

4. Thakar CV, Arrigain S, Worley S, Yared JP, Paganini EP. A clinical score to predict acute renal failure after cardiac surgery. J Am Soc Nephrol. 2005;16:162–8.

5. Wijeysundera DN, Karkouti K, Dupuis JY et al. Derivation and validation of a simplified predictive index for renal replacement therapy after cardiac surgery. JAMA. 2007;297:1801–9.

6. Candela-Toha A, Elías-Martín E, Abraira V et al. Predicting acute renal failure after cardiac surgery: external validation of two new clinical scores. Clin J Am Soc Nephrol. 2008;3:1260–5.

7. Knapik P, Rozentryt P, Nadziakiewicz P, Polonski L, Zembala M. Retrospective cross-validation of simplified predictive index for renal replacement therapy after cardiac surgery. Interact Cardiovasc. Thorac Surg. 2008;7:1101–6.

## 0825

### VARIABILITY IN AKI AND RENAL REPLACEMENT APPROACH IN SPANISH ICUS. ARE INTERNATIONAL CONSENSUS CONFERENCES APPLIED IN OUR UNITS?

M.E. Herrera-Gutierrez[1], G. Seller-Pérez[1], J.-Á. Sánchez-Izquierdo-Riera[2], J. Maynar-Moliner[3], For the Corte de Prevalencia del Fracaso Renal y Depuración Extrarrenal en UCI investigators, COFRADE Study

[1]Complejo Hospitalario Carlos Haya, ICU, Málaga, Spain, [2]Hospital 12 de Octubre, ICU, Madrid, Spain, [3]Hospital Santiago Apostol, ICU, Vitoria, Spain

**INTRODUCTION.** Acute kidney injury (AKI) is an important problem in the ICU. The use of consensus definitions and protocols for detection and management of these patients could be crucial for patient safety.

**OBJECTIVES.** We survey the clinical practice of different ICUs in Spain regarding AKI definition and prevention as well as renal replacement therapies (RRT) safety issues.

**METHODS.** Prospective, observational, multicentre study on the prevalence of AKI in UCIs that will be held on 2009–2010, COFRADE Study. We asked all recruited ICUs to answer a survey on operational characteristics at the start of the study. Data are presented as percentages. Chi-square and non-parametric methods were applied for analysis.

**RESULTS.** We received 41 surveys out of 50 ICUs recruited. The participants were from First level hospitals in 4 (9.8%) cases, Second level in 5 (12.2%) and Third level in 32 (78%). Regarding ICU size, 16 (39%) had up to 12 beds, 11 (26.8%) up to 24 and 14 (34.1%) more than 24 beds. The vast majority of ICUs were polyvalent (70.7%), 6 (14.6%) medical and 6 (14.6%) surgical specialized units. Method used for estimating glomerular filtration rate was serum creatinine in 15 (36.6%) Units, creatinine clearance in 17 (41.5%) and equations [7 CG and 2 MDRD] in 9 (22%) Units. None reported using cystatin-C. Only 16 (39.1%) ICUs reported the use of stratification scores (13 RIFLE and 3 AKIN), almost all of them were polyvalent Units. Specialized medical units did only in 16.7% and surgical Units did not report on their use. Twenty (48.8%) Units had no written protocols for AKI prevention, 13 (31.7%) reported using them just for contrast nephropathy, 3 (7.3%) for nephrotoxic drugs and 5 (12.2) for both. In contrast, 26 (63.4%) participants had written protocols for TDE management, 29 (70.7%) had implemented a training program and 22 (53.7%) had some method for adjusting doses of drugs when on TDE. The size of the Unit or the Hospital did not supposed a clear difference between ICUs regarding AKI or TDE management.

**CONCLUSIONS.** We have detected a wide variability in practice regarding diagnostic criteria and prevention of AKI in Spanish ICUs. The application of consensus recommendations and stratification scores for AKI (ADQI or AKIN) is still low in our Units. The use of RRT is more standardized and seems to raise more concern to our intensivists than AKI.

**GRANT ACKNOWLEDGMENT.** This study has been endorsed by the Sociedad Española de Medicina Intensiva, SEMICYUC.

## 0826

### PROGNOSTIC FACTORS AND LONG-TERM OUTCOME IN PATIENTS RECEIVING CONTINUOUS RENAL REPLACEMENT IN THE ICU. HAVE EVOLVING CHANGES IN THEIR USE HAD ANY EFFECT IN THE RESULTS?

M.E. Herrera Gutierrez[1], J.E. Moreno-Quintana[1], G. Seller-Pérez[1], R. Olalla-Sánchez[1], A. Cabrera-Calandria[1], G. Quesada-García[1]

[1]Complejo Hospitalario Carlos Haya, ICU, Málaga, Spain

**OBJECTIVES.** To evaluate changes in continuous renal replacement (CRRT) use and define prognostic factors for mortality and long-term prognosis in these patients.

**METHODS.** Preliminary results of a prospective single centre observational study. We included in a dedicated registry all patients treated since we started the CRRT program and defined three periods: P1 (from 1994 to 1998, when we used an isolated blood pump [AK, Gambro®]); P2 (from 1999 to 2001, when we used a two-pump system [BSM-32®]) and P3 (2002 to 2005, with a four-pump system [Prisma®]) and did follow-up survivors 5 years after discharge. We applied ANOVA, Chi-square, Kaplan–Meier and Log-Rank for univariate analysis and logistic regression for ICU mortality and Cox regression for 5-year survival.

**RESULTS.** Included 347 patients: 71 in P1, 105 in P2 and 171 in P3. CRRT differed in dose (27.2 ± 6.6 mL/kg/h in P3, 19.8 ± 5.4 in P2 and 15.1 ± 6.1 in P1, $p < 0.001$) but no in previous renal function. Delay in initiation was shorter for P3 and then P2 but without statistical significance. Patients profile was similar but differed in severity (Apache II at admission 22.1 ± 7.1 in P3, 23.3 ± 8.3 in P2 and 20.9 ± 6.1 in P1, $p < 0.05$). ICU mortality was 74.6% for P1, 80% P2 and 59.1% P3, $p < 0.05$), but after ICU discharge mortality in follow-up was similar for all periods. After discharge, survival was 92.3% for P1 patients, 100% P2 and 86.7% P3. Intermittent haemodialysis was used in 13.5% patients after CRRT but 87.2% were successfully weaned during follow-up. In the logistic regression, Apache II, number of failing organs and oliguria were risk factors for in-hospital mortality. Higher initial creatinine, previous history of renal dysfunction and higher CRRT dosage were protective factors. A Cox regression for survival at 5 years gave similar result.

Figure 1. Five years survival

**CONCLUSIONS.** Number of CRRT treatments has risen steadily as well as severity of patients treated, but mortality has decreased significantly and this improvement seems related to CRRT dosage. Patients surviving the acute episode have a very good prognosis both for survival and for kidney function.

## 0827

### A SERVICE EVALUATION OF VENOUS THROMBOEMBOLISM PROPHYLAXIS WITH LOW MOLECULAR WEIGHT HEPARIN (LMWH) IN INTENSIVE CARE PATIENTS RECEIVING CONTINUOUS RENAL REPLACEMENT THERAPY

L.S. Brown[1], R.S. Bourne[1], S. Kitchen[1], J. VanVeen[1], S. Byrne[2]

[1]Sheffield Teaching Hospitals NHS Trust, Sheffield, UK, [2]University College Cork, Cork, Ireland

**INTRODUCTION.** Few data exist to guide the management of venous thromboembolism (VTE) prophylaxis with LMWHs in patients on CRRT. UK guidelines[1] recommend LMWH as first line for prophylaxis of VTE, acknowledge the risk of accumulation of LMWHs in renal impairment, and risk of unpredictable and potentially excessive anticoagulation, but do not provide any further guidance. Furthermore, the co-administration of unfractionated heparin (UFH) to anticoagulate the CRRT filter in such patients may result in a degree of systemic anticoagulation.

**OBJECTIVES.** To determine the degree of systemic anticoagulation in patients receiving CRRT (systemic Activated Partial Thromboplastin Ratio (APTR) ≥1.5); if there was evidence of enoxaparin (40 mg SC daily) accumulation in patients on CRRT (trough anti-Xa levels >0.4 iU/ml); and whether current local practice of CRRT filter anticoagulation with UFH, and enoxaparin VTE prophylaxis were in line with national guidelines and practice.

**METHOD.** All patients receiving CRRT on the General ICUs in Sheffield Teaching Hospitals during a 12-week study period were eligible for the service evaluation unless fulfilling exclusion criteria. Systemic and filter APTRs were recorded 4-hourly and trough plasma anti-Xa levels taken between 1400–1800 h daily. To determine national practice an electronic questionnaire was distributed through a national Critical Care Pharmacists message board (UK Clinical Pharmacy Association).

**RESULTS.** All patients included received CVVH 30 ml/kg/h (n=12). 118 (69.4%) systemic APTRs were <1.5; of which 27 (93.1%) of those recorded with a trough anti-Xa level were <1.5. Twenty-nine anti-Xa levels were recorded ranging from 0.01–0.41 iU/ml (mean 0.14 (SD 0.11) iU/ml). Twenty-one anti-Xa levels were suitable for group analysis and ranged from 0.01–0.27 iU/ml (mean 0.11 (SD 0.07) iU/ml). All but one of the observed anti-Xa levels were below the pre-determined anti-Xa level (0.4 iU/ml) to indicate accumulation, this level was excluded from group analysis for clinical reasons. No correlation was seen between anti-Xa level and number of days of enoxaparin therapy on CVVH (r=0.116 p=0.613). The questionnaire results identified a wide variety of practice which may reflect the lack of national VTE thromboprophylaxis guidance in patients on CRRT.

**CONCLUSIONS.** The systemic APTR results in patients on CRRT support the requirement for additional VTE prophylaxis according to local guidance, available evidence and national practice. There was no evidence of bioaccumulation of enoxaparin 40 mg SC daily in patients receiving CVVH ≥30 ml/kg/h based on the anti-Xa level results, supporting local thromboprophylaxis guidelines and practice. The survey results suggested that national practice is highly variable and often not in line with available evidence, or recommended guidelines.

**REFERENCES.** 1. Hunt B, Retter A. The Intensive Care Society. Venous Thromboprophylaxis in Critical Care Standards and Guidelines (2008).

## 0828

### TIMING OF CONTINUOUS RENAL REPLACEMENT THERAPY (CRRT) CHANGES PROGNOSIS IN SEPTIC SHOCK PATIENTS

X. Perez-Fernandez[1], J. Sabater[1], D.P. Gutierrez[1], R. Albertos[1], E. Santafosta[1], M. Huguet[1], R. Mañez[1]

[1]Hospital Universitario de Bellvitge, Servei de Medicina Intensiva, Barcelona, Spain

**INTRODUCTION.** Acute renal failure (ARF) in septic shock patients is common and worsens prognosis. When CRRT are required mortality rises reflecting disease severity. Recent studies have questioned high ultrafiltrate dose and hemofiltration does not seem to be superior to hemodiafiltration even in the scene of septic shock patients. However we still dont know when to start CRRT and if this *timing* could affect prognosis.

**OBJECTIVES.** Analyze survival impact in SS and ARF patients of early CRRT (timing) in terms of time from admission to initiation of therapy.

**METHODS.** Prospective observational single center study from 2007 to 2009. We studied 196 patients with SS and ARF admitted in our critical care medicine department (ICU), all of them requiring CRRT for more than 24 h during evolution. We excluded all those patients in which CRRT was started more than 5 days after admission to avoid confussion. We also excluded patients with chronic renal failure. Mean age was 61 ± 13 años, APACHE II score was 26 ± 8. Baseline situation (when TCRR was started): 100% were on vasopressor support, 89% were on mechanical ventilation, 45% presented liver failure, 27% had hyperkaliemia. Urea 23 ± 10 mmol/L, creatinine 322 ± 154 umol/L, lactate 5 ± 4 mmol/L.

**RESULTS.** Mean time fron admission to CRRT was 1.8 ± 2.1 days. According to RIFLE ARF score we initiated CRRT at Risk-Injury stage in 26% of our patients. 74% received CRRT at Failure stage. 62% of our patients were started on continuous venovenous hemofiltration (CVVH) and 38% were started on continuous venovenous hemodiafiltration (CVVHDF). Mean convective dose was 36 ± 12 ml/kg/h in CVVH patients. Mean total dose was 38 ± 14 ml/kg/h in CVVHDF patients. Mean CRRT duration was 7.7 ± 7.5 days. Mean ICU stay was 21.7 and 28 day mortality was 52%. We could not found differences in terms of survival according to technique, ultrafiltration dose or RIFLE stage. However we found an statistically significant survival improvement ($p < 0.034$) in those patients in which CRRT was started within the first 24 h of admission to our ICU compared to the >24 h group with no baseline group differences and independent from technique, dose and RIFLE stage.

**CONCLUSIONS.**

- Septic shock patients with ARF who need CRRT present high mortality.
- Neither technique, nor ultrafiltrate dose, nor RIFLE stage seem to change prognosis.
- In our patients initiation of CRRT within the first 24 h from ICU admission seems to improve survival.

## 0829

### QUANTIFICATION OF SYSTEMIC DOSE OF SUBSTRATES FOR INTERMEDIATE METABOLISM DURING CITRATE ANTICOAGULATION OF CONTINUOUS RENAL REPLACEMENT THERAPY

M. Balik[1], M. Zakharchenko[1], M. Otahal[1], J. Hruby[1], K. Rusinova[1], F. Polak[1], Z. Stach[1], J. Vavrova[2], A. Jabor[3]

[1]1st Medical Faculty, Charles University, Anaesthesia and Intensive Care, Prague, Czech Republic, [2]Clinical Biochemistry, University Hospital, Hradec Kralove, Czech Republic, [3]Institute for Clinical and Experimental Medicine, Prague, Czech Republic

**INTRODUCTION.** Citrate anticoagulation is associated with metabolic side effects which are linked to a portion of citrate reaching systemic circulation. Patient might also receive doses of lactate as a buffer and glucose if 2.2% ACD solution is used.

**OBJECTIVES.** Data on significance of systemic dose of metabolic substrates are missing. The authors tested the method of quantification of citrate load with the aid of unmeasured anions (UA).

**METHODS.** Prospective observational study comparing critically ill anticoagulated with 2.2% citrate (ACD Fenwal, Baxter) with lactate buffer (n = 41) and control patients on unfractioned heparin (n=17) with lactate (n=7) or bicarbonate (n=10) buffer. 23 of the citrate study group were on standard CVVHDF and 18 on standard CVVH. All heparine controls were on CVVHDF. Both groups were treated on Baxter Aquarius, polysulfone filters Aquamax 1.9 m2. Samples for acid–base, iont, albumine and citrate analysis were taken from central venous catheter, ports pre and post filter and from dialysate/filtrate 24 h after commencing with CRRT (T0) and 60 min later (T1). The settings were kept constant between T0 and T1. Citrate levels were measured with capillary zone electroforesis.

**RESULTS.** The load of citrate in CVVH (42.8 ± 17.9 mmol/h) was not different from CVVHDF (33.5 ± 13 mmol/h, p=0.17). Mean dose of citrate was 37.4 ± 15.7 mmol/h, i.e. 898 mmol of citrate/24 h. Controls on heparin lost endogennous citrate (0.2 ± 0.2 mmol/h, $p < 0.0001$). The systemic load of lactate in CVVH (34.5 ± 18.4 mmol/h, 828 mmol/24 h) was lower than in CVVHDF (52.4 ± 19.4 mmol/h, 1258 mmol/24 h, $p < 0.02$). Control subgroup on heparin with bicarbonate lost 5.53 ± 2.51 mmol/h of endogennous lactate ($p < 0.00001$). The load of glucose (29.2 ± 11.4 mmol/h) in CVVH was similar to the load in CVVHDF (25.0 ± 9.9 mmol/h, p=0.27). Mean dose of glucose was 26.9 ± 10.7 mmol/h, i.e.116 g/24 h. Controls showed insignificant losses of glucose (2.6 ± 3.9 mmol/l, tj. 11.3 g/24 h, $p < 0.0001$). The mean difference between post and pre filter UA (ΔUA 11.7 ± 2.8 mmol/l) correlated significantly with mean difference of citrate concentrations (Δcitrate 4.1 ± 1.2 mmol/l, r=0.80, $r^2$=0.63, $p < 0.00001$). Regression analysis revealed mean prediction error Δcitrate 0.60 ± 0.4 mmol/l using ΔUA.

**CONCLUSIONS.** Systemic dose of citrate is not negligible and can be predicted using difference of UA in the extracorporeal circuit. Citrate CRRT might represent significant load of substrates for intermediate metabolism particularly if administered with lactate buffer. 2.2% ACD causes also significant load of glucose.

## 0830

### INFLUENCE OF CONTINUOUS VENOVENOUS HEMOFILTRATION (CVVH) AND CATHETER POSITION ON TRANSPULMONARY THERMODILUTION DERIVED PARAMETERS WITH PICCO

A. Van Craenenbroeck[1], A. Van Ingelgem[1], P.-J. Palmers[1], C. Cordemans[1], A. Van Hootegem[1], N. Van Regenmortel[1], I. De Laet[1], K. Schoonheydt[1], H. Dits[1], M. Malbrain[1]

[1]ZNA Stuivenberg, Intensive Care Medicine, Antwerpen, Belgium

**INTRODUCTION.** Interpreting hemodynamic parameters obtained by transpulmonary thermodilution (TD) techniques can be a challenge during CVVH. Previous studies showed that CVVH lowers cardiac index (CI) and global end diastolic volume (GEDVi) while it increases extravascular lung water (EVLWi) [1]. Others showed no influence [2]

**OBJECTIVES.** To study the effects of CVVH and catheter position on PiCCO measurements.

**METHODS.** In 30 mechanically ventilated pts (18 male), 107 paired PiCCO calibrations were performed without/during CVVH. Age 66.1 ± 5.24, BMI 25.4 ± 4, SAPS II 60.2 ± 12.3 and SOFA score 14.3 ± 4.2. For each calibration 3 consecutive injections of 20 mL cold saline via central venous line (CVL), giving 642 TDs. Abdominal pressure (IAP) measured via bladder. Values mean ± SD.

**RESULTS.** Blood flow 129.7 ± 35 ml/min, ultrafiltration 123.7 ± 107.6 ml/h, pre- and postdilution rates 1913 ± 478 versus 996 ± 352 ml/h respectively. Regardless of catheter position, CI decreased from 4.4 ± 3.1 to 3.8 ± 1.1 L/min.m2 ($p < 0.0001$) and GEDVi from 1,001 ± 240 to 846 ± 164 ml/m$^2$ ($p < 0.0001$) during CVVH while EVLWi increased from 11.4 ± 4.6 to 12.4 ± 5.1 (p=NS), and from 12.9 ± 4.7 to 14.1 ± 5.3 when indexed to predicted body weight (p=0.08). The results of a subgroup analysis comparing correct catheter position (CVL jugular or subclavian and dialysis catheter femoral, 67 paired measurements in 25 pts) and wrong position (dialysis catheter positioned in between thermodilution injection and detection site, 40 paired measurements in 14 pts) are summarized in the Table 1.

**TABLE 1** EFFECT OF CVVH AND CATHETER POSITION ON PICCO TD

| | CVVH (correct position) | No CVVH (correct position) | p value | CVVH (wrong position) | No CVVH (wrong position) | p value | CVL in correct position (subclavian or jugular) | CVL in wrong position (femoral) | p value |
|---|---|---|---|---|---|---|---|---|---|
| CI (L/min.m$^2$) | 3.6 ± 0.9 | 4 ± 1 | 0.017 | 4.1 ± 1.2 | 5.1 ± 1.6 | 0.003 | 4.3 ± 1 | 5 ± 1.6 | 0.008 |
| GEDVi (ml/m$^2$) | 802.1 ± 137.3 | 894.8 ± 162.8 | 0.001 | 919.5 ± 180.5 | 1178.2 ± 244.5 | <0.0001 | 835.6 ± 193.6 | 1042.8 ± 260.4 | <0.0001 |
| EVLWi (ml/kg) | 11.6 ± 4.6 | 10.8 ± 4.3 | NS | 13.9 ± 5.5 | 12.3 ± 4.9 | NS | 12.5 ± 4 | 15.1 ± 5.4 | 0.009 |

The observed changes in CI, EVLWi and GEDVi were more pronounced when catheters were in wrong position. PiCCO calibration via a CVL in the femoral vein (94 measurements in 9 pts) resulted in a significant increase (or overestimation) of all three parameters, regardless of whether the CVVH was running or stopped (Table). The overall IAP was 11.2 ± 4.1 mmHg and higher in pts with wrong catheter position: 12.9 ± 2.8.

**CONCLUSIONS.** In critically ill patients treated with CVVH, hemodynamic parameters obtained by transpulmonary TD with PiCCO can be influenced. This prospective study shows a significant decrease in CI and GEDVi during CVVH, regardless of catheter position, while EVLWi increased. We hypothesize that this may be due (amongst other causes) to the relative position of CVL and dialysis catheters. Patient management should be based on parameters obtained without CVVH (ideally before start or after restitution). Moreover, irrespective of CVVH, PiCCO calibration via a femoral CVL increases CI, EVLWi and GEDVi significantly and thus cannot be recommended. We hypothesize that this may be influenced by IAP and venous return hence altering mean transit times.

**REFERENCES.** 1. Martinez-Simon A Crit Care 2006;10:410. 2. Sakka S et al. Anesth Analg 2007;105:1079–82

## 0831

### EPIDEMIOLOGY OF ACUTE RENAL FAILURE AND RENAL REPLACEMENT THERAPIES IN SPANISH INTENSIVE CARE UNITS

M. Delgado[1], V. Lacueva[1], R. Catalán[1], E. Curiel[1], M. Gutierrez[1], J. Solsona[1], J. Añón[1], P. Vera[1], V. Gomez-Tello[1], R. Fernandez[1], Sabadell Score Group

[1]Sant Joan de Deu Hospital. Xarxa Assistencial de Manresa, Intensive Care Unit, Manresa, Spain

**OBJECTIVES.** To report on the diagnosis, treatment, and prognosis of acute renal failure (ARF) and on renal replacement therapies (RRT) in Spanish ICUs.

**METHODS.** The 27 ICUs participating in the "Sabadell Score Validation Study" (1) completed a questionnaire about the routine management of ARF and RRT. We contrasted these results with the Sabadell Score database for every ICU to obtain a profile of clinical practice and patient outcomes. Variables were described by means and SD and analyzed for mortality by the Mann–Whitney U and Chi-square tests.

**RESULTS.** We analyzed data from 3670 patients, 764 (21%) of whom developed ARF. Hospital mortality was slightly higher than predicted in ARF patients (45 vs. 37%) and lower than predicted in patients without ARF (12 vs. 16%). Serum creatine was used to diagnose ARF in 100% of the ICUs, oliguria in 96%, and urea in 55%. Fluid therapy was based mainly on crystalloids in 70% of centers, on colloids in 11%, and on both in 19%, without impact on mortality (21 vs. 20%, p=0.7). Diuretic therapy in established ARF was reported by 89% of ICUs, with no significant impact on mortality (43 vs. 46%, p=0.3). The threshold for starting RRT was 189 ± 52 mg/dl for urea, 3.3 ± 1.44 mg/dl for creatinine, and 546 ± 200 ml/day for oliguria. Based on the RIFLE/AKIN classifications, 16 ICUs were defined as "early RRT" because RRT was applied before phase F/3. Mortality was significantly higher in "early RRT" (48 vs. 42%, p=0.04). Continuous RRT was used in 92% of centers and intermittently in 11%, with no significant differences in mortality (45 vs. 52%, p=0.2). High flow RRT was applied in only 26% of ICUs, with no significant differences in mortality (47 vs. 44%, p=0.3).

**CONCLUSIONS.** We confirm ARF as an independent factor for mortality. We found no differences in mortality related to fluid therapy, use of diuretics, or continuous versus intermittent RRT. We found no benefits for high flow RRT, but higher mortality for early RRT compared to standard timing.

**REFERENCE(S).** 1. Fernandez R et al. Ward mortality after ICU discharge: a multicenter validation of the Sabadell Score. Intensive Care Med 2010 (in press).

## 0832

### RETROSPECTIVE ANALYSIS OF RENAL REPLACEMENT THERAPY WITHIN CRITICAL CARE IN THE NEWCASTLE UPON TYNE HOSPITALS NHS FOUNDATION TRUST: A FOCUS ON OUTCOMES

C. Kalluri[1], I. Clement[1]

[1]Newcastle Upon Tyne Hospitals Foundation NHS Trust, Anaesthesia and Intensive Care, Newcastle Upon Tyne, UK

**INTRODUCTION.** Renal failure is a common pathology in the critically ill population, arising from a wide spectrum of insults within the kidneys or elsewhere in the body. Continuous veno-venuous haemofiltration is the commonest mode of organ support for severe renal dysfunction. Earlier studies have demonstrated that that the requirement for renal replacement is in itself a risk factor for poor outcome in Intensive care.Primary pathology, severity of critical illness, requirement for respiratory support and vassopressors are independent risk factors for poor outcome in patients requiring renal support.

**OBJECTIVES.**

- To review the demography of patients who required renal replacement therapy and their outcome.
- To identify the primary pathology and severity of illness in these patients.
- To correlate the presence of co morbid factors and outcome.
- To identify the risk factors for poor outcomes in these patients.
- To study special cases and their outcome.
- To compare the outcomes from earlier studies.

**METHODS.** Study DESIGN. Retrospective, 3 critical care units within one NHS Trust. Study SETTING. The Newcastle Upon Tyne Hospitals NHS Foundation Trust has three general adult Critical Care Units based at the Freeman Hospital, Newcastle General Hospital, and Royal Victoria Infirmary. *Study period*: August 2007 to February 2010.(31 months). *Source of data*: ICNARC Database, 'Ward Watcher'. **Outcomes:** *Primary outcome***:** Intensive care unit survival. *Secondary outcomes*: survival to hospital discharge and requirement for long-term renal support.

**RESULTS.** Out of 6534 admissions to critical care 724 patients underwent CVVH (11.1%). Critical care mortality was 38.7% and the overall hospital mortality was 47.9%). The mean ITU stay, duration of Renal, Respiratory and Cardiovascular support was10.6, 4.93, 7.87 and 1.58 respectively.

Mean APACHE II Scores and Prediction of Death from APACHE II were 23.5 and 46.25 respectively. Mean age, ITU stay, APACHE II and duration of organ support were higher in non survivors. A higher rate of mortality was observed with some co-morbidities and certain groups of medical and surgical patients.

**CONCLUSIONS.** A wide spectrum of demographic, pathophysiological factors and need for medical or surgical interventions influence outcome in patients requiring renal replacement therapy.Renal replacement therapyby itself is also an independent risk factor for poor outcome in intensive care.

**REFERENCE(S).**1. Acute Renal Failure in Critically Ill Patients. A Multinational, Multicenter Study. Shigehiko Uchino, MD *JAMA*. 2005;294:813–818.

2. Critical Care Medicine: February 1996;24 (2);192–8

Acute renal failure in intensive care units–Causes, outcome, and prognostic factors of hospital mortality: A prospective, multicenter study Brivet, Francois G. MD;

## 0833

### CONTINUOUS RENAL REPLACEMENT THERAPY, CAN WE CONTROL HYPERCALCEMIA?

I. Carrasco Barber[1], R. Andino Ruiz[1], J. Gutiérrez Vázquez[1], N. Mula Rey[1], P. Alonso Alonso[1]

[1]Hospital de la Princesa, Medicina Intensiva, Madrid, Spain

**INTRODUCTION.** Continuous renal replacement therapy (CRRT) with commercial replacements can cause important modifications on ionic concentrations of solutes, including serum ionized calcium.

**OBJECTIVES.** We presume that long time treatment with CRRT produces high serum concentration of ionized calcium, as concentration of calcium in the dialysis bags is 1.75 mmol/l (Hemosol® and Prismasol®), causing a positive balance of calcium during CRRT. In some cases substitution of those bags to 0 mmol/L calcium concentration (Prismocal ®) is needed to normalize ionized calcium.

**METHODS.** We conducted a retrospective study with patients admitted in the ICU of a tertiary care academic hospital who were treated with CRRT using commercial dialysis bags between December 2008 and November 2009, during at least 24 consecutive hours. The CRRT techniques used were veno-venous hemofiltration and hemodialysis, using a Prismaflex® system. Bags substitution was performed when serum calcium concentration reached 1.21 mMol/L to prevent from hypercalcemia.

**RESULTS.** 30 consecutive patients were included in the study. 60% were male, median age 66.73 (±9.6), APACHE 26.57 (±8.74) and SAP 52.76 (±18.03), maximum ionized calcium 1.26 (±0.13) and maximum total calcium 8.08 (±2.14). Range of duration of CRRT was between 1 and 35 days. 50% of patients required change to dialysis bags without calcium, 80% before 6 days of CRRT. 73% of these patients presented ionized calcium over 1.25 mMol/L, 47% over 1.30 mMol/L and 27% over 1.35 mMol/L. Mortality rate was 66%, no significant differences between patients who needed bag susbstitution and patients who did not.

**CONCLUSIONS.**

- Treatment with CRRT using commercial bags (Hemosol®, Prismasol®) can cause significant hypercalcemia.
- High ionized calcium levels occurs in 50% of patients undergoing CRRT, usually in the first 6 days of therapy.
- CRRT without calcium can prevent from severe hypercalcemia.
- Ionized serum calcium should be monitorized frequently in patients undergoing CRRT.
- Total calcium level did not prove to be an effective test to detect hypercalcemia as in all of our cases serum total calcium was underneath 10.5 mg/dl.
- There were no cases of hipocalcemia between our patients.

**REFERENCE(S).**

- Continuous veno-venous hemodiafiltration or hemofiltration: impact on calcium, phosphate and magnesium concentrations. Morimatsu H, Uchino S, Bellomo R, Ronco C. Int J Artif Organs 2002;25(6):512–9.
- Intermittent versus continuous renal replacement therapy in the ICU: impact on electrolyte and acid–base balance. Uchino S, Bellomo R, Ronco C. *Intensive Care Med* 2001;27(6):1037–43.
- Albumin-adjusted calcium is not suitable for diagnosis of hyper- and hypocalcemia in the critically ill. Slomp J, van der Voort PH, Gerritsen RT, Berk JA, Bakker AJ. Crit Care Med. 2003; 31(5) :1389–93.

**GRANT ACKNOWLEDGMENT.** No potential conflict of interest relevant to this article was reported.

## 0834

### OUTCOME IN CRITICALLY ILL PATIENTS REQUIRING RENAL REPLACEMENT THERAPY FOR ACUTE KIDNEY INJURY IN A MULTIDISCIPLINARY INTENSIVE CARE UNIT IN NORTHERN INDIA

H. Singh[1], D. Bhasin[1], A.K. Mandal[1], R. Duggal[1], M. Kaur[1], A.K. Singh[1], A. Saini[1], G. Adil[1], S. Pathak[1], K. Sekri[2], R. Nandha[2]

[1]Fortis Hospital, Critical Care, Mohali, India, [2]Dr. H.S.J Institute of Dental Sciences, Pharmacology, Chandigarh, India

**INTRODUCTION.** Acute Kidney Injury (AKI) is a common problem in Intensive Care Units (ICU) and large proportion of these patients require Renal replacement therapy(RRT). In India early recognition and treatment of AKI itself is a big challenge because of scarcity of resources

**OBJECTIVES.** We sought to evaluate the outcome of these patients with AKI who received RRT.

**METHODS.** Out of 625 admissions to multidisciplinary intensive care unit in northern India between 1st January 2009 to 31st December 2009, we retrospectively reviewed the data of the patients with AKI who recieved RRT. 70 patients, 47 (67%) males and 23 (33%) females were included in the study. Demographic data, co-morbidities, Acute Physiology and Chronic Health Evaluation II (APACHE II) score, aetiology of AKI, degree of AKI at admission according to RIFLE (Risk, Injury, Failure, Loss, End-stage kidney disease) classification, timing of RRT, number and modality of dialysis used, source of admission, length of stay (LOS) in ICU and hospital along with Outcome were documented.

**RESULTS.** The overall hospital mortality in these patients was found to be 70%.

The most common factor contributing to AKI was sepsis, 54 (77.1%) patients and Nonseptic group had 20 (22.9%) patients. Patients with sepsis related AKI had higher in- hospital mortality as compared to non septic AKI (72.22 vs. 62.5%).Patients who were admitted directly from emergency room (ER) had a lower mortality compared to those admitted from wards in the same hospital, (59.45 vs. 81.8%,P= 0.042). The mortality of patients in Failure group (61.36%) was lower than the Risk (85.7%) and Injury group (81.1%). This may be attributed to early institution of RRT in the Failure group, 90.9% received RRT within 24 h of ICU admission as compared to 64% in Risk and 63.6% in Injury group (P = 0.003). The mean(±SD) APACHE II score of non survivors 26.69 (8.95) was higher than the survivors 21.86 (4.62) with P=0.022. The mean (±SD) ICU and hospital LOS of survivors 13.00 (9.57) and 19.86 (13.16) days respectively were higher than non survivors 8.20 (9.56) and 10.37 (11.08) days.

**CONCLUSIONS.** Our results showed that that mortality of patients with ARF requiring hemodialysis remains high. Direct admission from ER and Early intervention with RRT is associted with improved survival. Higher APACHE II score is associated with higher mortality. In survivors ARF is associated with prolonged ICU and hospital length of stay.

**REFERENCE(S).** 1. Uchino S, Kellum JA, Bellomo R, Doig GS, Morimatsu H, Morgera S, Schetz M, Tan I, Bouman C, Macedo E, Gibney N, Tolwani A, Ronco C: Acute renal failure in critically ill patients: A multinational, multicenter study. *JAMA 2005;* 294: 813–818

2. Ostermann M, Chang RW: Acute kidney injury in the intensive care unit according to RIFLE. *Crit Care Med 2008;*35:1837–43

**GRANT ACKNOWLEDGMENT.** No grant was taken for the study.

## 0835

### USEFULNESS OF TRANSMEMBRANE PRESSURE AND ULTRAFILTRATION COEFFICIENT TO EVALUATE FILTER CLOTTING DURING CONTINUOUS RENAL-REPLACEMENT THERAPY

M. Rodriguez Lopez[1], I. Moran Chorro[1], J. Baldira Martinez de Irujo[1], K. Nuñez Vazquez[1], L. Zapata Fenor[1], A. Roglan Piqueras[1]

[1]Hospital Santa Creu i Sant Pau, Barcelona, Spain

**INTRODUCTION.** Filter clotting is a common problem during Continuous Renal-Replacement Therapy (CRRT), inducing blood loss, increasing transfusions and costs. Although there is no a gold standard, a high level of transmembrane pressure (TMP) is frequently used by physicians for remove filter before clotting.

**OBJECTIVES.** The aim of this study is to evaluate the usefulness of ultrafiltration coefficient in this setting.

**METHODS.** Intensive Care Unit of a terciary hospital. The operating data and alarms were collected directly from monitor dialysis register (Prismaflex®). Filters with the AN69® membrane were used (ultrafiltration coefficient of unused filter described by manufacturer is 22 ml/h/mmHg). We calculated the TMP and ultrafiltration coefficient 60 and 120 min before removing the filter ($T_1$ and $T_2$ respectively).

**RESULTS.** Fifty filters were studied in seventeen patients, ten of whom were male. Age (M±SD) was 61.8 ± 16.5 and APACHE II was 23.2 ± 7.2. CRRT treatment parameters were: blood flow 205 ± 48 ml/min; replacement flow 1,892 ± 648 ml/h; dialysate flow 380 ± 372 ml/h and fluid balance −136 ± 80 ml/h. Twenty-one filters were removed because of filter clotting or alarm "tendency to clotting" (group 1), fourteen because of alarm "high TMP" (group 2), and fifteen for other heterogeneous reasons. TMP and ultrafiltration coefficient showed good inverse correlation at $T_1$ ($r = -0.723$; $p < 0.001$) and $T_2$ ($r = -0.633$; $p < 0.001$). TMP showed significant differences between group 2 and 1 at $T_1$ and $T_2$ (276 ± 51 vs. 211 ± 61 mmHg; $p < 0.002$ and 240 ± 52 vs. 162 ± 49 mmHg; $p < 0.001$ respectively). However, ultrafiltration coefficient did not showed statistical differences between both groups at $T_1$ (8.9 ± 2.9 vs. 9.6 ± 3.8 ml/h/mmHg; p=0.569) or $T_2$ (10.4 ± 3.6 vs. 11.9 ± 3.4 ml/h/mmHg; p=0.206). When replacement flow was >2000 ml/h (n=23), TMP showed higher values compared with others (n=27) both in $T_1$ (247 ± 62 vs. 195 ± 76 mmHg; p=0.011) and $T_2$ (224 ± 58 vs. 150 ± 51 mmHg; $p < 0.001$). On the contrary, ultrafiltration coefficient showed no statistical differences comparing same groups and times respectively (10.4 ± 3.7 vs. 9.3 ± 3.6 ml/h/mmHg; p=0.287 and 11.6 ± 4.2 vs. 11.4 ± 3.3 ml/h/mmHg; p=0.852).

**CONCLUSIONS.** Our data suggest that TMP is not always reliable as an indicator of filter clotting. The calculation of ultrafiltration coefficient may be a useful tool to decide remove the filter, especially in patients with higher volumes of replacement.

**REFERENCE(S).** None.

## 0836

### RENAL REPLACEMENT THERAPY IN ACUTE RENAL FAILURE: COMPARATIVE RESULTS OF TWO DIFFERENT PERIODS OF TREATMENT

A. Navas Pérez[1], R. Ferrer Roca[1], M.L. Martínez González[1], C. De Haro[1], M. Martínez Pérez[1]

[1]Hospital Parc Taulí Sabadell, Critical Care Center, Barcelona, Spain

**INTRODUCTION.** Despite advances in dyalisis technology, many questions remain about how best to provide renal replacament to patients with acute renal failure (ARF).

**OBJECTIVES.** To describe patients profile admitted in our intensive care unit (ICU) with ARF that have been treated with renal replacement therapies (RRT). We analyzed treatment variation over a period of 10 years.

**METHODS.** Prospective observational study of all patients treated in our medical-surgical ICU (26 beds) with ARF that needed RRT. Patients were treated with intermittent hemodyalisis (IHD), continuous venovenous hemofiltration (CVVH), continuos venovenous hemodiafiltration (CVVHDF) or high-volume hemofiltration (HVHF). We collected epidemiological data, risc factors, severity using APACHEII score and RIFLE classification, ARF etiology, RRT and days of technique, ICU mortality and renal function recovery. We divided the period in two parts according with a change in our treatment protocol that includes HVHF techniques in the last one; part 1 (2000–2004) and part 2 (2005–2009). Data are presented as median or percentage.We have compared the two periods using student test for continuous variables and Chi-square for categorical ones.

**RESULTS.** A total of 304 pacients were treated (part 1 n= 126, part 2 n= 178).Age was 64.7 ± 13.8 years and 66 ± 14.2; (p 0.43) respectively, with an APACHEII score 24 ± 10 and 22 ± 8; (p 0.13).Sepsis was the principal etiology of ARF (61%), mainly respiratory and abdominal.A total of 85.5% patients had risc factors for ARF with an increase in the part 2 (81.7 vs. 88.2%;p 0.08).Importantly we have noted an increase in patients with neoplasms treated with RRT in the last one.Its surprising that in the second period community ARF was by far more prevalent that in the first one (28 vs. 72%; $p < 0.005$).RIFLE classification was Failure in 86.5% of patients. ARF was prerenal in 94%. Related to RRT method, IHD was applied (as unique technique or combined with others) in 49% of patients.Continuous RRT were used in 75% of patients with an increment of patients that combines more than one technique (16.7 vs. 30.9%; p 0.01).We have observed that in continuous techniques, CVVH and HVHF have significantly increased in the last period (p 0.013 and $< 0.001$, respectively) with an important decrease of CVVHDF (p 0.04).They were less days of therapy in the second period (19.7 vs. 12.3 days; p 0.015).Total ICU mortality was 52.3% found a decrease in the last period mortality (61.9 vs. 45.5%: p 0.003). Survivors have normal renal function at ICU discharge in 56.7% in the part 2 versus 72.9 in the first with more patients treated with IHD in the second period (10.4 vs. 26.8%).

**CONCLUSIONS.** In the second period of study, we observed an increase of patients treated, using more convective techniques with less days of therapy duration. It was observed a significant reduction in ICU mortality in the last period with more patients under replacament theraphy at ICU discharge.

# Cardiac arrest 2: 0837–0850

## 0837

### IMPLEMENTATION OF ILCOR GUIDELINES ON THERAPEUTIC HYPOTHERMIA AFTER CARDIAC ARREST IN A UK DISTRICT GENERAL HOSPITAL: A FOUR-YEAR EXPERIENCE

M. Wakatsuki[1], A. Keeton[1], B. Harris[1], K. Shammas[1], F. Noble[1], D. Pogson[1]

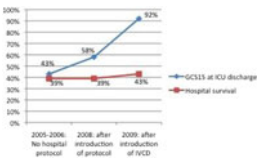
[1]Queen Alexandra Hospital, Department of Critical Care, Portsmouth, UK

**INTRODUCTION.** International Liaison Committee on Resuscitation (ILCOR) guidelines on therapeutic hypothermia (TH) [1] following Out of Hospital (OOH) cardiac arrest due to Ventricular fibrillation or pulseless ventricular tachycardia (VF/VT) were published in 2003. At our institution, these were implemented in 2005 and have subsequently audited our performance against ILCOR standards. The developments in our hospital include an introduction of the local guidelines in 2007 [2] and the use of intravascular cooling device (IVCD) in 2009.

**OBJECTIVES.** To review the performance of our institution between 2005–2009 on TH after cardiac arrest.

**METHODS.** Three non-consecutive 12 months of retrospective data between 2005–2009 were collected from the patients admitted to our ICU presenting with cardiac arrest. [3, 4] The following were reviewed: the number of cardiac arrests and their initial presenting rhythms; number of those who met the criteria for TH and subsequently cooled; survival rate of TH and their neurological outcome.

**RESULTS.** There were 211 patients in the 3 years who were admitted to the ICU following cardiac arrest [68 (32%) OOH VF/VT, 16 (8%) in hospital (IH) VF/VT, 55 (26%) OOH non-VF/VT, 72 (34%) IH non-VF/VT]. Of the OOH VF/VT patients, 67% underwent TH in 2005–2006 and after the introduction of a local guideline in 2006, this rate rose to 100% in 2008 and 2009. Altogether we have instituted TH in 77 patients which includes rhythms other than OOH VF/VT. The survival and neurological outcomes of the TH patients are shown in Table 1.




Graph 1

**CONCLUSIONS.** Introduction of a local guideline has led to an improved compliance for TH in all eligible patients presenting with cardiac arrest. Our survival figures following TH are similar to those from the published data [5, 6]. Although the use of GCS is a crude marker compared with Cerebral Performance Category (CPC) Score used within the Utstein definition [7], we have nevertheless seen an improvement in the neurological outcome of the TH survivors at ICU discharge since the introduction of the local guideline and IVCD. Current numbers are small therefore future audits are required to assess a real trend in the neurological outcome including CPC score to compare our data with the published evidence.

**TABLE 1**

| | 2005-2006: No hospital guideline (%) | 2008: After introduction of hospital guideline (%) | 2009: After introduction of IVCD (%) |
|---|---|---|---|
| Hospital Survival | 39 | 39 | 43 |
| GCS 15 at ICU discharge | 43 | 58 | 92 |

**REFERENCE(S).** 1. Nolan et al. Resuscitation 2003 57:231–235. 2. Pogson. TH guidelines. Portsmouth Hospitals 2009. 3. Harris and Pogson. Abstract number 0539 ESICM Vienna 2009. 4. Shammas, Noble and Pogson. Portsmouth Hospitals Cardiac Arrest Audit 2005–2006. 5. Bernard et al. NEJM. 2002;346:557–563. 6. The Hypothermia after Cardiac Arrest Study Group NEJM. 2002;346:549–556. 7. Jacobs et al. Circulation. 2004 23;110(21):3385–97.

## 0838

### THERAPEUTIC HYPOTHERMIA BY INTRAVASCULAR COOLING FOLLOWING OUT OF HOSPITAL CARDIAC ARREST; AN AUDIT OF PERFORMANCE AND OUTCOMES

N. Main[1], E. Spencer[1], J. Walker[1]

[1]Royal Liverpool University Hospital, Liverpool, UK

**INTRODUCTION.** It is recommended that unconscious adult patients with a spontaneous circulation after out of hospital cardiac arrest, and initial rhythm of ventricular fibrillation (VF), should be cooled to 32–34°C for 12–24 h [1–3]. There is no single recommended mode of cooling. In this university teaching hospital Intensive Care Unit, therapeutic hypothermia is delivered using an intravascular catheter (Coolgard 3000$^{TM}$ or Thermogard XP$^{TM}$, Alsius Corp, USA). Our protocol is to cool to 34°C within 6 h post cardiac arrest for 24 h, then re-warm at ≤0.25°C/h.

**OBJECTIVES.** To assess adherence to this protocol, outcomes and complications following the introduction of intravascular cooling.

**METHODS.** Data on patient characteristics, presenting rhythm, time to initiate cooling, time to reach target temperature, time at target temperature, time to re-warm, length of time catheter left in situ, complications, mortality and morbidity were prospectively collected on all patients treated with intravascular cooling following out of hospital cardiac arrest between January 2008 and December 2009.

**RESULTS.** 25 patients (20 male) underwent therapeutic hypothermia [median age 64 years (range 38–82)]. 23 had a presenting rhythm of VF and 2 pulseless electrical activity (PEA). 13 (52%) of the catheters were inserted in the emergency department (ED), 12 in ICU. The median time from arrival at hospital to transfer to ICU was 3.03 h (0.6-8.9). Table 1. summarises the results. 7 (28%) patients reached 34°C within 6 h of arrest. Target temperature was maintained until decision to rewarm in 19 (76%) patients. Re-warming to 36°C at a rate of 0.25°C/h was achieved in 14 (56%) patients. 4 (16%) patients died before re-warming. Complications included arrhythmias [7 (28%)], pneumonia, coagulopathy and arterio-venous fistula (1 of each).The catheter was used to control pyrexia after re-warming in 9 (60%) of the pyrexial patients. 15 (60%) patients survived ICU and all of these survived to hospital discharge, of which 8 (53%) had normal neurological status and 3 (20%) had mild cognitive impairment.

**TABLE 1**

| Time (hours) from cardiac arrest… | Median | Range |
|---|---|---|
| To catheter insertion | 3.8 | 0.9–10.6 |
| To initiate cooling | 5.1 | 1.5–11.6 |
| To reaching target temp | 7.2 | 0.4–13.6 |
| Time (hours)at target temperature | 22 | 10–29 |

**CONCLUSIONS.** 28% of our patients achieved target temperature within 6 h. Delays occurred in time to catheter insertion, starting cooling once catheter in situ and in transfer to ICU. Therapeutic targets could be better met by reducing these delays and by using external cooling methods in the interim. Intravascular cooling was effective in maintaining hypothermia, in controlling re-warming and in controlling post re-warming pyrexia.

**REFERENCES.** 1. Nolan J.P et al.Circulation. 2003; 108:118–21

2. The Hypothermia After Cardiac Arrest Study Group. N Engl J Med. 2002;346:549–556.
3. ILCOR Circulation. 2008;118:2452–83

## 0839

### STROKE IN PATIENTS WITH VENTRICULAR ASSIST DEVICE: THE ROLE OF ANTICOAGULATION

A.L. van Duijn[1], A.J. Slooter[1], L.M. Peelen[1], E. Sukkel[1], J.R. Lahpor[1], W.M. van den Bergh[2]

[1]UMC Utrecht, Utrecht, Netherlands, [2]Academic Medical Center, Amsterdam, Netherlands

**INTRODUCTION.** The incidence of thromboembolic stroke in patients with end stage heart failure and ventricular assist device (VAD) implantation varies from 14 to 47%. There is no evidence how anticoagulation therapy should be performed in these patients in order to prevent this devastating complication.

**OBJECTIVES.** This study aims to determine if anticoagulation status affects the occurrence of cerebrovascular events in patients with VAD.

**METHODS.** We performed an observational study in 123 consecutive patients with VAD implantation to determine the relation between coagulation status and the occurrence of thromboembolic stroke. The occurrence of thromboembolic stroke was assessed by means of screening patient correspondence, patient charts and reviewing radiological investigations. Coagulation status was retrieved from patients at the moment of the first ischemic stroke and 2 weeks preceding the event and compared with controls that were censored at the time of heart transplantation, VAD explantation, or death. Coagulation status was defined as normal when INR or aPTT ratio was below 1.25 (group I), intermediate when between 1.25 and 2.50 (group II), and high when above 2.50 (group III). Patients in group I were considered to use an inadequate dose or no coumarins or heparin, but may use antiplatelets. The primary endpoint coagulation status at the time of a thromboembolic stroke or in the preceding 2 weeks compared with coagulation status in patients without a thromboembolic stroke (controls) was assessed by means of logistic regression analysis.

**RESULTS.** Forty-one strokes occurred in 24 patients. Except for preoperative cardiac index there were no significant differences in baseline characteristics. Patients in group II (RR 7.8; 95% CI 1.1-56) and III (RR 4.4; 95% CI 0.6-33) had an increased risk for thromboembolic stroke compared with patients in group I, but this was only borderline statistically significant.

**CONCLUSIONS.** We could not detect a decreased risk for thromboembolic stroke in patients with an intermediate or high coagulation status, which suggest that the use of coumarines or heparin has no additional value to antiplatelets. No clear differences were seen between the type of VAD and incidences of stroke.

## 0840

### AN AUDIT OF THE MANAGEMENT OF POST CARDIAC ARREST PATIENTS ADMITTED TO INTENSIVE CARE IN A DISTRICT GENERAL HOSPITAL

C.L. Nutt[1], A. Cullen[1]

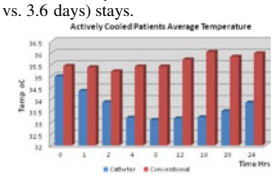
[1]Craigavon Area Hospital, Portadown, UK

**INTRODUCTION.** Cardiac arrests account for 6% of intensive care admissions with survival around 30%, but outcome can vary [1]. As certain post-resuscitation interventions have been shown to influence outcome, the Intensive Care Society has published guidelines on post resuscitation care [2].

**OBJECTIVES.** This audit was conducted to assess our compliance with these guidelines.

**METHODS.** Cardiac arrest admissions were identified from ICNARC data over an 18 month period. Patient demographics, as well as information concerning pre-morbid health, cause and type of arrest and pre admission Glasgow Coma Scores (GCS) were recorded. Patient observations and management were obtained from ICU charts.

**RESULTS.** Data was collected on 33 patients. Overall survival was 30%. The average age was 69(34-97). 78% of patients had previous cardiovascular disease. Of the 18 out of hospital (OOH) arrests, 13 had a shockable rhythm, while two-thirds of in hospital (IH) arrests were non-shockable. 76% of patients had a GCS less than eight. Primary cardiac disease accounted for 21 arrests, 10 met intervention criteria. Six had lysis or stenting, while four received antiplatelet agents and enoxaparin. 82% of patients required inotropes; an adequate blood pressure was achieved in 91% of patients. Carbon dioxide and blood glucose were difficult to manage with only 25 and 20% consistently achieving recommended targets. In total 16 patients were cooled, this included all OOHVF arrests as per guidelines, 50% of IHVF/VT and one IHPEA. An intravenous cooling catheter was used in half of cases. The catheter cooled more patients to the desired temperature (100 vs. 50%), achieved the required temperature faster (1.3 vs. 3.9 h) and maintained temperatures more reliably than conventional methods. Survivors were younger, had less co-morbidities and more shockable rhythms but had similar inotrope requirements and GCS. They had longer ICU (2.6 vs. 3.6 days) stays.




Catheter versus conventional cooling

**CONCLUSIONS.** Our post cardiac arrest care can be improved, despite this outcome was similar to published data. Attempted cooling met current guidelines but conventional methods were less satisfactory than the catheter technique. Introduction of care bundles may improve our overall care.

**REFERENCE(S).** 1. Nolan et al. Outcome following admission to UK intensive care units after cardiac arrest. Anaesthesia. 2007;62:1207–16.

2. Nolan J. Standards for the Management of Patients After Cardiac Arrest. Intensive Care Society Standards, 2008.

## 0841

### EVOLUTION OF HYPERDYNAMIC HYPERLACTAEMIA DURING THERAPEUTIC MILD HYPOTHERMIA

S. Kaptein[1], M.A. Kuiper[1], E.C. Boerma[1]

[1]Medical Center Leeuwarden, Leeuwarden, Netherlands

**INTRODUCTION.** Therapeutic mild hypothermia has been advocated to reduce ischemia/reperfusion injury in order to minimize cerebral and myocardial damage [1]. However, anecdotal reports of increased lactate levels during hypothermia might indicate ongoing anaerobic tissue metabolism [2].

**OBJECTIVES.** Aim of this study is to describe the evolution of arterial lactate levels during steady-state hypothermia after resuscitation and to correlate arterial lactate levels with global hemodynamic variables.

**METHODS.** We performed a single centre retrospective study in a 22-bed mixed ICU. 62 Patients after cardiac arrest with return of spontaneous circulation were included, in case invasive hemodynamic monitoring was started immediately after ICU admission. Monitoring was performed with a pulmonary artery catheter (Vigilance®) or with arterial pulse contour analysis (PiCCO®). Therapeutic endpoints were a mean arterial pressure ≥75 mmHg and central/mixed venous oxygen saturation (S(c)v02) ≥70%. In case these endpoints were not fulfilled, a fluid bolus of 250 ml was administered up to a point were left ventricular stroke volume rose <10%. Administration of dopamine was titrated on cardiac index in combination with central venous oxygen saturation and norepinephrine was administered in case of a persistent hypotension despite the first 2 steps. Primary outcome was the change in arterial lactate levels at the beginning and end of a 24 h steady state at 33°C. Secondary outcome were correlations between the change in arterial lactate and indices of global perfusion. Statistical comparison for paired data was performed with applicable tests; data are expressed as median (IQR). Correlation coefficients for non-parametric data are expressed as spearman's rho ($r_s$).

**RESULTS.** Median age was 64 (55–75) and APACHE IV 121(109–129). Lactate levels at the beginning of steady state hypothermia were 2.1(1.2–3.7) mmol/L and increased significantly to 3.4 (1.8–4.9) at the end of hypothermia (p=0.000). Cardiac index (CI) and S(c)v02 also increased from 2.3 L/m$^2$ (1.9–3.0) to 2.7 (2.3–3.8), p=0.002 and from 77% (70–84) to 80 (75–85), p= 0.12 respectively. The change in CI was correlated with the change in S(c)v02 ($r_s$=0.64, p=0.000), change in lactate ($r_s$=0.48, p=0.001), and dopamine dose ($r_s$=0.32, p=0.02), but not with norepinephrine dose ($r_s$=0.08, p=0.57).

**CONCLUSIONS.** During therapeutic mild hypothermia after cardiac arrest we observed a rise in arterial lactate levels, in combination with an increase in CI and S(c)v02, suggesting distributive circulatory alterations.

**REFERENCE(S).** 1. Holzer et al. Critical Care med 2005;33:414–18.

2. Bergman et al. Eur J Anaesthesiol 2010;27:383–7

## 0842

### HAVE THE 2005 EUROPEAN RESUSCITATION COUNCIL GUIDELINES AND THE USE OF PERCUTANEOUS CORONARY INTERVENTION IMPROVED OUTCOME IN UNCONSCIOUS OUT-OF-HOSPITAL CARDIAC ARREST SURVIVORS?

M. Busch[1], E. Søreide[1]

[1]Stavanger University Hospital, Anesthesiology and Intensive Care Medicine, Stavanger, Norway

**AIM.** Out-of-hospital cardiac arrest (OHCA) is still associated with poor survival. Both quality of cardiopulmonary resuscitation (CPR) and post-resuscitation treatment have been shown to affect outcome.

**OBJECTIVE.** We wanted to study to what extent the implementation of the new European Resuscitation Council (ERC) guidelines (1) and percutaneous coronary intervention (PCI) had improved outcome in unconscious OHCA survivors.

**METHODS.** Retrospective study of all unconscious OHCA survivors from 2002 to 2008 treated with therapeutic hypothermia in our ICU, age ≥ 15 years with no upper age limit and who fulfilled the HACA study (2) inclusion criteria: bystander-witnessed arrest, presumed cardiac cause of arrest, ventricular fibrillation as initial rhythm, interval from collapse to return of spontaneous circulation (ROSC) no more than 60 min, maximum intervals of 5–15 min from collapse to arrival of the ambulance and start of resuscitation. Good cerebral outcome was defined as a Glasgow–Pittsburgh Cerebral Performance Category 1-2 (3) and the relationship to various factors (Table 1) presented as odds ratio (OR) from a multivariate logistic regression analysis.

**RESULTS.** The median age of the 113 OHCA survivors studied was 62 years (15–80 year), and 77% were male. Median time from collapse to ROSC was 15 min (3–50 min). Bystander CPR was performed in 76% and PCI in 63%. The overall good outcome rate was 69%. Both lower age and shorter time to ROSC, as well as bystander CPR and the ERC 2005 guidelines were associated with good outcome (Table 1).

**TABLE 1** PROGNOSTIC FACTORS FOR GOOD OUTCOME AFTER OHCA

| Variable | p Value | Odds ratio (OR) | 95% confidence interval (CI) |
|---|---|---|---|
| Male gender | 0.449 | 1.551 | 0.499, 4.826 |
| Age <62 years | 0.023 | 3.024 | 1.168, 7.826 |
| Bystander-CPR applied | 0.025 | 4.382 | 1.437, 13.369 |
| Collapse to ROSC >15 min | 0.009 | 2.969 | 1.143, 7.711 |
| PCI applied | 0.144 | 2.827 | 0.701, 11.401 |
| 2005 ERC guidelines applied | 0.026 | 3.820 | 1.178, 12.388 |

**CONCLUSION.** We found that some previously well-described factors like age, bystander-CPR and time to ROSC still were linked to good-outcome. Interestingly, the same was the case for the new 2005 ERC guidelines but not for PCI.

**REFERENCES.** 1. International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Resuscitation 2005; 67:S3-180.

2. Hypothermia after Cardiac Arrest Study Group. Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. N Engl J Med. 2002 Feb 21;346(8):549-56.

3. Booth CM, Boone RH, Tomlison G, Detsky AS. Is this patient dead, vegetative, or severely neurologically impaired? Assessing outcome for comatose survivors of cardiac arrest. JAMA 2004; 291:870-9.

## 0843

### CPR: IS THERE AN APP FOR THAT? TWO CENTRE, TWO NATION, BEFORE AND AFTER CONTROLLED TRIAL OF CHEST COMPRESSION PERFORMANCE USING THE ZOLL POCKETCPR APPLICATION FOR IPHONE

T.D. O'Leary[1], P.G. Brindley[2]

[1]Nottingham University Hospitals NHS trust, Adult Critical Care, Nottingham, UK, [2]University of Alberta, Critical Care Medicine, Edmonton, Canada

**INTRODUCTION.** We recently identified near identical shortcomings in performance by young staff members during simulated cardiac arrests in two centres from different nations, and despite different health care delivery models. Chest compressions, when needed, were frequently at too shallow a depth, and at very variable rates. The importance placed on chest compressions, relating to survival from cardiac arrest, means any technique to improve quality of compressions might be beneficial, and is therefore worth exploring. Given the popularity of the iphone, (and its association application aka "Apps") we wished to see whether this technology could be used to improve performance. However, what is not known is whether an improvement in quality of chest compressions (i.e. rate and depth) might come at the expense of a delay in their initiation.

**OBJECTIVES.** To see if iPhone App technology can be used to improve chest compression rate and depth.

**METHODS.** Randomized control cross-over trial comparing rate and depth and delay in initiation of chest compressions in both physicians and nurses using the free iphone application pocketcpr (Zoll) in two university tertiary care hospitals (Edmonton, Canada and Nottingham, UK) and using standardized simulated cases environment. We also surveyed staff in Emergency Departments, Intensive Care Unit and a General Medical Ward regarding iphone availability, compared to other resources such as written guidelines.

**RESULTS.** We assessed 20 healthcare professionals in each site. There was no significant difference in the rate (mean compressions per minute (CPM) of 92.8 using iphone application versus 96.1 cpm without (p=0.57)). There was also no difference in depth of chest (mean depth of 4.0 cm using iphone application versus 4.1 cm without (p=0.85)). However, there was a statistically significant delay in the initiation of chest compressions associated with use of iphone, (mean of 16.8 s with the iphone vs. 4.8 s without ($p < 0.01$). Of note, more physicians (42.1 vs. 12%) and more nurses (33.3 vs. 7%) were found to be carrying an iphone compared to pocket CPR guidelines. Staff also reported high levels of comfort and familiarity with this device.

**CONCLUSIONS.** Despite the availability of, and familiarity with the iphone, there was no clear benefit in terms of rate or depth of chest compressions. In addition, despite its suggested benefits (ref), we found the iphone app was association with a delay in the initiation of chest compressions. In short, while clinicians might make the claim that "*Resuscitation, there's an App for that*"., our results offer an important caution before changing from the use of pocket guidelines to unproven, albeit popular, technological gimmicks.

**REFERENCE(S).** Milander, M., P. Hiscok et al. Chest compression and ventilation rates during cardiopulmonary resuscitation Acad Emerg Med, 1995;2(8):708–13. Semeraro,F et al., Abstract 544 22nd Annual Congress of ESICM

## 0844

### CORRELATION BETWEEN GUT INJURY AND ENDOTOXINEMIA FOLLOWING RESUSCITATION FROM A CARDIAC ARREST

D. Grimaldi[1], E. Guivarch[1], N. Neveux[2], B. Zuber[1], N. Demars[1], C. Rousseau[3], J.-S. Marx[4], J.-D. Chiche[1,3], A. Cariou[1]

[1]Hôpital Cochin APHP, Medical ICU, Paris, France, [2]Hôpital Cochin APHP, Biology, Paris, France, [3]Insitut Cochin INSERM U567, Cellular Biology, Paris, France, [4]Hôpital Necker APHP, Emergency Department SAMU de Paris, Paris, France

**INTRODUCTION.** Despite advances in resuscitation of cardiac arrest (CA) patients, considerable mortality still occurs due to post-resuscitation shock (PRS). The underlying mechanisms include a systemic inflammation related to a whole-body ischaemia/reperfusion syndrome [1]. This inflammation could be due to endotoxinemia linked previously to high level of pro-inflammatory cytokines [1]. We hypothesized that endotoxinemia was related to an ischemic gut injury. Plasma citrulline (Cp), which reflects the functional enterocyte mass [2], and urinary intestinal fatty acid-binding protein (Iu), which is released in case of intestinal permeability [3], have been validated to assess gut function. The aim of this proof-of-concept study was to examine the release of these biomarkers in the post-CA setting and to search for a correlation with endotoxinemia.

**METHODS.** Following resuscitation after a CA, 21 patients were prospectively included and data were recorded according to Utstein recommendations. Blood and urine samples were collected at admission (Adm), Day (D) 1, 2, 3 and 6. Whole blood endotoxin (Eb) was quantified using the EAA (Spectral Diagnostics Ontario). According to manufactor instruction, normal value is <0.4 [4]. Cp was determined by HPLC as described elsewhere [2], normal value is 30–46 µmol/L. Iu was measured by ELISA test (Hycult biotech The Nederlands), we used 9 healthy control patients to determine normal value. Statistical analyses were performed with Statview 4.0 software.

**RESULTS.** Patients' median age was 55 years (27–88) and 75% were male. Median "no flow" and "low flow" were 2 (0–15) and 10 min (1–45). 13 patients (62%) presented a PRS and 13 (62%) died during their ICU stay.

8 (38%) patients had an Adm Eb >0.4. Median level of endotoxinemia increased between Adm and D2 in patients with shock, whereas it decrease in patients without (+0.11 [−0.11; +0.37] vs. −0.19 [−0.27; −0.05] P=0.05).

Adm Iu was extremely high in comparison with control (6668 pg/mL [2,113–9,587] vs. 54 pg/mL [1–80] $P < 0.0001$) with a normalization at D2 (100 pg/mL [29-1739], P=0.0005). Adm Cp was low (24 [12–28] µmol/L), decreased with a nadir at D2 (11 µmol/L [7–14] P=0.01) and trended to normalized at D6 (21 µmol/L [13–31]). Maximal (max) Eb was correlated with max Iu ($R^2$=0.31, P=0.01) and inversely correlated with max Adm-D1 Cp ($R^2$=0.38, P=0.005), the highest the gut injury, the highest the Eb. Finally, max Adm-D1 Cp level was correlated with max Iu, ($R^2$=0.29, P=0.02).

**CONCLUSION.** Our study supports the concept of gut injury following CA, as suggested by low Cp citrulline correlated with high Iu. These two markers were correlated with the level of endotoxinemia. The physiological consequences of this post-resuscitation gut injury now require further investigations.

**REFERENCE.** 1. Adrie et al. Circulation 2002 106; 562–8
2. Crenn et al. Clin Nutrition 2008 27; 328–39
3. Rahman et al. J Gastrointest Surg 2003 7; 26–36
4. Marshall et al. J Infect Dis 2005 190; 527–34

## 0845

### PROGNOSIS AND PROGNOSTICATION AFTER CARDIAC ARREST AND HYPOTHERMIA; RESULTS OF PROPACII, A DUTCH MULTICENTER, PROSPECTIVE COHORT STUDY

A. Bouwes[1,2], J. Binnekade[1], M. Kuiper[3], F.H. Bosch[4], D.F. Zandstra[5], A. Toornvliet[6], H. Moeniralam[7], B.M. Kors[8], H.J. Koelman[1], M. Verbeek[9], H. Weinstein[2], A. Hijdra[1], J. Horn[1]

[1]Academical Medical Center, Amsterdam, Netherlands, [2]SLAZ, Amsterdam, Netherlands, [3]MCL, Leeuwarden, Netherlands, [4]Rynstate Hospital, Arnhem, Netherlands, [5]OLVG, Amsterdam, Netherlands, [6]MCA, Alkmaar, Netherlands, [7]St Antonius Hospital, Nieuwegein, Netherlands, [8]KG, Haarlem, Netherlands, [9]UMCN, Nijmegen, Netherlands

**INTRODUCTION.** Guidelines for determination of prognosis in patient with postanoxic coma after cardiac arrest are all based on data collected in patients who were not treated with hypothermia [1]. In most hospitals however, induced hypothermia has become standard care. Therefore data regarding the reliability of diagnostic tools used to determine prognosis have to be collected in patients treated with hypothermia.

**OBJECTIVES.** To establish the validity of diagnostic methods to predict poor outcome in patients treated with hypothermia after CPR.

**METHODS.** This multicenter prospective cohort study included adult comatose patients admitted after CPR and treated with induced mild hypothermia (32–34°C). Data collected: Age, gender, presenting rhythm, time to return of spontaneous circulation, characteristics about hypothermia treatment, serum neuron specific enolase levels (NSE) on admission, 12 h after reaching target temperature, 36 and 48 h after CPR, results of SSEP recorded during hypothermia, and SSEP recorded if patients remained in coma after rewarming and wearing off of sedative drugs. Neurological examination (GCS and brain stem reflexes) was performed 48 and 72 h after CPR. Neurological outcome was assessed 30 days and 6 months after admission with the Glasgow Outcome Scale. Poor outcome was defined as death, vegetative state or severe disability 6 months after CPR. For SSEP, GCS-M score (M score dichotomy M1-2 vs. M3-6), pupillary reaction, corneal reflex and NSE levels >33µg/L, false positive rates (FPR, 1-specificity (2)) for prediction of poor outcome was calculated with 95% CI.

**RESULTS.** 391 patients were included in 10 collaborating hospitals between September 2007 and October 2009. Patient characteristics: median age 65, 73% male, median time to ROSC 15 min., initial rhythm VF/VT in 77%. Outcome: 205 (53%) patients died, of whom 149 died in the first week after admission. No patient remained in a vegetative state, 9 patients were severely disabled, 49 moderately disabled and 124 made a good recovery. Predicting poor outcome: (1) SSEP (normothermia) FPR 0.01, 95% CI 0–0.05, (2) GCS-M score (72 h) FPR 0.12, 95% CI 0.07–0.18, (3) pupillary reaction (72 h) FPR 0.01, 95% CI 0–0.07, (4) Corneal reflex (72 h) FPR 0.04 95% CI 0.01–0.13 and (5) NSE (48 h) FPR 0.07 95% CI 0.04–0.12

**CONCLUSIONS.** This study shows that absent pupillary reaction 72 h after CPR and absent cortical response in SSEP after rewarming reliably predict poor outcome at 6 months in patients who remain comatose after CPR and treatment with hypothermia. These tests can be used shortly after rewarming and wearing off of sedative drugs. The results are in accordance with the recently published results of Rosetti et al. found in a much smaller group of patients from one centre [2]. Further results of analyses will be presented on the conference.

**REFERENCE(S).** 1. Wijdicks, Neurology (2006).
2. Rosetti, Ann Neurol (2010).

**GRANT ACKNOWLEDGMENT.** Dutch Heartfoundation 2007B039.

## 0846

### DOES THE CHANGE OF EDUCATIONAL STRATEGY FOR CPR ACCORDING TO THE CHANGE OF GUIDELINES AFFECT ON THE QUALITY OF OUT-OF-HOSPITAL CPR?

Y. Moriwaki[1], Y. Tahara[1], H. Toyoda[1], T. Kosuge[1], M. Iwashita[1], S. Arata[1], N. Harunari[1], N. Suzuki[1]

[1]Yokohama City University Medical Center, Critical Care and Emergency Center, Yokohama, Japan

**INTRODUCTION.** Although guidelines for CPR teach us to do 100 times of chest compression (CC) per minute, all types of out-of-hospital emergency technicians such as paramedics or emergency life support technicians (ELSTs) are known to tend to perform CC more quickly and ventilation more slowly. The ratio of CC and ventilation they have been taught was changed from 15:2 to 30:2 after 2005 according to the change of international guidelines. However, it is unclear how this change effect the appropriateness of the frequency of CC and ventilation on the scene and in the ambulance.

**OBJECTIVES.** The object of this study is to clarify the effect of the change of educational strategy for CPR according to the change of the guideline on the quality of CPR by ELSTs in the ambulance.

**METHODS.** We recorded the frequency of CC and ventilation performed by Japanese ELSTs during CPR in the ambulances, and the frequency of CC and ventilation were compared between the first period when ELSTs performed CPR according to the guideline 2000 (15:2 CPR) and the second period when they perform CPR according to the guideline 2005 (30:2 CPR). In our special out-of-hospital EMS system for CPA patients in Yokohama, 12 hospitals have been selected to receive and to treat CPA patients, one emergency director (medical doctor) belongs in these 12 hospitals is always conducting his duties in the ambulance operation center in shift, and he/she advices some treatment to ELST and notifies the transfer of the CPA patients to these 12 hospitals, and he/she continue to talk with ELSTs from the contact with the patients to the arrival on the hospital. The emergency director can detect the frequency of CC and ventilation by ELSTs in the ambulance during his/her work.

**RESULTS.** In the first period, ELST performed CC 15 times per 7.2 s, (125 times per minute), and performed 2 ventilations for 4.5 s. 36% of patients underwent appropriate CC (100–120) whereas 43% underwent high-frequency CC (120–150) and 13% too quick CC (more than 150). In the second period, they performed CC 30 times per 18.1 s (99 times per minute), and performed 2 ventilation for 4.3 s.

**CONCLUSIONS.** Although ELSTs performed inappropriate CPR (rapider CC and slower ventilation) in ambulances in the time when they were taught to do 15:2 CPR, according to the concept recommended in the guideline 2000, they now perform more appropriate CPR according to the guideline 2005. To educate the concept of 30:2 CPR described in the guideline 2005 can lead ELSTs to do more appropriate CPR.

## 0847

### MILD THERAPEUTIC HYPOTHERMIA MODIFIES THE CURRENT PROGNOSTIC PARAMETERS IN PATIENTS AFTER CARDIAC ARREST

L. Bisschops[1], N. van Alfen[2], S. Bons[1], J.G. van der Hoeven[1], C. Hoedemaekers[1]

[1]Radboud University Nijmegen Medical Centre, ICU, Nijmegen, Netherlands, [2]Radboud University Nijmegen Medical Centre, Department of Clinical Neurophysiology, Nijmegen, Netherlands

**INTRODUCTION.** Outcome studies in patients with anoxic-ischemic encephalopathy focus on the early and reliable prediction of a persistent vegetative state or severe disability. The currently used outcome predictors are based on studies that were performed before the use of mild therapeutic hypothermia. A recent web-based survey among in the ICUs in the Netherlands demonstrated that the vast majority of physicians use clinical neurological examination (92%) and the median nerve SSEP (94%) for the prediction of neurological outcome [1].

**OBJECTIVES.** Aim of the present study was to determine the effect of mild therapeutic hypothermia on clinical and electrophysiological outcome parameters.

**METHODS.** We conducted a retrospective single centre cohort study in comatose patients after cardiac arrest who were admitted to the ICU and treated with mild therapeutic hypothermia for 24 h. A favourable outcome was defined as a Glasgow Outcome Score (GOS) of 4 and 5.

**RESULTS.** We analysed data of 103 patients. A favourable outcome was recorded in 35.0% of the patients. The ICU mortality was 57.3% and the hospital mortality was 62.1%. A motor score of M1 or M2 *or* absent pupil reactions to light *or* absent corneal reflexes on day 3 was present in 80.6% of patients with an unfavourable and 11.1% of patients with a favourable outcome [positive predictive value 0.93 (0.82–0.98)]. The combination of M1 or M2 and absent pupil reactions to light and absent corneal reflexes on day 3 was present in 14.9% of patients with an unfavourable and 0% of patients with a favourable outcome [positive predictive value 1.00 (0.66–1.00)]. An SSEP was performed in 47 patients. The SSEP had no cortical response in 38.3% of patients with an unfavourable outcome versus none of the patients with a favourable outcome [PPV 1.0 (0.78–1.00)]. The EEG was unreactive to noxious stimuli in 15 patients (65.2%) with an unfavourable outcome and in none of the patients with a good outcome [PPV of an unreactive EEG for predicting a poor outcome 1.00 (0.75–1.00)].

**CONCLUSIONS.** Mild therapeutic hypothermia modifies the current prognostic parameters in patients after cardiac arrest. Prognostication according to the AAN guidelines cannot be applied to patients treated with hypothermia.

**REFERENCE.** 1. Bouwes A, Kuiper MA, Hijdra A, Horn J. Induced hypothermia and determination of neurological outcome after CPR in ICUs in the Netherlands: results of a survey. Resuscitation. 2010;81(4):393–7.

## 0848

### THE PREDICTIVE VALUE OF BRAIN ARREST NEUROLOGICAL OUTCOME SCALE ON MORTALITY AFTER CARDIAC ARREST

C. Sahutoglu[1], M. Uyar[1], K. Demirag[1], H. Isayev[2], A.R. Moral[1]

[1]Ege University Hospital, Anesthesiology and Reanimation, Izmir, Turkey, [2]Ege University Hospital, Radiology, Izmir, Turkey

**INTRODUCTION.** Discharge ratio of patients after cardiac arrest is low and some of these patients have permanent brain injury. There are several prediction scales and parameters for prognosis after cardiac arrest. One of these scales is BrANOS which consists of duration of cardiac arrest, Glasgow coma scale score and Hounsfield unit measured on cranial CT scan. BrANOS is a reliable predictor of neurological outcome following cardiac arrest.

**OBJECTIVES.** The objective of this study is to investigate the effectiveness of BrANOS on predicting mortality and disability after cardiac arrest.

**METHODS.** We investigated the cardiac arrest patients who were hospitalized in our ICU within 2 year period. Inclusion criteria were age over 18 years old, survival of more than 24 h after cardiac arrest and availability of cranial CT. We recorded age, sex, diagnosis, duration of cardiac arrest and hospital stay, mortality, Glasgow outcome score (GOS) and BrANOS score.

**RESULTS.** The mean age of the patients was 57 $\pm$ 17 years (33 female, 67 male). The mean duration of cardiac arrest was 19.28 $\pm$ 12.26 min. The survivors had a significantly lower duration of cardiac arrest when compared to non-survivors (15.37 $\pm$ 11.17 vs. 22.23 $\pm$ 12.32 min; p=0.005). ICU mortality rate was 57% (20 female, 37 male).

The BrANOS mean score was 10.3 $\pm$ 3.2. There was a significant difference between survivors and non-survivors regarding BrANOS score (8.8 $\pm$ 3.2 vs. 11.6 $\pm$ 2.7; $p < 0.01$). BrANOS predicted survival reliably with a ROC area-under-curve of 0.733. The scale > 14 predicted death with 100% accuracy. BrANOS score also correlated well with GOS. All the patients without disability had a BrANOS score below 10.

**CONCLUSIONS.** In this study we demonstrated that BrANOS provided reliable data for prognostic evaluation after cardiac arrest.

**REFERENCE(S).** Torbey MT, Geocadin R, Bhardwaj A. Brain arrest neurological outcome scale (BrANOS): predicting mortality and severe disability following cardiac arrest. Resuscitation. 2004;63:55–63.

## 0849

### CORRELATION BETWEEN ARTERIAL AND VENOUS LACTATES AND BLOOD GASES IN ACUTE POISONINGS TREATED WITH EXTRACORPOREAL LIFE SUPPORT FOR REFRACTORY CARDIAC FAILURE OR ARREST

B. Mégarbane[1], C. Le Gall[1], N. Deye[1], I. Malissin[1], F.J. Baud[1]

[1]Hôpital Lariboisière, Réanimation Médicale et Toxicologique, Paris, France

**INTRODUCTION.** Extracorporeal life support (ECLS) has been proposed as an alternative rescue method to treat patients suffering from cardiac failure or arrest if not responding to conventional treatment and cardiopulmonary resuscitation.

**OBJECTIVES.** Our aims were: (1) to study the correlations between arterial and venous lactates and blood gases in these poisonings associated with extremely poor cardiovascular conditions and (2) to assess their respective predictive values regarding survival at 24 h in case of cardiac arrest and ICU discharge in case of cardiac failure.

**METHODS.** We designed a prospective study including all ECLS-treated patients in our toxicological ICU with arterial and venous samplings obtained at the time of femoral vessel cannulation to measure lactates and blood gases. We calculated the inotropic score, roughly representing the severity of myocardial dysfunction [IS (µg/kg/min)= dopamine + dobutamine + isoprénalinex100 + adrénalinex100 + noradrénaline × 100]. Results were expressed as median [25–75%-percentiles]. Correlations were performed using Pearson tests, univariate comparisons using $\chi^2$ and Mann–Whitney tests, and multivariate analysis using logistic regression with Odds ratio (OR) and 95%-confidence interval determination.

**RESULTS.** Twenty-eight patients (14 M/18F, 42 years [34–51], SAPSII: 82 [72–89]) were included. Among these patients, 23 were in refractory cardiac arrest (low flow: 150 min [105–172], 24 h-survival rate: 47% and ICU survival rate: 11%), while 19 in severe cardiac failure (inotropic score: 145 µg/kg/min [105–243] and ICU survival rate: 67%)]). Poisonings involved sodium-channel blockers (21/28), meprobamate (2/28), and calcium-channel blockers (1/28). Whatever the indication of ECLS was, correlations between arterial and venous lactate ($R^2$=0.78), bicarbonate ($R^2$=0.85), base excess ($R^2$=0.92), pH ($R^2$=0.88), and $PCO_2$ ($R^2$=0.49) were good ($p < 0.0001$). In contrast to the low-flow duration, none of these parameters were significantly associated with the 24 h-survival rate in cardiac arrest patients. Based on a multivariate analysis, the arterial lactate concentration measured at the time of cannulation (9.4 mmol/l [6.3–12.2]) was the only predictive factor of survival in ECLS-treated patients for cardiac failure (OR: 16 [1.1–234.3] for lactate concentrations >8 mmol/l).

**CONCLUSIONS.** Despite good correlations between their corresponding parameters, arterial and venous samplings remain complementary in case of extremely poor cardiac conditions to better evaluate oxygenation level as well as the respiratory/metabolic acidosis parts.

## 0850

### EARLY INITIATION OF THERAPEUTIC HYPOTHERMIA AFTER CARDIAC ARREST AND CORRELATION WITH SURVIVAL AND NEUROLOGIC OUTCOME: AN ITALIAN REPORT

S. Alongi[1], F. Polli[1], M. Panigada[1], for the ICE Group (Italian Cooling Experience)

[1]Fondazione IRCCS 'Ca Granda' Policlinico, Milan, Italy

**INTRODUCTION.** Therapeutic hypothermia should be part of standardised treatmentstrategy for comatose survivors of cardiac arrest. The optimal timing of initiation has not been clinically defined, corrent consensus is to initiate cooling as soon as possible [1]

**OBJECTIVE.** To evaluate the effects of early initiation of therapeutic hypothermia (TH) after cardiac arrest (CA) on survival and neurologic outcome.

**METHODS.** We enrolled all patients admitted to an intensive care unit (ICU) after a CA (22 participating Italian ICUs). We recorded the time (minutes) from CA to the beginning of basic life support resuscitation manoeuvres (CA-BLS) and that from CA to the return of spontaneous circulation (CA-ROSC). Patients who had received TH were divided into two groups: early TH (group 1: TH initiated <2 h from CA) and late TH (group 2: TH initiated 2–6 h from CA). Survival at ICU discharge and at 6 months after CA was recorded. Favourable neurologic outcome was evaluated according to the Pittsburgh Cerebral Performance Category (CPC). Good neurologic outcome occurred with CPC 1 (good cerebral performance) or CPC 2 (moderate cerebral disability).

**RESULTS.** From January to September 2009, 149 patients were admitted to the participating ICUs after experiencing CA (age 64 ± 15 years; M/F = 103/43; 67 out-of-hospital CA [OHCA]). One hundred patients underwent TH (70 in group 1 and 30 in group 2). The main results are shown in the Table 1 below.

**CONCLUSIONS.** Our data suggest that survival at ICU discharge and at 6 months may be similar for patients who underwent early therapeutic hypothermia and for those who underwent late therapeutic hypothermia. Furthermore, the early initiation of TH was not associated with improved long-term neurologic outcomes.

**TABLE 1**

| | Group 1 (early TH) | Group 2 (late TH) | |
|---|---|---|---|
| Patients, n | 70 (59 OHCA) | 30 (8 OHCA) | |
| CA-BLS, min | 5.0 ± 4.6 | 6.3 ± 4.4 | p = 0.20 |
| CA-ROSC, min | 23 ± 15 | 20 ± 15 | p = 0.40 |
| Survival at ICU discharge, n (%) | 32 (45.7%) | 19 (63.3%) | p = 0.16 |
| Survival at 6 months, n (%) | 25 (36.0%) | 17 (58.6%) | p = 0.08 |
| CPC 1-2 at 6 months, n (%) | 24 (75%) | 14 (73.6%) | p = 0.81 |

**REFERENCES.** 1. Jerry P. Nolan et al. Post cardiac arrest syndrome. Resuscitation. 2008; 79:350–79

# Trauma: 0851–0863

## 0851

### SAFETY OF PERCUTANEOUS TRACHEOSTOMY IN TRAUMA PATIENTS

S.A. Becker[1,2], I. Maldonado[2,3]

[1]Maimonides Medical Center, Brooklyn, USA, [2]Jersey Shore University Medical Center, Trauma Center, Neptune, USA, [3]Maimonides Medical Center, Surgical Critical Care, Brooklyn, USA

**INTRODUCTION.** Percutaneous tracheostomy is a common procedure in many Trauma Intensive Care units. Concerns about the safety of percutaneous tracheostomy in patients without cervical spine clearance or with cervical spine injury limited its adoption for some surgeons. Most experts recommend the use of fiberoptic bronchoscopy during percutaneous tracheostomy.

**OBJECTIVES.** To determine the safety of performing percutaneous tracheostomy in trauma patients with either no cervical spine clearance status or with cervical spine injury.

**METHODS.** : From 1/1/2001 to 12/31/2007 we retrospectively evaluated the medical records of all patients with blunt trauma who required tracheostomy in a Level II Trauma Center. Data was gathered from a trauma registry database and medical records. Patients were divided in two groups, Open Tracheostomy (OT) and Percutaneous Tracheostomy (PT). Patient age, Injury Severity Score (ISS), type of tracheostomy insertion method, cervical spine clearance status prior to tracheostomy, presence of cervical spine injury, use of bronchoscopy assistance in percutaneous tracheostomy, and immediate complications post tracheostomy were recorded for each patient. The results: The total number of tracheotomies during the study period was 220 of which 125 (56%) were PT and 95(44%) were OT. Both groups were similar in age, sex and ISS distribution. Of the OT group, 60 (63%) were done in patients with no cervical spine clearance or cervical spine injury. No immediate complications were reported in the OT group. The PT group had 63 cases (50.4%) done with no pre-operative cervical spine clearance or positive for cervical spine injury. The PT group underwent the procedure without bronchoscopy assistance in 95% of the cases. Two cases (1.5%) in the PT group were reported with postoperative bleeding from the insertion site that did not required intervention. Both cases were PT done without bronchoscopy assistance and did not have pre-operative cervical spine clearance. No other immediate complications were reported.

**RESULTS.** The results of this study suggest that PT is safe in trauma patients without preoperative cervical spine clearance or with cervical injuries as compared with the OT group. Most of the PT cases were done without bronchoscopy assistance (95%).

**CONCLUSIONS.** Percutaneous tracheostomy without bronchoscopic guidance is safe and efficacious in trauma patients even if cervical spine injury has not been excluded.

**REFERENCE(S).** 1. Fernandez L et al. Bedside percutaneous tracheostomy with bronchoscopic guidance in critically ill patients. ArchSurg.1996;131(2):129–32.

2. Barba CA et al. Bronchoscopic guidance makes percutaneous tracheostomy a safe, cost-effective, and easy-to-teach procedure. Surgery. 1995;118(5):879–83.
3. Mayberry JC et al. Cervical spine clearance and neck extension during percutaneous tracheostomy in trauma patients. CritCareMed. 2000;28(10):3436–40.

## 0852

### TWO HOSPITALS WITH ONE TRAUMA SYSTEM: A JOINT APPROACH TO THE CARE OF THE INJURED PATIENT

R. Jawa[1,2], D. Yetter[2], D. Young[1,2], V. Shostrom[1], L. Nelson[1,2], M. Wagner[1,2], S. Cemaj[3], D. Mercer[1,2], J. Stothert[1,2]

[1]UNMC, Omaha, USA, [2]Nebraska Medical Center, Omaha, USA, [3]Creighton University, Omaha, USA

**INTRODUCTION.** Care of the injured patient requires extensive resources. In difficult economic times, providing the necessary personnel and equipment at a single hospital may not be possible. This has forced many trauma centers to close in the US [1]. To this end, a joint trauma system was developed in 1994, whereby two hospitals in different neighborhoods of a metropolitan area of approximately 800,000 people alternate days of trauma coverage.

**OBJECTIVES.** To demonstrate the sustainability of a joint trauma system.

**METHODS.** Since 1994, 3 days per week, all trauma patients are transported by Emergency Medical Services to hospital A, a university affiliated hospital with a surgical residency program. Four days per week, all trauma patients are transported to hospital B, also a university affiliated hospital with its own surgical residency. Each hospital is responsible for management of walk-ins to their hospital. Both centers have 24 h per day, 7 days per week in-house coverage by surgical residents. In-house trauma attending coverage is provided at both hospitals on Trauma days. Each month, joint morbidity and mortality conference and peer review are held; system related issued are also discussed. The trauma registry database was queried for the first 15 years of the joint trauma system.

**RESULTS.** Trauma system statistics (1994–2008):

TRAUMA SYSTEM STATISTICS

| | Hospital A | Hospital B |
|---|---|---|
| Total trauma patients (n) | 15,234 | 13,102 |
| Mean Injury Severity Score (ISS) | 11 | 13 |
| ISS>15 (n, %) | 3252 (21%) | 3566 (27%)* |
| Blunt trauma (n, %) | 13732 (90%) | 11258 (86%)* |
| Mortality (%) | 5.25% | 6.4%* |
| Arrived from scene (n, %) | 7,906 (52%) | 9,479 (72%)* |
| Transferred to trauma center (n, %) | 3,518 (23%) | 2,325 (18%)* |
| Trauma team activation on Trauma days (n, %) | 5,413 (36%) | 6,562 (50%)* |
| Trauma team activation on Non-trauma days | 177 (1%) | 307 (2%)* |

* $p < 0.01$ between Hospital A and B by Chi-square analysis, % calculated from total trauma patients per hospital

**CONCLUSIONS.** Hospital B had more penetrating trauma victims, arrivals from injury scene, trauma team activations, and patients with ISS >15. Correspondingly, they had a slightly higher mortality. On each center's non-trauma days, trauma team activation was required infrequently. Thus, the data suggest that in challenging economic times, combining scarce resources amongst two hospitals may be a sustainable method for providing care to critically injured patients. In 2008, the two hospital joint trauma system received comprehensive trauma system designation by the state; this designation is similar to the American College of Surgeons Level I trauma center designation. To this day, it remains the only comprehensive trauma system in a mostly rural state with a population of approximately 1.7 million.

**REFERENCE(S).** 1. http://www.traumafoundation.org/restricted/tinymce/jscripts/tiny_mce/plugins/filemanager/files/publications/NFTC_CrisisReport_May04.pdf

## 0853

### EARLY TRACHEOSTOMY ADVANTAGES IN NEUROINTENSIVE CARE, OUR 6 YEARS EXPERIENCES

J. Prochazka[1]

[1]Masaryk Hospital, Central ICU, Usti nad Labem, Czech Republic

**INTRODUCTION.** Tracheostomy is among the most commonly performed surgical interventions in ICU in patients requiring ventilatory support. The best appropriate method of this procedure and the issue of timing of the tracheostomy are permanently debated.

**METHODS.** Our ICU performed 351 tracheostomies in total between January 2004 and December 2009; out of this number we assessed 293 tracheostomies in patients with neurological or neurosurgical diseases, 178 males and 115 females, aged 15 to 89, averege age 56.9 years. These interventions were performed using standard surgical approach with trachea fixation to the skin using suture.

**RESULTS.** The most common diagnosis in our study were brain injuries (29%), followed by subarachnoidal hemorrhage (21%), hemorrhage stroke (18%), brain tumours (11%), ischemic stroke (10%), spinal injuries (6%) and other diagnoses in 5% patients. The average duration of the ventilatory support to tracheostomy was 4 days (rating from 1 to 20). The duration of the procedure averaged 20.5 min (10–75 min). A surgical manipulation with tyreoid gland was necessary in 49% procedures.

Majority of the tracheostomed patients were afterward transported into their regional hospitals (42%), 27% patients died in our ICU, 12% patients were transferred in other department within our hospital, 11% patients were decannulated in our hospital after stabilisation of their health condition, 7% were transferred in nursing home or long-term medical care department and 1% in spinal care department.

The most common complication we met was bleeding (usually from tyroid gland's bed, in 4.8% procedures), discission of the tracheal ring during tracheal fixation to skin (3.4%) and endotracheal tube cuff perforation (2%). One patient suffered cardiac arrest with successful resuscitation during procedure.

**CONCLUSIONS.** Performing an early tracheostomy (within 7 days of intubation) helps to decrease the level of sedation needed for tracheal tube tolerance, makes weaning from ventilatory support easier, improves pulmonary toilet, and in emergency transport conditions enables easier handling in contrast with intubated patients. Regarding neurointensive patients, at our department we definitely prefer early tracheostomy. Employing the surgical technique with tracheal fixation to the skin facilitates coping with possible periprocedural complications.

**REFERENCE(S).** 1. Freeman BD et al. Relationship between tracheostomy timing and duration of mechanical ventilation in critically ill patients. Crit Care Med. 2005;33:2513–20

2. Silvester W et al. Percutaneous versus surgical tracheostomy: a randomized controlled study with long-term follow-up. Crit Care Med. 2006;34:2145–52

## 0854

### FUNCTIONAL OUTCOME OF TRAUMATIC BRAIN INJURY AT DISCHARGE FROM THE INTENSIVE CARE UNIT AND AFTER ONE YEAR FOLLOW-UP

M.A. Prieto[1], J.F. Fernandez[1], A. Muñoz[1], M. Delange[2], G. Quesada[1], O. Pérez[3]

[1]Hospital Carlos Haya, Intensive Care Unit, Málaga, Spain, [2]Hospital Axarquía, Intensive Care Unit, Vélez Málaga, Spain, [3]Fundación Imabis, Málaga, Spain

**INTRODUCTION.** Traumatic brain injury (TBI) is a great problem of Public Health and the first cause of mortality and dysfunction in youth and adult live. Results obtained after their management in Intensive Care Units (ICU) are usually referred only in terms of morbimortality.

**OBJECTIVES.** To compare the functional outcome of patients with mild-moderate and severe TBI at discharge from the ICU and after 1 year follow up.

**METHODS.** Cohort study with adult patients admitted to ICU through 2005–2009 with TBI. Demographic, epidemiologic and clinical data were recorded. Validated measurement scales such as Glasgow Coma Scale (GCS), Glasgow Outcome Scale (GOS), Injury Severity Score (ISS) and the quality of life questionnaire PAEEC (Project for the Epidemiological Analysis of Critical Patients), considering basic physiological activities, normal daily activities and emotional state, at discharge and 1 year after by phone contact, were used. Comparison between groups was made using the Chi-square and t Student tests.

**RESULTS.** We included in the study data from 447 patients (Table 1). TBI were usually caused by traffic accidents. Cranial computed tomography (CT) scan most frequent findings were diffuse injury II and III (51%) following Marshall classification. GOS 2–3 at discharge from ICU and 1 year postinjury were, respectively, 85.1 and 45.9% in the GCS $\leq$ 8 group, and 76.3 vs. 21.2% in the GCS $\geq$ 9 group (in both cases, $p < 0.0001$). One year after discharge 245 of the 323 surviving patients answered the questionnaire (75.85%): severe physiologic dysfunction, great dependence in daily activities and emotional disturbances were detected when leaving ICU and marked as 60.1, 89.9 and 70.9%, while 1 year after they were 19.3, 33.3 and 38%, respectively ($p=0.0001$) in the GCS $\leq$ 8 group. The results in the GCS $\geq$ 9 group were 30.4, 68.6 and 42.2% when leaving ICU and 11.2, 13.3 and 27.6% after 1 year follow up, respectively ($p=0.0001$).

**CONCLUSIONS.** The survivors whit mild-moderate and severe traumatic brain injury showed better GOS level and physiologic and functional capacity, being more independent in their way of life after 1 year follow-up from discharge of ICU.

**TABLE 1** EPIDEMIOLOGIC AND CLINICAL DATA IN OUR SERIES

| | GCS≤8 (n=301) | GCS≥9 (n=146) | p (CI 95%) |
|---|---|---|---|
| Male | 241 (80.1%) | 122 (83.6%) | 0.44 |
| Mean age±SD | 36.74 ± 18.8 | 45.39 ± 20.4 | 0.001 (-12.6,-4.6) |
| ISS/APACHE II | 33/20 | 14/13 | 0.001/0.001 |
| Days of mechanical ventilation | 7.62 | 4.93 | 0.001 |
| ICU length of stay | 11.12 | 8 | 0.005 |
| Exitus | 109 (36.2%) | 15 (10.3%) | 0.0001(0.18–0.33) |
| GOS 2/3 at discharge ICU | 166 (85.1%) | 100 (76.3%) | 0.06 |
| GOS 2/3 1 year postinjury | 73 (45.9%) | 21 (21.2%) | 0.0001(0.12–0.36) |

**REFERENCE(S).** Suarez JI. Outcome in neurocritical care: Advances in monitoring and treatment and effect of a specialized neurocritical care team. Crit Care Med. 2006; 34[Suppl.]:S232–8

## 0855

### ENTERAL NUTRITION WITH GLUTAMIN SUPPLEMENTATION VS STANDART ENTERAL FORMULA IN PATIENTS WITH INTRACRANIAL HEMORRHAGES

A.A. Solodov[1], S.S. Petrikov[1], Y.V. Titova[1], V.Y. Zinkin[2], V.V. Krylov[3]

[1]Sklifosovsky Research Institute, Neurosurgical Intensive Care Unit, Moscow, Russian Federation, [2]Sklifosovsky Research Institute, Clinical Immunology Department, Moscow, Russian Federation, [3]Sklifosovsky Research Institute, Neurosurgery Department, Moscow, Russian Federation

**INTRODUCTION.** It's known from the literature that glutamine augments cellular immune functions, especially those associated with cell mediated immunity, and plays an important role in intestine function. According to ESPEN guideline enteral glutamine should be used in patients with trauma and burns. But the data about enteral glutamine effects in patients with intracranial hemorrhages (ICH) is insufficient.

**OBJECTIVES.** To investigate the effects of enteral glutamine supplementation in patients with ICH.

**METHODS.** 20 patients with ICH with GCS $\leq$ 9 were randomized into 2 groups at the 1st day of postoperative (p/o) period. 10 patients were feed with standard enteral formula (enteral admixtures (60–75 g of protein, 1,500 ccal in 1 l) (Control group). 10 patients received enteral nutrition with high-protein admixture (Fresubin-HP-energy—75 g of protein, 1,500 ccal in 1 l) with enteral glutamine supplementation (Intestamin—30 g of glutamine in 500 ml) (Glutamine group). Energy expendure was estimated by Harris-Benedict formula, hypercatabolism severity—by nitrogen balance calculation and determination of blood transthyretin level. In case of high energy requirements and severe hypermetabolism parenteral nutrition was used according to intrahospital protocol. We recorded and compared between groups infection complications incidence, gastrointestinal function and hypercatabolism severity dynamics.

**RESULTS.** Patients of both groups had no differences in SOFA score during the investigation. Glutamine supplementation was accompanied by pneumonia incidence decrease from 70 to 40% and better gastrointestinal function. At the 2 p/o day enteral nutrition was started in 100% of patients in Glutamine group versus 80% of Control group patients. Enteral nutrition volume in Glutamine group at 2nd p/o day was 1,620 ± 471 ml, at 3rd p/o day—1,650 ± 412 ml, at 3rd p/o day—1,440 ± 508 ml versus 1,060 ± 593 ml ($p < 0.05$), 835 ± 494 ml ($p < 0.05$) and 811 ± 659 ml ($p < 0.05$) in Control group. The hypercatabolism severity was higher in Glutamine group. Urea nitrogen excretion in patients of Glutamine group was 29.4 (25.1; 58.7) g, 50.7 (32.8; 66) g and 47.4 (43.8; 58.7) g at 1, 4–5 and 6–7 p/o days respectively versus 16 (14.1; 17.9) g ($p < 0.05$), 22.6 (17.9; 32.2) g ($p < 0.05$) and 28.2 (16.5; 29.3) g ($p < 0.05$) in Control group. Transthyretin levels were comparable between groups despite such differences. However we mentioned different trends of transthyretin dynamics. In the Control group it decreased from 0.13 ± 0.04 g/l at the 1st p/o day to 0.1 ± 0.05 g/l at 4–5 p/o days and 0.1 ± 0.07 g/l at 6–7 p/o days. In the Glutamin group transthyretin level decreased from 0.16 ± 0.06 g/l at 1st p/o day to 0.12 ± 0.05 g/l at 4–5 p/o days. But at 6–7 p/o days its level increased to 0.14 ± 0.05 g/l.

**CONCLUSIONS.** High energy and protein enteral nutrition with enteral glutamine supplementation in patients with ICH is accompanied by better gastrointestinal tract function recovery and pneumonia incidence decrease.

## 0856

### IDENTIFICATION OF PNEUMOTHORAX BY LUNG ECHOGRAPHY IN TRAUMA PATIENTS

M. Fragou[1], A. Zacharaki[1], P. Zotos[1], K. Tsikritsaki[1], A. Damelou[1], I. Poularas[1], N. Katsarelis[1], G. Koukoulitsios[1], D. Karakitsos[1], A. Karabinis[1]

[1]G.Gennimatas General Hospital of Athens, Department of Intensive Care Medicine, Athens, Greece

**INTRODUCTION.** Management of trauma patients requires rapid and safe diagnostic techniques. Ultrasound may assist the clinician with a goal-directed examination that could confirm life-threatening diagnosis, such as pneumothorax.

**OBJECTIVES.** We investigated whether lung echography (LE) could detect pneumothorax in trauma victims.

**METHODS.** One hundred trauma patients (65 males, 35 ± 15 years old, body mass index = 23.9 ± 6.1 kg/m$^2$, APACHE II score = 18 ± 4) who were admitted in the intensive care unit (ICU) were studied. Mean period of hospitalization was 42 ± 17 days. All patients were intubated and mechanically ventilated. Prior to admission, pneumothorax, hemothorax and hemo-pneumothorax were identified clinically and by means of radiography in 12, 15 and 25% of cases, respectively. In the ICU, LE was applied on a daily basis to test the progress of preexisting pneumothorax and identify possible new cases. LE recordings were compared to standard radiography and chest CT scan findings. We utilized a Philips XD11 XE ultrasound device (Philips, Bothell, USA) equipped with a convex 5–7 MHz and a linear 10–12 MHz transducer to perform LE. Using anterior and posterior-axillary lines as anatomical landmarks, each chest wall was divided into six lung regions for scanning: upper and lower parts of the anterior, upper and lower parts of the lateral, and upper and lower parts of the posterior chest wall. Pneumothorax was diagnosed by LE if any of the following lung patterns could be observed: absent lung sliding and horizontal A-lines (barcode sign) (Figure 1) and the lung point sign (Figure 2).

**RESULTS.** New cases of pneumothorax were identified by LE in 65% of patients in the ICU. These were attributed to complications of mechanical ventilation (30%) and to surgical complications (70%), such as misplaced thoracostomy tubes, and severe chest trauma. Associated pleural effusions were recorded in 75% of cases. The incidence of LE signs in cases with pneumothorax was: absent lung sliding (80%), barcode sign (85%), and lung point sign (15%). The latter was mainly associated of with smaller sized pneumothorax (r=0.8) and/or pleural effusion (r=0.7). LE was strongly correlated to standard radiography and computed tomography findings (r=0.8, r=0.9, respectively). LE exhibited 99% sensitivity and 100% specificity in detecting pneumothorax.

**CONCLUSIONS.** LE is a powerful by the bed tool in detecting pneumothorax.

## 0857

### ABDOMINAL TRAUMA. CLINICAL CHARACTERISTICS AND THERAPEUTIC MANAGEMENT

A.V. Aller[1], M. Mourelo[1], P. Vidal[1], S. Pita[1], M.T. Bouza[1], A.I. Hurtado Doce[1], P. Jiménez[1]

[1]Complexo Hospitalario Universitario A Coruña, A Coruña, Spain

**INTRODUCTION.** Abdominal trauma is frequently associated in patients with multiple injuries. It is frequently under-diagnosed initially by coexistence with other injuries, so it is important to know the characteristics of these patients.

**OBJECTIVES.** In our study we describe the clinical and epidemiological characteristics and specific management of the patients with abdominal trauma.

**METHODS.** Retrospective study of patients admitted to an intensive care unit (ICU) for 6 years (January 2004–December 2009). Epidemiological variables were studied, mechanism and type of trauma, APACHE II, Injury Severity Score(ISS), Revised Trauma Score(RTS), Glasgow Coma Scale(GCS); laboratory values, therapeutic management, complications and mortality. We made a descriptive analysis: estimation percentage with 95% confiance interval (CI) to define cualitative variables and mean ± standard desviation (SD) for cuantitative variables.

**RESULTS.** 209 patients were included. The mean age was 40.9 ± 18.5 years. Male were 79.4% (CI 74.2–85.6). The most common injury mechanism was circulation accident: cars 40.2% (CI 31.5–45.5), motorcycles 19.6% (13.8–25.2). 88% were closed (CI 81.5–91.5). 29.4% showed peritonism (CI 23.5–37.0). The most frequently injury associated was chest trauma (61.7% CI 52.3–66.5) followed by Traumatic Brain Injury (38.8% CI 29–43). Mean initial GCS was 13.4 ± 3.7. Hemoperitoneum was present in 49.8% (CI 44.8–59.2).The most commonly organ affected was the spleen (45.9%), severe splenic injury was more frequent (52.1%) than mild (grades I, II, III AAST).The second one was the liver(35.8%), mild more frequent than severe(71.1 vs. 28.9%). The most frequently diagnostic test used was the CT (78.5%). The mean pH was 7.31 ± 0.79, hematocrit 35.9 ± 7.8, GOT 270 ± 380, GPT 277 ± 491, total bilirubin 0.7 ± 0.8, CPK 1,410 ± 1,548.2, Amylase 103.5 ± 178.9, PT 17 ± 11.5, APTT 30.4 ± 14.1. 49.8% needed surgical treatment (CI 40.8–55.2). Cathecolamines were used in 32.2% (CI 26.8–40.5), more in the medical group(42.3 vs. 22.1%). 48.1% needed mechanical ventilation(CI 37.5–51.9). 51.8% needed blood transfusion. 90.7% of the patients received nutrition in ICU, preferently by enteral route. 16.8% of the patients presented late complications. The scores were: ISS 34.5 ± 16.9 (survivors 33 ± 15.5 vs. dead men 56.7 ± 21.1), RTS 10.1 ± 1.9, APACHE II 14.9 ± 7.9 (medical: 11.8 ± 8.1 vs. surgical 17.9 ± 6.3).The mean ICU length of stay period was 12.5 ± 15.4 days and in the hospital 39.8 ± 51 days. The global mortality in ICU was 6.2% (CI 3.6–11.1): medical 2.9 versus 9.6% surgical patients.

**CONCLUSIONS.** Abdominal trauma occurs in young patients, especially in traffic accidents. The initial physical examination is unreliable for diagnosis. There is frequent association with chest trauma. The most frequent lesion is the spleen, followed by the liver. More than half received conservative treatment, especially in the spleen. We found higher mortality in the surgical group.

## 0858

### AN AUDIT OF THE MANAGEMENT OF PATIENTS WITH AN ACUTE BRAIN INJURY, PRIOR TO AND DURING THEIR TRANSFER TO A NEUROSURGICAL UNIT (NORFOLK AND NORWICH UNIVERSITY HOSPITAL NNUH, UK)

K.J. Wild[1], B. Maiya[2]

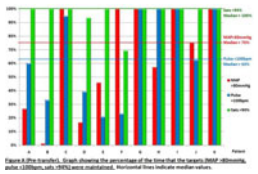
[1]Norfolk and Norwich University Hospital, Anaesthesia, Norwich, UK, [2]Norfolk and Norwich University Hospital, Intensive Care, Norwich, UK

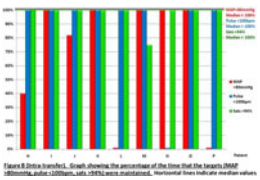
**INTRODUCTION.** Most patients with an acute brain injury are initially treated at centres which lack neurosurgical units. Several insults cause secondary brain damage, including: raised intracranial pressure, haemodynamic instability, hypoxia and hypercarbia. Guidelines have been published to optimise initial management [1].

**OBJECTIVES.** We examined the pre-transfer and intra-transfer management of acute brain injuries, admitted to the NNUH during 2009.

**METHODS.** Selection criteria of: acute brain injury, GCS < 8, and transfer to a neurosurgical unit, identified 19 patients. Of these, pre-transfer data was available for 11, and intra-transfer data for 9. Guidelines [1] provide several standards, including maintaining: a mean arterial pressure (MAP) of >80 mmHg, pulse rate <100 bpm, $PaO_2$ >13 kPa, and $PaCO_2$ 4.5–5 kPa. The proportion of time that these targets were met was expressed as a median value with an interquartile range (IQR).

**RESULTS. Pre-transfer:** The 11 patients were monitored for 75% (62–90%) of their admission time, during which a MAP of >80 mmHg was maintained in 75% (36–100%), and a pulse of <100 bpm in 63% (36–100%). 9/11 patients (82%) had oxygen saturations ($O_2$ sats) maintained at >94%, 6/11 patients (55%) had a $PaO_2$ of >13 kPa, and only 1/11 patients had a $PaCO_2$ of 4.5–5.0 kPa. **Intra-transfer:** The 9 patients were monitored for 100% of their transfer time, during which a MAP of >80 mmHg, pulse of <100 bpm and $O_2$ sats of >94% were achieved for a 100% (40–100%) of monitored time.





**CONCLUSION.** Our audit shows that although intra-transfer management is acceptable, pre-transfer management needs improvement with regards to monitored time, haemodynamic parameters, and $PaO_2$ and $PaCO_2$ regulation. More rigorous implementation of the guideline is required to limit worsening of secondary brain injury.

**REFERENCES.** Association of Anaesthetists of Great Britain and Ireland. Recommendations for the safe transfer of patients with brain injury. AAGBI (2006)

## 0859

### SURVEY OF CALORIC INTAKE FROM NUTRITIONAL REPLACEMENT AND PROPOFOL IN A NEUROINTENSIVE CARE UNIT

A. Rae[1], S. Sharma[1], B. Dawson[1], J. Pennington[2], S.P. Young[1]

[1]Institute of Neurological Sciences, Department of Neuroanaesthetics, Glasgow, UK, [2]Southern General Hospital, Department of Nutrition and Dietetics, Glasgow, UK

**INTRODUCTION.** Adequate provision of nutritional support is important in patients with head injury due to the concurrent hyper-metabolic state[1]. Provision of enteral nutrition can be inadequate in the critical care setting for a number of reasons[2].

**OBJECTIVES.** To determine actual caloric intake compared with the target regimen, to investigate the contribution of propofol to calorie intake, and ascertain reasons for feed interruption.

**METHODS.** We prospectively gathered data on 20 patients with acute brain injury and illness admitted to our ICU, whose length of stay was at least 5 days.

**RESULTS.** The mean time from ICU admission to commencing enteral feeding was 22 (range 7–44) h. There were 52 interruptions to feeding in 100 patient days. The mean duration of interruption was 9 h, and represented 20% of the hours available for feeding. Planning for extubation, fasting for theatre, and lack of NG tube accounted for 38/52 of these interruptions (73%). Excessive gastric aspirates accounted for 7/52 feeding failures (13%); half of patients received pro-kinetic agents during the studied period. The mean target caloric intake for this cohort was calculated to be 1885 kcal $d^{-1}$. Mean achieved caloric intake from enteral feed was 911 kcal $d^{-1}$, and from propofol was 77 kcal day [1]:

DEMOGRAPHICS

| | | | |
|---|---|---|---|
| Gender 13 M: 7F | Age 51 (22–71) y | APACHE II 22 (10–33) | BMI 26 (21–30) kg $m^{-2}$ |

MEAN DAILY CALORIC INTAKE AND SOURCE

| Day | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Kcal from feed | 351 | 834 | 1108 | 1150 | 1465 |
| Kcal from propofol | 111 | 106 | 87 | 42 | 37 |
| % of target achieved | 25 | 50 | 63 | 63 | 80 |

**CONCLUSIONS.** Actual mean caloric intake was just over half (52%) of the target caloric intake. There was a substantial delay in commencing feeding. Upon subsequent feeding, the reasons for interruptions were predictable and care needs to be taken to emphasise restarting feeding following interventions. Mean caloric intake from propofol only contributed 8% of daily caloric intake. Future work in our ICU will include an assessment of adherence to feeding protocol which has been shown to improve delivery of enteral feeding in critical care[3].

**REFERENCES.** 1. Crit Care Med. 1999;27:1252 2. Cochrane Database of Systematic Rev. 2006;18 3. J Parenter Enteral Nutr. 1999;23:288

## 0860

### DAMAGE CONTROL USING GAUZE PACKING FOR THORACIC TRAUMA WITH UNCONTROLLABLE MASSIVE INTRATHORACIC HEMORRHAGE AND SHOCK

Y. Moriwaki[1], N. Harunari[1], H. Toyoda[1], T. Kosuge[1], M. Iwashita[1], S. Arata[1], N. Suzuki[1]

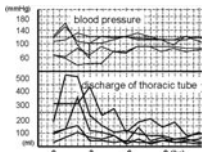
[1]Yokohama City University Medical Center, Critical Care and Emergency Center, Yokohama, Japan

**INTRODUCTION.** Although we can easily control most of intrathoracic hemorrhage with non-operative management such as simple thoracic drainage using thoracic catheter, we often encounter cases with uncontrollable intrathoracic hemorrhage due to acidosis, hypothermia, and coagulopathy (lethal triad). Damage control (DC) is familiar and established strategy for traumatic abdominal hemorrhage with shock. However, the usefulness of the DC for thoracic trauma with uncontrollable hemorrhage is not established and we have few experiences with DC in thoracic trauma. It is not clear what type of thoracic injuries DC is effective and which procedure is useful and effective as thoracic DC surgery. We herein reported case series that extends the spectrum of the damage control approach to the thorax, outside the abdomen.

**OBJECTIVES.** The objective of this study is to clarify the usefulness of gauze packing for hemostasis as a DC surgery in patients with thoracic trauma.

**METHODS.** Medical records of 10 patients with chest trauma with uncontrollable intrathoracic hemorrhage who were performed intrathoracic packing as a DC surgery. The change of circulatory condition, volume of discharge from thoracic tube were evaluated and compared between survivors and non-survivors.

**RESULTS.** Five cases survived to discharge (50%) and 5 died. Cause of injuries were traffic accident in 4, free fall in 4, gun shot wound in 1 and struck by falling object in 1 case. All 4 cases due to free fall died. Four cases underwent symultaneous resuscitative laparotomy, and 20 of them survived to discharge. Major origins of hemorrhage in the thoracic cavity was thoracic wall in 5, lung in 6, vertebrae in 1 and descending aorta in 1. Gauze packing were performed for thoracic wall in 3, lung in 4, vertebrae in 2 and descending thoracic aorta in 1; 2 (67%), 1 (33%), 1 (50%) and no patient of them, respectively, survived to discharge. In surviving cases discharge of thoracic drain decreased in 250 ml/h within 5–6 h (Fig. 1).




**CONCLUSIONS.** DC is thought as one of the most useful strategy for thoracic trauma with uncontrollable hemorrhage same as for abdominal trauma, particularly for hemorrhage from thoracic wall or thoracic vertebrae. Chest trauma patients who have been performed intrathoracic packing as a DC surgery and whose thoracic hemorrhage does not decrease in 250 ml/h in 6 h may require re-packing.

## 0861

### EARLY CORTISOL RESPONSE AFTER ACUTE TRAUMA

C. Brorsson[1], P. Dahlqvist[2], A. Sylvan[3], S. Naredi[4]

[1]Institution of Surgery and Perioperative Sciences, Umeå University, Department of Anaesthesia and Intensive Care, Umeå, Sweden, [2]Institution of Public Health and Clinical Medicine, Umeå University, Department of Medicine, Umeå, Sweden, [3]Institution of Surgery and Intensive Care, Umeå University, Department of Surgery, Umeå, Sweden, [4]Institution of Surgery and Perioperative Sciences, Department of Anaesthesia and Intensive Care, Umeå, Sweden

**INTRODUCTION.** The purpose was to study early (the first 24 h), cortisol response after acute trauma. As acute trauma has a defined time zero when the insult to the body starts, it is possible to relate cortisol levels to time after trauma.

**OBJECTIVES.** Activation of the hypothalamic–pituitary–adrenal (HPA)-axis is important for survival in acute illness, such as severe trauma. Critical illness related corticosteroid insufficiency (CIRCI) might be suspected in hypotensive patients that respond poorly to fluids and vasopressor agents. However, the temporal pattern of cortisol secretion after trauma has not been extensively studied [1].

**METHODS.** Prospective observational clinical study in 50 acute trauma patients treated at Umeå University Hospital. Serum cortisol was obtained at the emergency department and thereafter at fixed time points. The analysis was performed with an immunoassay method, Roche Elecsys reagents on Modular E170 analyser. The severity of trauma was assessed with the Injury Severity Score (ISS) and circulatory organ failure with the Sequential Organ Failure Assessment (SOFA) score.

**RESULTS.** The median time from accident to arrival at the emergency department was 70 (13–182) min. 7/50 patients (14%) had serum cortisol levels <200 nmol/L at least once during the first 24 h after the trauma. The serum cortisol levels (570 ± 362 nmol/L, n=23) within 18–24 h after trauma were significantly lower compared to the serum cortisol levels within 1–2 h (819 ± 221 nmol/L, n=16) and 2–4 h (875 ± 310 nmol/L, n=11) after trauma ($p < 0.005$ and $p < 0.05$ respectively, non-parametric, Mann–Whitney U test). Low serum cortisol (<200 nmol/L) was not correlated to a SOFA circulation score of ≥3, gender, sedation or not, mortality, or ISS more or less than 16 (Fisher's exact test).

**CONCLUSIONS.** Serum cortisol levels decreased significantly during the first 24 h after trauma. Time after trauma (insult to the body) could be of importance when a low cortisol value is assessed.

**REFERENCE(S).** 1. Marik P. Chest 2009;135:181

## 0862

### LONG TERM OBSERVATIONAL STUDY OF PATIENTS WITH ACUTE BRAIN INJURIES AFTER PERCUTANEOUS DILATATIONAL TRACHEOSTOMY IN AN EARLY NEUROREHABILITATION WARD

M. Wepler[1], S. Hafner[1], K. Traeger[1], B. Kobilke[1], R. Meierhenrich[1], D. Woischneck[2], M. Georgieff[1], W. Stahl[1]

[1]University Hospital Ulm, Department of Anesthesiologie, Ulm, Germany, [2]Klinikum Landshut, Department of Neurosurgery, Landshut, Germany

**INTRODUCTION.** Percutaneous dilatational tracheostomy is an established safe measure for airway management in critically ill patients after acute brain injuries. Tracheostomy in these patients provides a safe airway, facilitates airway suctioning and prevents oral and laryngeal decubitus. In order to achieve early neurorehabilitation, patients are often transferred to a rehabilitation unit with a tracheal canula still in place despite successful weaning from the ventilator.

**OBJECTIVES.** To determine the type, degree and frequency of specific problems and duration of cannulation in patients transferred with a canula to the neurorehabilitation ward.

**METHODS.** This observational study was performed in a mixed surgical and trauma ICU in a university hospital and in a neurorehabilitation ward over a period of 4 years (2006–2009). These are especially patients after acute traumatic brain injuries, ischemic or hemorrhagic strokes and others. Patient charts were reviewed for demographic data and time of tracheostomy, reason of admission, comorbidity and severity of illness were evaluated.

**RESULTS.** From 2006 through 2009, 64 patients requiring tracheostomy in our ICU were discharged with a tracheostomy and observed after acute brain injury.

**TABLE 1** DEMOGRAPHIC DATA; DATA ARE GIVEN AS TOTAL NUMBERS OR MEAN ± STANDARD DEVIATION

| | |
|---|---|
| Number of patients [n] | 64 |
| Mean age [years] | 67 ± 14 |
| Gender [male/female] | 43/21 |
| SAPS II at PDT | 46 ± 11 |
| Cause of admission to ICU: EDH/SDH/SAB/ischemia/tumor or combination [n] | 6/20/24/7/2/30 |
| Respiratory infection at PDT time [n] | 45 [70%] |
| Timing of PDT after ICU admission [days] | 6 |

**TABLE 2** PATIENTS VALUES PRO RATA TEMPORIS, DATA ARE GIVEN AS TOTAL NUMBERS OR MEDIAN (25TH QUARTILE; 75TH QUARTILE)

| | |
|---|---|
| Successful decanulation rate [n] | 35 [54.7%] |
| Final decanulation after PDT [days] | 43 [33; 53] |
| Start oral feeding after PDT [days] | 49 [41; 68] |
| Recanulation rate after decanulation [n] | 0 [0%] |
| Conversion in surgical stoma [n] | 5 [7.8%] |
| Surgical stoma closure [n] | 5 [7.8%] |
| Minor problems occuring with canula change [n] | 6 [9.4%] |

**CONCLUSIONS.** A successful decanulation was performed in 35 out of 64 patients, i.e. 54.7%. The duration of tracheostomy in the ward was 43 days. According to our data, patients being off the ventilator can early be transferred to a rehabilitation unit with a tracheal canula inside. Minor complications associated with tracheostomy however may occur, but none led to hospital readmission. It also was astonishing to see, that none of the patients could feeded successful oral before decanulation, after decanulation the success rate was nearly 90%, 49 days after PDT.

**REFERENCE.** Stelfox HT et al. Critical Care 2008; 12:R26

## 0863

### $CO_2$ DEPENDENT VASOMOTOR REACTIVITY OF CEREBRAL ARTERIES IN PATIENTS WITH SEVERE TBI: TIME COURSE AND EFFECT OF AUGMENTATION OF CARDIAC OUTPUT WITH DOBUTAMINE

M. Haenggi[1], A. Andermatt[1], C. Anthamatten[1], A. Galimanis[2], M.-L. Mono[2], A. Alfieri[3], J. Takala[1], S.M. Jakob[1]

[1]University Hospital Bern, Inselspital, Department of Intensive Care Medicine, Bern, Switzerland, [2]University Hospital Bern, Inselspital, Department of Neurology, Bern, Switzerland, [3]University Hospital Halle, Department of Neurosurgery, Halle, Germany

**INTRODUCTION.** Severe traumatic brain injury (TBI) is associated with impairment of cerebral vasomotor autoregulation. The time course of $CO_2$-vasoreactivity and the influence of increase of cardiac output (CO) with dobutamine in vasopressor dependent TBI patients is not known.

**METHODS.** Patients with severe TBI, [postresuscitation Glasgow Coma Score (GCS) <9], were subjected to daily $CO_2$ vasomotor reactivity testing, starting within 24 h after trauma. $CO_2$ vasoreactivity was obtained with transcranial Doppler (TCD) on both hemispheres, where the change of cerebral blood flow velocity in response to hyperventilation (reduction of et $CO_2$ of 6–10 mmHg for 10 min) was measured. The vasomotor reactivity index (VMR index) was calculated as the ratio of percent decrease in averaged mean flow velocity (MFV) and the difference between $PaCO_2$ measurements before and after hyperventilation. Once the patients needed the vasopressor norepinephrine to maintain a cerebral perfusion pressure (CPP) >55 mmHg, additional VMR index was assessed before and after addition of dobutamine. CO was measured with pulse contour analysis (Vigileo®).

**RESULTS.** 13 patients (mean age 44 ± 18 years, 85% male) were included, 8 patients required norepinephrine and subsequently received dobutamine to increase CO from 6.3 to 8.9 l/min. Dobutamine did not alter ICP significantly (13.9 ± 7.0 vs. 15.0 ± 10.2 mmHg). In 7 of 8 patients who had VMR index assessment without norepinephrine in the first 24 h after the insult, VMR index was below normal in least one hemisphere. Patients who subsequently did not receive norepinephrine had a significant improvement and normalization of VMR index in the following 2 days (see Table 1). In contrast, VMR index remained impaired in patients receiving norepinephrine. Augmentation of CO had an unpredictable impact on VMR.

**CONCLUSIONS.** $CO_2$ vasomotor response is impaired in patients after severe TBI. In patients receiving vasopressor treatment to maintain CPP, recovery of the imparied VMR seems to be delayed. Because the effect of augmentation of CO with dobutamine on $CO_2$ dependent autoregulation is not predictable, measurement of VMR in these patients is recommended.

**TABLE 1** VMR INDEX (N=NUMBER OF ASSESSMENTS)

| VMR index (ref. 3.7 ± 0.5) [% ΔMFV/mmHg $PaCO_2$] | 24 h | 48 h | 72 h | |
|---|---|---|---|---|
| Patients without catecholamines | 2.5 ± 1.4 (n=14) | 4.8 ± 1.2 (n=7) | 4.4 ± 2.6 (n=5) | One-way ANOVA: p=0.007 |
| Patients with norepinephrine | 3.0 ± 1.5 (n=8) t test no NA vs. NA: p=0.441 | 2.4 ± 1.5 (n=6) t test no NA vs. NA: p=0.011 | | t test p=0.473 |
| Norepinephrine + dobutamine | 3.1 ± 2.4 (n=8) t test NA vs. NA+dobu: p=0.892 | 2.6 ± 1.7 (n=6) t test NA vs. NA+dobu: p=0.785 | | t test p=0.672 |

# Emergency medicine: 0864–0877

## 0864

### ARE PREHOSPITAL CLINICINAS FASTER AT INTUBATION ON THE FLOOR WHILST WEARING CBRN-PPE THAN HOSPITAL CLINICIANS?

N. Castle[1,2], R. Owen[1,3], S. Clarke[2], L. Shaikh[4], M. Hann[5], D. Reeves[5], Y. Kuybida[4]

[1]Durban University of Technology, EMC&R, Durban, South Africa, [2]frimley park hospital, Emergency Department, Camberley, UK, [3]Hamad Medical Corporation, EMS, Doha, Qatar, [4]Frimley Park Hospital, Frimley, UK, [5]NPCRDC University of Manchester, Manchester, UK

**INTRODUCTION.** following a chemical incident health care professionals will be required to care for casualties wearing Chemical Biological Radiation Nuclear-Personal Protective Equipment (CBRN-PPE) [1]. Fine motor skills such as intubation are known to be adversely affected by CBRN-PPE but nothing is known about the impact of the patients position (e.g. on the floor) nor the clinical background of the intubator.

**METHODS.** 75 clinicians intubated a manikin on the floor whilst wearing CBRN-PPE as part of major incident training. 54 hospital and 21 prehospital clinicians were timed from picking-up a laryngoscope until ETT placement was confirmed by two independent checks (Positube & EasiCap) (actual position confirmed by researcher).

**TABLE 1**

| Intubation times | Median (seconds) | Inter-Quartile range | Failures |
|---|---|---|---|
| All attempts | 128.6 | 68.3–undetermined | 20 (20.7%) |
| Prehospital (N=21) | 101 | 64.7–170.7 | 3 (14.3%) 17 (31.5%) |
| Hospital (N=54) | 129 | 68.8–undetermined | |
| Excluding failures | 100.7 | 57.3–138.3 | |
| Prehospital (N=18) | 99.2 | 49.7–143 | |
| Hospital (N=37) | 100.7 | 57.6–129.1 | |

**RESULTS.** Over a quarter of intubation attempts resulted in failure; either being abandoned (11) or resulting in an oesophageal intubation (9). The presences of a number of abandoned attempts resulted in the use of 'undetermined in the analysis (Table 1). Intubation times were analysed using he Mann–Whitney test, with failed intubations assigned the highest rank. Despite a difference of almost 30 s, median intubation times were not significantly different between the two groups ($p > 0.1$). Although hospital clinicians had a two-fold higher failed intubation. Although not statistically significant ($p > 0.1$) it would pose a clinical challenge.

**DISCUSSION.** The combination of CBRN-PPE and patient position on the floor has a negative impact on times to intubate resulting in a clinically significant median intubation time exceeding 120 s. Prehospital clinicians tended to perform intubation quicker and with fewer failures but this study lack statistical power to demonstrate a significant difference but serves to demonstrate the potential of a clinician specific difference.

**CONCLUSION.** This subgroup analysis highlights that further investigation is required with regards to patient position and its affects on intubation whilst wearing CBRN-PPE. These results can inform a power calculation for future studies.

**REFERENCES.** Byers M et al. EMJ 2008;25:108–12

## 0865

### PERFALGAN® I.V. (PARACETAMOL) CAUSES ARTERIAL PRESSURE TO DROP IN NEUROCRITICALLY ILL PATIENTS: A BRAIN-IT STUDY

S.P. Young[1], B. Dawson[1], A. Rae[1], D. Young[2], I. Piper[3,4]

[1]Institute of Neurological Sciences, Department of Neuroanaesthetics, Glasgow, UK, [2]University of Strathclyde, Department of Statistics and Modelling Science, Glasgow, UK, [3]Institute of Neurological Sciences, Department of Clinical Physics, Glasgow, UK, [4]The BrainIT Group, Glasgow, UK

**INTRODUCTION.** Hypotension following paracetamol (both enteral & I.V.) administration is frequently observed clinically in our critically ill adult patients. Abstracts and short reports in the literature further allude to this phenomenon [1].

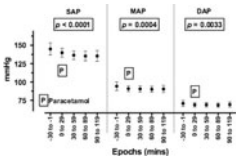
**OBJECTIVES.** We aimed to observe critically ill patients with neurological injury receiving Perfalgan® as part of their clinical management. The nature and degree of haemodynamic changes were examined using an electronic record.

**METHODS.** Formal REC requirements were waived for this purely observational pilot study. Patient data were logged electronically from bedside monitors at 1 min intervals, as described previously [2]. Twelve separate episodes (one in each of 12 patients) of IV Perfalgan® (1000 mg/100 ml over 30 min) administration were captured. Data were manually examined retrospectively, and nonsense values excluded. Demographics are described as medians (range). Patient data are described as means (with 95% CI for the mean on the graph), rounded to meaningful significant figures. As there was a large dataset, repeated measures ANOVA was used to investigate the relationship between the outcome of interest and the time of measurement (30 min pre-paracetamol and four 30 min epochs during and after). Where there was a significant time effect, post-hoc comparisons (Bonferroni) were performed with the pre-paracetamol epoch as reference. Adjusted $p$ values represent comparisons between first and last epoch.

**RESULTS.** Heart rate fell from first to last epoch following Perfalgan® administration: **92** to **88** $min^{-1}$ (n = 11; $p < 0.0001$). There were also significant drops in systolic (SAP), diastolic (DAP) and mean (MAP) arterial pressure (n = 12):

DEMOGRAPHICS

| | |
|---|---|
| Age | 40 (20–58) years |
| Gender | 10 M:2F |
| APACHE II | 15 (7–25) |
| TBI, IVH, aSAH, tumour (n) | 7, 2, 2, 1 |




Arterial pressure changes.

Additionally, temperature fell between first and last epochs: 38.1 to 37.9°C (n = 4; $p < 0.0001$).

**CONCLUSIONS.** Using the BrainIT electronic data capture system, we have confirmed that Perfalgan® I.V. is associated with drops in temperature, heart rate and arterial pressures in patients with neurocritical illness. These changes are most likely due to the paracetamol, although we cannot rule out the effects of excipients. Further studies are planned to examine the effects of Perfalgan® on cerebral haemodynamics.

**REFERENCES.** 1. *Intensive Care Med* 2000; **26**: 1408

*Acta Neurochirurg* 2003; **145**: 615

## 0866

### AIRWAY AND CIRCULATORY REFLEXES IN CRITICAL PATIENTS WITH BLIND NASOTRACHEA INTUBATLON RECEIVING SINGLE-DOSE DEXMEDETOMIDINE

W. Yichun[1], L. Zurong[1]

[1]Intensive Care Unit of Hunan Province Tumor Hospital, Changsha, China

**INTRODUCTION.** Dexmedetomidine is a selective alpha-2 adrenergic receptor against that exhibits sedative, anxiolytic, and sympatholytic effects without respiratory-drive depression,and reduces heart rate and blood pressure dose-dependently.

**OBJECTIVES.** We investigated whether it also has ability to attenuate airway and circulatory reflexes in critical patients with blind nasotrachea intubation.

**METHODS.** Fifty-eight ASA III-IV patients in ICU received a blind nasotrachea intubation. Five minutes before adequate preparation of blind nasotrachea intubation, they were randomly allocated to receive either dexmedetomidine 0.5 μg/kg (Group D)(n=29) or saline placebo (Group P) (n=29)intravenously over 60 s in a double-blind design.The blinded anaesthetist completed all procedures in all the patients, and the number of coughs per patient was continuously monitored for 15 min after intubation; coughing was evaluated on a 4-point scale. Any laryngospasm, bronchospasm or desaturation was recorded. Heart rate (HR) and systolic and diastolic blood pressure (SAP, DAP) were measured before, during and after tracheal intubation. The time of tracheal intubation and the successful rate of the intubations were recorded.

**RESULTS.** Median coughing scores were 1 (1–3) in Group D and 2 (1–4) in Group P ($P < 0.05$), but there were no differences between the groups in the incidence of breath holding or desaturation. HR, SAP and DAP increased at extubation in both groups ($P < 0.05$), but the increase was less significant with dexmedetomidine. The time of tracheal intubation in Group D was less than in Group P, and the successful rate of tracheal intubation in Group D was higher than in Group P ($P < 0.05$).

**CONCLUSIONS.** These findings suggest that a single-dose bolus injection of dexmedetomidine before blind nasotrachea intubation attenuates airway-circulatory reflexes during intubation.

## 0867

### FIRE EVACUATION OF A REHABILITATION HOSPITAL IN SOUTHERN GERMANY

G. Kafka[1], M.O. Maybauer[2,3], D.M. Maybauer[2,3]

[1]Emergency Physician Group Guenzburg, Guenzburg, Germany, [2]Philipps University of Marburg, Anaesthesia and Intensive Care, Marburg, Germany, [3]University of Texas Medical Branch, Anesthesiology, Galveston, USA

**INTRODUCTION.** In May 2004, the rehabilitation hospital at Ichenhausen, Germany was threatened by a fire and had to be evacuated, organized by a chief emergency physician.

**OBJECTIVES.** Valuable lessons can be learned from the evacuation of a hospital.

**METHODS.** Retrospective data analysis of patients' evacuation, treatment, and transport, as well as resources and logistics used.

**RESULTS.** At 11:26 p.m. on May 24, 2004, local firefighters, EMS paramedics, ambulance officers, physicians, and a "rapid response unit" of the German Red Cross were sent on scene. The initial assessment was that one of three buildings of the hospital was fully engaged in flames. The hospital staff had already started a horizontal evacuation of approximately 70 patients from the burning building to one adjacent. When the chief emergency physician arrived on scene, he began patient triage by determining victim's conditions, and organized the scene by separation into 3 sections, (1) inhouse, (2) outside, and (3) transport section, each section lead by a physician. Additional medical personnel were requested, and a second triage was performed to update the situation. The total duration of the evacuation was 7 h 46 min. One hundred nineteen patients were triaged into internationally used categories (I = 0, II = 7, III = 112, IV/V = 0 patients). The seven patients in category II suffered smoke inhalation injury, without burns. Of the 119 patients, 29 were transferred to a different building of the hospital (horizontal evacuation), 90 were transported to other hospitals within a 30 km radius. The number of personnel used was 154 (14 emergency physicians, 19 paramedics, and 121 EMTs), using 2 mobile intensive care units, one rescue helicopter staffed with a physician, as well as 15 ambulances and 31 other vehicles from the Red Cross fleet.

**CONCLUSIONS.** Difficulties faced on scene were (1) a lack of patients' paper records, aggravating the situation by a lack of knowledge of patients history, diagnosis, and medication, and (2) the initial horizontal evacuation was confused and uncoordinated, resulting in a lack of knowledge on the amount of patients that had been evacuated by nursing staff. However, with arrival of the chief emergency physician, an established disaster plan and logistics were initiated, which proved crucial for the final success of the evacuation. The critical lessons learned from this experience, included the following: 1. appointment of a chief emergency physician; 2. appointment of section commanders; 3. adequate communication systems on-scene as well as with the dispatch center, organizing hospital beds in surrounding counties; 4. patient assignment to ambulances and helicopters; 5. identification and assignment of transport personnel responsible for patient care, and 6. triage, including patient registration. The authors encourage physicians, as essential members of the health care team, to become prepared to respond to disasters.

## 0868

### DELAY FOR ADMISSION OF UNSTABLE HOSPITALIZED PATIENTS TO INTENSIVE CARE UNIT: A NEED FOR A MEDICAL EMERGENCY TEAM?

J.-L. Pagani[1], J.-P. Revelly[1], P. Eggimann[1], P. Jolliet[1], M.-D. Schaller[1]

[1]University Hospital, Intensive Care Unit, Lausanne, Switzerland

**INTRODUCTION.** Patients admitted in Intensive Care Unit (ICU) from general wards are more severe and have a higher mortality than those admitted from emergency department as reported [1]. The majority of them develop signs of instability (e.g. tachypnea, tachycardia, hypotension, decreased oxygen saturation and change in conscious state) several hours before ICU admission. Considering this fact and that in-hospital cardiac arrests and unexpected deaths are usually preceded by warning signs, immediate on site intervention by specialists may be effective. This gave an impulse to medical emergency team (MET) implementation, which has been shown to decrease cardiac arrest, morbidity and mortality in several hospitals.

**OBJECTIVES AND METHODS.** In order to verify if the same was true in our hospital and to determine if there was a need for MET, we prospectively collected all non elective ICU admissions of already hospitalized patients (general wards) and of patients remaining more than 3 h in emergency department (considered hospitalized). Instability criteria leading to MET call correspond to those described in the literature. The delay between the development of one criterion and ICU admission was registered.

**RESULTS.** During an observation period of 12 months, 321 patients with our MET criteria were admitted to ICU. 88 patients came from the emergency department, 115 from the surgical and 113 from the medical ward. 65% were male. The median age was 65 years (range 17–89). The delay from MET criteria development to ICU admission was higher than 8 h in 155 patients, with a median delay of 32 h and a range of 8.4 h to 10 days. For the remaining 166 patients, an early MET criterion was present up to 8 h (median delay 3 h) before ICU admission. These results are quite concordant with the data reported in the literature (ref 1-8). 122 patients presented signs of sepsis or septic shock, 70 patients a respiratory failure, 58 patients a cardiac emergency. Cardiac arrest represent 5% of our collective of patients.

**CONCLUSIONS.** Similar to others observations, the majority of hospitalized patients admitted on emergency basis in our ICU have warning signs lasting for several hours. More than half of them were unstable for more than 8 h. This shows there is plenty of time for early acute management by dedicated and specialized team such as MET. However, further studies are required to determine if MET implementation can reduce in-hospital cardiac arrests and influence the morbidity, the length of stay and the mortality.

**REFERENCE(S).** 1. K.-H. Hillman et al. ICM 2002 (28). 2. R Bellomo et al. CCM 2004 (32). 3. DeVita M et al. CCM 2006 (34). 4. BD Winters et al. CCM 2007 (35). 5. P Calzavacca et al. Resuscitation 2010 (81). 6. M DeVita et al. Resuscitation 2010 (81). 7. J Santamaria et al. CCM 2010 (38). 8. PS Chan et al. Arch Intern Med 2010 (170)

## 0869

### ULTRASOUND GUIDED TRANSVENOUS PACING IN THE CRITICALLY ILL PATIENT

P.M. D'Costa[1], S.P. D'Costa[2]

[1]K.E.M. HOSPITAL, Critical Care, Pune, India, [2]Patankar Hospital and Research Center, Radiology, Pune, India

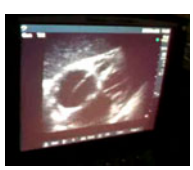
**INTRODUCTION.** Trans venous pacing in the critically ill patient is commonly done for life threatening bradyarrythmias. This procedure is ideally done under fluoroscopic guidance in the cardiac catheter lab, or by the bedside with the ecg leads as a guide for placement of the transvenous pacing wire. Ultrasound guidance remains a very underused tool for emergency purposes and can be used quite effectively for the above procedure. There are also many safety issues and medicolegal issues with blind procedures in the intensive care unit. The use of ultrasound has now found mention in acls protocols(pea differential diagnosis) and also the fast/e-fast survey for a trauma patient.

**OBJECTIVES.** To confirm that ultrasound placement of trans venous pacing wire is a safer and more definite method than previously used methods

**METHODS.** Ultrasound machine, sonosite was used for the above linear high frequency probe was used. the pacing wire was introduced via the femoral route, jugular and subclavian route in patients *views utilised*—subcostal 4 chamber view, view for the inferior vena cava, apical 4 chamber view, parasternal long axis views were all used to get a better visualisation of the anatomy during the insertion process. The tip of the pacing wire in the right ventricle when visualised was taken as a successful placement. A total 14 patients were included, who presented to the ICU requiring tvp (transvenous pacing) age of patients varied from 27 to 80 years. 4 patients had complete heart block with shock, the others included all types of bradycardic rhythms and pea's 10 of the "pacing sheaths were inserted via jugular and 4 via femoral route. Pacing was successful in all patients. 1 patient required repositioning of wire.

**RESULTS.** Trans venous pacing under sonographic guidance was successfully performed in more than 90% of patients.


Pacing wire in right ventricle



Pacing wire

**CONCLUSIONS.** Ultrasound guided transvenous pacing is a safer, easier and equally effective way to perform pacing in the critically ill patient. The most important advantage is it can be easily done at the bedside of the patient. The possible drawback is some level of proficiency and familiarity with echo is required. The obese patient, or the patient with copd could sometimes pose problems for visualisation of the anatomy

**REFERENCE(S).** Emergency transvenous cardiac pacing placement using ultrasound guidance. Aguilera PA, Durham BA.

## 0870

### SPECIALIZED MEDICAL CARE IN MOUNTAIN RESCUE: AN ANALYSIS OF THE CURRENT SITUATION IN THE AUTONOMOUS COMMUNITY OF CANTABRIA (SPAIN)

R. Abajas[1], M.J. Durá[1], A. Quesada[2], B. Fernández[3], F. Merino[1], I. de la Horra[1], S. González[1], L.M. López[1], E. Rodriguez[1], C. Rodriguez[4], M. Seguí- Gómez[5]

[1]University of Cantabria, Nursing Department, Santander, Spain, [2]Hospital Universitario Marqués de Valdecilla, Santander, Spain, [3]Servicio Cantabro de Salud, Santander, Spain, [4]University of Navarra, Pamplona, Spain, [5]University of Navarra/University of Hardvard, Pamplona, Spain

**INTRODUCTION.** The recent growth of mountain sports in Spain has led to an increase of incidents every year. Traditionally, rescues have been carried out by multidisciplinary first aid teams with different medical skills, resources and equipment. In the field of pre-hospital emergencies, the idea of moving patients from the incident scenario to medical assistance facilities (*scoop and run*) has been replaced by in situ health assistance. This new approach has been developed under different conditions depending on the autonomous community, especially regarding mountain incidents. In situ health care often means that health (rescue) teams have to work in hostile and hazardous environments, not always easily accessible. Advanced technical, physical and psychical training is needed in order to allow for a perfect integration of health professionals into mountain rescue teams.

**OBJECTIVES.** The main objective of this study is to assess the current situation of medicalization in mountain rescue teams in Cantabria and to determine the need of specialized health professionals in those teams

**METHODS.** An ecological research survey was developed. All mountain rescues that took place in Cantabria during 2008–2009 were studied. Information was collected from official data coming up from secondary sources.

**RESULTS.** Eighty-six injured subjects rescued in Cantabria within the study period were analyzed. In 64% of these, no specialized health professional was present. In situ health care was provided to 13% of the rescued subjects and 31.4% injured individuals needed fist aid help. No health professional was present when mountain conditions were difficult. Rescues (70%) and patient transfers (60%) were mainly undertaken by the Grupo de Rescate Especial de Intervención en Montaña (GREIM) (70%), a rescue team specialized in mountain incidents with no health professional among its staff. Incidents were mainly caused by falls (33%) and losses (33%), followed by lack of skill and/or lack of appropriate material (16%). 15% of the injures were due to dehydration, hypothermia, and exhaustion, 11% due to fractures in low extremities, 11% to sprain and contusions, and 6% of the injures resulted in deaths

**CONCLUSIONS.** In the Autonomous Community of Cantabria, a high percentage of mountain casualties do not receive in situ health care. Additionally, in a relevant percent of incidents no health care is provided during the patients' transfer to health facilities. Findings from this study highlight the need of medical teams specially trained in mountain rescue. We consider that the public professional model should include the medicalization of mountain rescue services. This approach has already been developed in other autonomous communities for several years and the characteristics of our community are suitable for adopting it.

**REFERENCE(S).** Emerg Med Clin N Am. 2004:511–24.

Wilderness Environ Med. 2003;14:155–60.

**GRANT ACKNOWLEDGMENT.** VII Premio de Investigación en Enfermería Sor Clara.

## 0871

### SPIRAL CT FOR DIAGNOSIS OF PULMONARY EMBOLISM

O.A. Sobh[1]

[1]KSH, ICU, Uniazah, Saudi Arabia

**OBJECTIVE.** 1. To assess the role of spiral CT in diagnosis of pulmonary embolism. 2. Show the relation between presenting symptoms, and severity of pulmonary embolism. 3. To determine Prognosis and outcome of pulmonary embolism.

**METHODS.** During the period from August 2007 to January 2009 151 patients with clinically suspected pulmonary embolism underwent complete history taken, physical examination chest X-ray, ECG, arterial blood gases analysis spiral CT chest, Echocardiography, and perfusion lung scan (in patients with normal spiral CT chest with high clinical suspicion of pulmonary embolism).

**RESULTS.** 1. The most common risk factors for pulmonary embolism were obesity, bed ridden, vasculitis, trauma, and in 4.6% there was no apparent risk factor. The most common presenting symptom was dyspnea in 43.1%, combination of cough hemoptysis and dyspnea in 25.8%, chest pain and cough in 18.54% and syncope was in 12.58%. Sign of pulmonary embolism included, tachycardia in 58.9%, hypotension (BP less than 90/60 mmHg) in 13.25%, fever and tachycardia in 8.6%, Sign of deep venous thrombosis was present only in 93 patients (61.58%) which included swelling in 78 patients (51. 7%) and leg pain in 15 patients 9.9%. 2. In patients with pulmonary embolism, ECG was normal in 12.8%, sinus tachycardia in 58.11%, S1Q3T3 pattern in 19.65% and right bundle branch block in 9.7%. 3. Chest radiography was normal in 17.94%, pleural effusion in 52.9%, pulmonary infarction in 13.67% and segmental atelectasis in 15.38%. 4. D-dimer was positive in 94% and negative in 6%. 5. Lower limbs duplex ultrasound was normal in 29% and DVT in 71%. 6. Echocardiography was normal in 29%, right ventricular dilatation in 38.46%, main pulmonary artery and right ventricular dilatation in 28.2% and right atrial thrombus in 4.2%. 7. Spiral CT was normal in 4.27% saddle shape embolism in 4.27%, unilateral lobar branches filling defect in 35.8%, bilateral lobar branches filling defect in 15.38%, segmental branches filling defect in 23.9%, and sub segmental branches filling defect in 16.23%. 8. In 39 patients with normal CTPA, perfusion lung scan was done which showed non-diagnostic in 34 (87.17%)patients (with normal D -dimer and normal lower limb duplex) and high probability in 5(12.83) patients with positive D-dimer, so consider as pulmonary embolism. Mortality rate in our study was 4.27%

**CONSCLUSION:** Our finding indicates that spiral CT pulmonary angiography. D-dimer and duplex lower limb ultrasound can diagnosed or exclude pulmonary embolism in 146 of 151 patients (96.6%) without need for pulmonary angiography. So spiral CT can be use as first step in-patients with suspected pulmonary embolism.

## 0872

### PROGNOSTIC FACTORS AND DETERMINANTS OF MORTALITY IN ABDOMINAL TRAUMA

A.V. Aller[1], M. Mourelo[1], P. Vidal[1], P. Fernandez[1], S. Pita[1], L. Seoane[1], P. Jimenez[1]

[1]Complexo Hospitalario Universitario A Coruña, A Coruña, Spain

**INTRODUCTION.** In abdominal trauma patients there is often a delayed diagnosis. Conservative management is controversial and inappropriate choice of treatment is associated with increased mortality.

**OBJECTIVES.** Evaluation of outcome in patients with abdominal trauma and predictors of mortality.

**METHODS.** Retrospective study of patients with abdominal trauma admitted to our ICU from January 2004–December 2009. We collected epidemiological data, analytical parameters, conservative or surgical management, complications and severity scores: ISS, RTS, APACHE II. T Student to compare means, and Chi square and OR with 95% for qualitative variables. ROC curves to determine diagnostic accuracy of the variables to predict mortality. Logistic regression analysis to determine variables associated with mortality. Statistically significant $p < 0.05$.

**RESULTS.** 209 patients were included. Mean age was $18.5 \pm 40.9$. 79.4% were men. The scores were: ISS 34.5 RTS 10.1 APACHE II 14.9. The most frequently affected organ was spleen (45.9%).There were thoracic injuries associated in 61.7%, and TBI in 38.8%. Mean stay in ICU was 12.5 and hospital was 39.8. Overall mortality was 6.2%. Univariate analysis of variables associated with mortality found differences in age (survivors 39.9 vs. dead 55.8, p 0.00), GCS (13.7 vs. 8.4 p 0.01), APACHE II (14.3 vs. 23.5 p 0.00), ISS (32.9 vs. 56.7 p 0.002) and RTS (10.3 vs. 7.5 p 0.007). The best predictor of mortality is RTS (Area under the curve (AUC): 0.80). In analytic parameters we found: hematocrit 24 h (30.3vs26.1 p 0.001), Hemoglobin (Hb) 24 h (10.5 vs. 8.7 p 0.00), initial pH(7.3 vs. 7 2 p 0.006), initial base deficit (BD) (3.9 vs. 8.6 p 0.002). The hospital stay is different (41.5 vs. 14.9 p 0.00). The best analytical predictor of mortality was Hb 24 h (AUC 0.8). Association was found with the presence TBI (OR=19.9, 2.5–157.6) and chest trauma (OR=7.4, 0.9–58.4). There was association between mortality and the use of amines (OR=30.5, 3.9-240.5), mechanical ventilation (OR=14.6, 1.9–114.4) and transfusion (OR=5.1, 1.1–23.7). We found surgery (OR=0.28, 0.0–1.03) and nutrition (OR=0.12, 0.03–0.43) as protector factors. In the multiple regression analysis of scores, age, chest trauma and TBI, the variable with independent mortality effect was age (OR=1.05, 1.0–1.1). Between management variables (amines, VM, nutrition, surgery) amines (OR=31.1, 2.1–453.2) have independent effect; surgery (OR=0.18; 0.04–0.8) and nutrition are protective (OR= 0.11, 0.016–0.77).

**CONCLUSIONS.** We found that the best predictors of mortality in patients with abdominal trauma are RTS, GCS, ISS, APACHE II, Hb 24 h and the initial base deficit. Age has independent effect in mortality. Nutrition and surgery are protective.

## 0873

### CREATION OF A COLLECTIVE MEDICAL EVACUATION SYSTEM

J.-P. Tourtier[1], E. Forsans[1], L. Mangouka[1], A. Chrisment[1], J.-V. Schaal[1], L. Grasser[1], M. Borne[1]

[1]Military Hospital Val-de-Grâce, Paris, France

**INTRODUCTION.** Aeromedical Evacuation (MEDEVAC) is a component dimensioning of French Armed Forces foreign deployment. Considering the technical limitations of the previous collective MEDEVAC system (conversion of an Airbus A 310), the ministry of defense have asked for a new one, designed for multiple MEDEVAC of critically injured patients. The operational requirements of this project were permanent availability and ability to take off at H24 or earlier.

**METHODS.** We selected a non-dedicated vector among existing French Air Force Aircraft with cargo capacity, high range and permanent availability. A platform meeting of medical and aeronautical standards was then created, based on a combination of modules specifically designed to be changeable. The organization had to be modular, in order to be installed or uninstalled quickly and easily on the plane, and also adapt to a specific mission. Composition and training of medical teams manning this platform were also determined.

**RESULTS.** The C135FR strategic tanker was chosen as a suitable vector. Eleven Aircraft have been modified to accommodate the medical solution. The technical platform includes patient care modules and logistical modules (2 racks, 1 preparation table and 1 centralized monitoring area). The Module Seriously Injured or Intensive Care Module allows the management of a patient on a respirator. The Module Slight Injury or Light Care Module allows the support of two lightly wounded. The medical team includes 11 to 12 people. This is a mixed team composed of medical and paramedical staff from hospitals, medical services unit and pooling of air conveyors. It consists of two intensivists, two air forces physicians, three anesthetist nurses, two air conveyors and two nurses. All have been trained on the ground and in flight. A twelfth place is reserved for a specialist (neurosurgeon, psychiatrist, cardiologist…) or a liaison officer as part of a mission for the benefit of another nation. The team is sized to ensure its ability in taking charge of about 6 to 12 injured people during about 10 h for a mission lasting a total of 30 to 50 h. Designed to reproduce the conditions for monitoring a patient in an ICU, the composition of the conveying team was studied to ensure the continuum of care throughout the flight.

**CONCLUSIONS.** The MEDEVAC system and its successful operational missions emphasize the versatility and efficiency of a solution based on mission-tailored "plug and play" modules easily and quickly installable aboard a non-dedicated aircraft.

## 0874

### HEMODYNAMIC AND INFLAMMATORY RESPONSE TO VOLUME REPLACEMENT WITH CRYSTALLOID OR HYPERTONIC SALINE WITH AND WITHOUT PENTOXIFYLLINE ON EXPERIMENTAL HEMORRHAGIC SHOCK

L.A. Magno[1], M.A.P. Kahvegian[2], C.T.S. Dias[2], J. Noel-Morgan[2], A.B. Cavalcanti[3], D.T. Fantoni[2], L.F. Poli-de-Figueiredo[4], E. Silva[5]

[1]São Paulo University, Heart Institute, Incor, São Paulo, Brazil, [2]São Paulo University, Surgery Department, School of Veterinary Medicine and Zootechnic, São Paulo, Brazil, [3]Hospital do Coração, HCor, Research Institute, São Paulo, Brazil, [4]São Paulo University, Department of Surgery, School of Medicine, São Paulo, Brazil, [5]Hospital Israelita Albert Einstein, São Paulo, Brazil

**INTRODUCTION.** Major trauma is associated with complex hemodynamic and microcirculatory changes. Volume depletion resulting from blood loss and inflammation triggered by tissue trauma, besides the systemic tissue ischemia, are the main factors leading to these changes. Hypertonic saline hyperoncotic (HHS) and pentoxifylline has been proposed as options in the resuscitation of hemorrhagic shock, showing the effect of modulation of the inflammatory response and efficacy in the restoration of hemodynamic parameters

**OBJECTIVES.** To evaluate the progression of inflammatory mediators and oxidative burst during 4 h after initial resuscitation in the treatment of hemorrhagic shock, with three different solutions: Ringer lactate, hypertonic hyperoncotic solution (HHS) and hypertonic hyperoncotic solution associated with pentoxifylline (PTX)

**METHODS.** anesthetized and instrumented 20 Landrace pigs of 28–32 kg were randomized to Sham group (5 animals—only anesthetized and monitored) and 15 submitted to hemorrhagic shock. The mean arterial pressure (MAP) was maintained at 40 mmHg by 30 min. After shock 5 animals were treated with 32 ml/kg Ringer's lactate (RL group), 5 animals with 4 ml/kg HHS (HHS group) and 5 animals with 4 ml/kg of HHS + 25 mg/kg pentoxifylline. In addition to systemic and regional hemodynamic parameters, we determine the oxidative burst of circulating neutrophils and inflammatory mediators (TNF-alpha, interleukin 1$\beta$, interleukin 6 and interleukin 10).

**RESULTS.** The animals in the HHS and PTX groups showed a significant decrease in oxidative burst after resuscitation, unlike the RL group, which showed an opposite ($p < 0.001$ for HHS vs. RL and PTX vs. RL after treatment). TNF alpha and interleukins also showed stable values in the groups treated with HHS and PTX, whereas in animals treated with RL was significant increase of these mediators. The HHS was ineffective in normalizing some regional and systemic hemodynamic variables ($p < 0.05$ after treatment at T0 for HHS vs. RL for Portal vein flow index), which improved when combined with pentoxifylline

**CONCLUSIONS.** In an experimental model of hemorrhagic shock during the observation of 4 h, hypertonic saline hyperoncotic used as a solution for volume replacement in volume 4 ml/kg weight, shown to cause less activation of neutrophils and decreased production of inflammatory mediators when compared to Ringer's lactate. When coupled with pentoxifylline 25 mg/kg effects on modulation of inflammatory response were similar.

**REFERENCE(S).** Cruz RJ Jr., Yada-Langui MM, de Figueiredo LF, Sinosaki S, Rocha e Silva M. The synergistic effects of pentoxifylline on systemic and regional perfusion after hemorrhage and hypertonic resuscitation. Anesth Analg. 2006;102:1518–24.

**GRANT ACKNOWLEDGMENT.** Thanks to National Council for development of Research and Technology in Brazil—CNPQ (Grant Number 505319/2004-7).

## 0875

### CORTICAL BLINDNESS IN PREECLEMPTIC PATIENTS: DUE TO PRES OR REGIONAL ANESTHESIA?

S. Akin[1], A. Aribogan[1], S. Giray[2], Z. Arlier[2]

[1]Baskent University School of Medicine, Anesthesiology and Reanimation Department, Adana, Turkey, [2]Baskent University School of Medicine, Neurology Department, Adana, Turkey

**INTRODUCTION.** Preeclampsia is a serious medical disorder (hypertension, proteinuria and oedema) of a pregnant with significant maternal and fetal morbidity and mortality. Posterior Reversible Encephalopathy Syndrome (PRES) is a neuroclinical pathology expressed by cortical and subcortical changes localised in posterior regions of cerebral hemispheres and cerebellum. A rapidly increased blood pressure altering autoregulation of cerebral blood flow produces cerebral oedema and ischaemia of brain tissue. Controversial issue is the use of subarachnoid block for Caesarean anaesthesia in this patients. The major concern is the low cerebral perfusion with exaggerated hypotension with onset of the block.

**OBJECTIVES.** In this report we present three cases of preeclampsia followed with cortical blindness after cesarean sectio.

**METHODS.** Severe preeclampsia with cortical blindness patients admitted to ICU were assessed including demographic characteristics, hemodynamic parameters, anesthesia techniques, blindness time and outcomes.

**RESULTS.** Three women's files were investigated with severe preeclampsia and blindness in ICU. The common demographics of all women were young ages (19, 21, 22, respectively), high blood pressures (systolic blood pressures >180 mmHg), delivery of first gestation and anesthesia techniques (spinal anesthesia with bupivacaine, 0.05%). Only one of them was admitted from another hospital who presented with blindness in the first hour of C/S. Blindness of the other two women were diagnosed in 24 h of the delivery. PRES was confirmed with MRI. After the early therapy the patients' vision were improved in 48 h and were normal in 72 h in all the patients.

**CONCLUSIONS.** Sudden total blindness of a healthy person after the delivery is a depressing experience for both physicians and patients. All preeclampsia cases should be followed seriously for neourologic manifestations including PRES and blindness after delivery. Regional especially spinal anesthesia may be controversial though it is known to be safe in preeclampsia. Subarachnoidal intervention may cause intracranial hypotension which was hypertensive due to increased pressure of the brain and also may cause decreased perfusion of the brain due to sympatholytic effects causing sudden hypotension especially after the delivery.

**REFERENCE(S).** 1. Borromeo CJ, Hirsch JA, Blike GT et al. Anesth Analg. 2000;91:609–11

2. Crosby ET, Preston R. Can J Anaesth. 1998;45:452–59

## 0876

### CRITICAL CARE TRIAGE IN HAITI: FROM FRONT LINE CARE TO SHIP-BASED TERTIARY CARE

J. Geiling[1], D. Amundson[2], P. Auerbach[3]

[1]Dartmouth Medical Schiool, Hanover, NH, USA, [2]UCSD, San Diego, USA, [3]Stanford University, Stanford, USA

**INTRODUCTION.** The earthquake that devastated Haiti on January 12, 2010 resulted in an overwhelming number of casualties and injuries. Most of the healthcare infrastructure in downtown Port au Prince was destroyed, thus victims of the disaster either fled the city to areas less affected or presented to one of the numerous makeshift facilities established by numerous non-governmental organizations (NGOs).

Patients with overwhelming injuries initially were afforded all of the complex care the healthcare providers and supporting agencies could muster. As the numbers of patients presenting soon overwhelmed the evacuation possibilities, tough decisions regarding the intensity of care that could be provided had to be made by providers at all echelons of care. This discussion presents information from the authors' experiences at University Hospital in Port au Prince to the USNS Comfort, the US Navy's hospital ship that provided tertiary level care.

**OBJECTIVES.** To describe the practical challenges facing critical care providers in providing emergency and critical care. Additionally, describe how resources and follow-up care also challenged tertiary care facilities in providing ideal critical care.

**METHODS.** The abstract is descriptive, based on observations of the authors and contributors.

**RESULTS.** (1) Initial attempts at providing emergency and critical care in post-earthquake Haiti were provided on first-come, first-served basis by those governmental and NGOs first arriving in country. The overwhelming number of injuries included crush injuries. Many were treated with local wound care, debridement, and as tolerated, amputation. (2) Even with the addition of minimal pharmaceuticals, including antibiotics, very limited oxygen, red blood cell transfusions, and pain medications, staff shortages and lack of evacuation capability resulted in only stable patients being afforded care. Excellence in care was determined by detailed and periodic wound care provided by a single nursing team in a designated intensive care unit. (3) Tertiary level care on board a floating ICU did not prevent the requirement for triaging care, whether that be due to lack of staff or equipment. Often the limiting factor in deciding the intensity of care provided was determined by the available resources for long-term care and support within Haiti's healthcare system of those of NGOs.

**CONCLUSIONS.** Emergency and critical care in a disaster setting forces providers to make triage decisions on the intensity of care they provide. Evacuation to a more robust care setting such as a hospital ship helps support those with limited capability, but also forces triage decisions to be made by those critical care providers. Disaster critical care requires a change in mind set of the provider and resource investment in order to optimize the care to the greatest number of critically ill patients.

**REFERENCE(S).** Geiling J (ed) Fundamental Disaster Management, Des Planes, IL (2008)

## 0877

### EFFECTIVENESS OF MEDICAL HELICOPTERS IN PEDIATRIC TRAUMA CARE: DIRECT TRANSPORT FROM THE SCENE VERSUS INTERHOSPITAL TRANSFERS

S.G. Suvorov[1], V.M. Rozinov[1], G.A. Chogovadze[1], V.G. Mahnev[2], Y.V. Divilina[3], A.U. Lekmanov[1], S.F. Pilyutik[3]

[1]Moscow Research Institute of Pediatics and Children's Surgery, Moscow, Russian Federation, [2]Center of Emergency Medical Care, Moscow, Russian Federation, [3]Speranskiy Children's Hospital #9, Moscow, Russian Federation

**INTRODUCTION.** Helicopter-based emergency medical system including an onboard emergency physician (intensivist) for prehospital trauma care is working in the Moscow region since 1995.

**OBJECTIVES.** The goal of this study was to retrospective analyze the prehospital care of the pediatric trauma victims (road accidents, falls, burns etc.) under 16 years of age transported to the Speranskiy Children's Hospital #9 of the City of Moscow (it is approximately equal to level 1 pediatric trauma center) by physician-staffed medical helicopters.

**METHODS.** In this study we compared 78 pediatric trauma patients transported by helicopter from the injury scene (S group) to our pediatric hospital and 98 trauma victims transported by air after stabilization in local hospitals of the Moscow Region (H group) between January 1, 2001 and March 15, 2010. The patients were evaluated by the pediatric anesthesiologist-reanimatologist (intensivist) at the time of admission and categorized due to clinical judgment by illness severity (mildly ill, moderately ill, severely ill, very severely ill or critically ill)—see Table 1. We compared the groups depending on requirement for therapy onboard the helicopter and mortality in the hospital.

**RESULTS.** The groups had statistically significant difference in clinical status/severity ($\chi^2$=102.2; df=4; $p < 0.001$). Patients transported from local hospitals (group H) had a higher rate of mechanical ventilation [41 (41.8%) vs. 14 (17.9%), $\chi^2$=11.5, $p < 0.001$], oxygen administration [91 (92.9%) vs. 27 (34.6%), $\chi^2$=66.7, $p < 0.001$], infusion therapy [93 (94.9%) vs. 39 (50.0%), $\chi^2$=46.7, $p < 0.001$].

**TABLE 1** CLINICAL STATUS/SEVERITY AT THE TIME OF ADMISSION

| Clinical Status/Severity | S group | H group |
|---|---|---|
| Mildly ill | 19 | 0 |
| Moderately ill | 45 | 8 |
| Severely ill | 4 | 31 |
| Very severely ill | 5 | 49 |
| Critically ill | 5 | 10 |
| Overall | 78 | 98 |

Patients transported from the injury scene (S group) were less likely to be admitted to the PICU [15 (19.2%) vs. 80 (81.6%), $\chi^2$=68.1, $p < 0.001$] and contributed to a lower rate of surgery [12 (15.4%) vs. 63 (64.3%), $\chi^2$=42.5, $p < 0.001$]. Nobody died during transportation. Mortality rates were 2 (2.6%) in the S group and 11 (11.2%) in the H group [$\chi^2$=4.76, p=0.029].

**CONCLUSIONS.** Triage of victims in regional hospitals allows using medical helicopter for patients in severe conditions, who more often require immediate interventions and intensive therapy. Considering cost of the medical helicopter usage, it is expedient to use it primarily for interfacility transfers.

**REFERENCE(S).** Suvorov SG, Rozinov VM, Shilkin IP et al. Pediatric trauma care to road traffic victims in the Moscow region. Intensive Care Med. 2009;35(Supl.1):S233, 0902.

# Quality of care: 0878–0890

## 0878

### PREVENTION OF PRESSURE SORES IN PATIENTS WITH POOR PERFUSION TISSUE: A PILOT STUDY COMPARING OIL VS MILK HYPEROXYGENATED FATTY ACIDS

E. Gallart[1], M.A. Riera[1], G. Marin[1], J. Gomez[1], M.A. Gallart[1], M. Llauradó[2]

[1]Vall d'Hebron University Hospital, Critical Care Department, Barcelona, Spain, [2]CIBERES, Barcelona, Spain

**OBJECTIVE.** To assess the effectiveness of the implementation of Mepentol milk® versus Mepentol oil® in the prevention of pressure sores (PS) in critically ill patients with poor tissue perfusion.

**MATERIALS AND METHODS.** Pilot randomized clinical trial. Patients admitted without pressure ulcers and capillary refill time >2 s were enrolled. A standardized PS prevention protocol was implemeted in all ICU patients. The control group was prescribed with Mepentol oil® and the intervention group was prescribed Mepentol milk®. Patient's follow up was assessed every 24 h over 5 consecutive days. Independent Variables: age, sex, comorbidities, APACHE II score, risk of pressure sores (using EMINA score), preventive measures, capillary refill time. A descriptive and inferential statistical analysis was performed to assess the homogeneity of the two groups, using SPSS 15.0. ($\alpha = 0.5$)

**RESULTS.** 34 patients [median age of 56 (26–84) years] were included, being 28 (82.35%) men. Thirty-one (91.2%) completed the study, and three died. The mean global capillary refill time was 7.06 s (DE: 3.7). Both groups were found to be homogeneous. The incidence rate of PS in the control group was 47.1 versus 14.2% in the experimental group. OR for PS was 0.18 (95% CI 0.03–1.10).

**CONCLUSIONS.** Hyper-oxygenated fatty acids in the milk formulation may have a protective effect, reducing the risk of pressure sores in patients with severely compromised tissue perfussion when compared with an oil formulation.

## 0879

### A PROMISING NON-PHARMACOLOGICAL THIRST INTERVENTION FOR INTENSIVE CARE PATIENTS

S.R. Arai[1], M. Kiranou[1], K. Puntillo[1]

[1]University of California San Francisco, Physiological Nursing, San Francisco, USA

**INTRODUCTION.** Thirst is one of the most intense and distressing symptoms reported by intensive care patients. A randomized prospective pilot study was conducted to test the feasibility of an innovative family-administered thirst intervention to provide symptomatic relief for patient thirst.

**OBJECTIVES.** The study hypothesis was that patient thirst intensity and distress scores will significantly decrease after a non-pharmacological thirst intervention performed by their family member as compared to patient thirst scores in the usual care/control group.

**METHODS.** In this randomized single-blinded interventional pilot study, ICU patients who reported thirst intensity or distress scores ≥3 [as measured by a 0 to 10 numeric rating scale (NRS)] with a visiting family member were eligible for the study. The 26 enrolled patients and their family members were randomly assigned to the thirst intervention or usual care/control group. Institutional review board approval was obtained for all procedures. Patients were comparable in age, 61.38 ± 14.49 (control), 57.46 ± 19.38 (intervention) and predominantly male (61.5%). Intervention group family members were coached by a research nurse to perform the thirst intervention; a series of moistened oral swabs, moisturizing sprays, and a lip moisturizer repeated every 10–15 min for 30 min. The unrestricted activities of family participants in the usual care/control group were observed for a similar time interval. A second research nurse, blinded to the thirst reports and group assignment, conducted all post-thirst assessments.

**RESULTS.** See Table 1 for the patient-reported pre and post thirst score ratings. Per a 2-way repeated measures Analysis of Variance, there was a significant main effect for the thirst intensity scores, $F(1, 24) = 18.41$, $p < 0.001$, with a significant interaction, $F(1, 24) = 8.51$, $p = 0.008$; partial eta squared 0.26. The main effect for the thirst distress scores was also significant, $F(1, 24) = 9.99$, $p = 0.004$, however, the interaction was only marginally significant, $F(1, 24) = 3.91$, $p = 0.06$, partial eta squared 0.14.

**CONCLUSIONS.** This initial promising response suggests that a simple bedside intervention may potentially ameliorate one of the most pervasive symptoms reported by ICU patients but requires further study in a larger sample.

**TABLE 1** PRE AND POST THIRST RATINGS

| Thirst Ratings | Usual Care/Control Group n= 13 | Thirst Intervention Group n= 13 |
|---|---|---|
| Thirst intensity pre-score | 6.0 ± 3.51 | 7.77 ± 1.79 |
| Thirst intensity post-score | 5.38 ± 3.07 | 4.54 ± 2.63 |
| Thirst distress pre-score | 5.23 ± 3.47 | 7.23 ± 2.24 |
| Thirst distress post-score | 4.54 ± 3.95 | 4.23 ± 2.92 |

**REFERENCE(S).** Nelson JE et al. Self-reported symptom experience of critically ill cancer patients receiving intensive care. Crit Care Med. 2001;29(2):277–82.

Puntillo K et al. Symptoms experienced by intensive care patients at high of dying. Crit Care Med (in review)

**GRANT ACKNOWLEDGMENT.** Funded by the National Palliative Care Research Center

## 0880

### INNOVATIVE DISCHARGE PLAN FOR VAD PATIENTS: A MULTIPLE CASE STUDY

N. Shnaider[1]

[1]Sheba Medical Center, Tel Aviv University, Cardiac Surgeries, Tel Aviv, Israel

**AIMS.** To present an original discharge plan for patients with end stage CHF. Ventricular assist devices (VAD) are used as a bridge to cardiac transplantation by providing mechanical circulation when the natural heart cannot maintain adequate cardiac output. With proper training, VAD patients can leave the hospital and wait for their transplant at home restoring their quality of life. Prior discharge a training process of self care and life supporting equipment management is needed.

**METHOD.** A multiple case studies of applying an original discharge plan for five patients with end stage CHF (and one of them also with PHTN). All patients went under LVAD HeartMateII transplantation as a bridge to cardiac transplantation.

Nurse management team developed an evidence-based education program. Nursing staff was instructed by management team, the surgeon and Gamida company presenter regarding the postoperative surgical care and basic concepts related to device

Three weeks prior the discharge patient's primary caregiver was trained to treat exit site using sterile technique under nurse monitoring and guided to identify signs of infection. In this time frame patient was trained how to operate the device. A week prior the discharge family was instructed on daily basis regarding the equipment that must be carried on at all times, follow-up care, device maintenance and troubleshooting. Community services which are not experienced with VAD's were instructed by the management team and Gamida presenter. SHL Telemedicine provided monitoring, call center and emergency services.

**RESULTS.** All patients were discharged with LVAD HeartMateII and maintained their routine management at home. Four out of five patients went under donor cardiac transplantation.

**CONCLUSION.** The current plan—involving the patient, his caregivers, nursing staff and community services—ensured a safe discharge for all five VAD patients. This plan maintains quality care with reduced costs and assures patient's Quality of Life.

## 0881

### PERIPHERALLY INSERTED CENTRAL CATHETER (PICC) INSERTION USING ULTRASOUND GUIDANCE IN A WARD ENVIRONMENT

M. Phillips[1], H. Finnegan[1], C. Talbot[1], M. Kyi[1]

[1]Good Hope Hospital, Sutton Coldfield, UK

**INTRODUCTION.** Peripherally Inserted Central Catheters (PICC) are a viable alternative to direct cannulation and catheterization of the jugular and subclavian veins in ward-based patients requiring long term venous access for Total Parenteral Nutrition (TPN), extended duration antibiotics or who are difficult to cannulate peripherally. Convention in the hospital was to book this group of patients into the Emergency Theatre to have the procedure which frequently delayed patients' treatment. This led to the development of a multi-disciplinary PICC Outreach Service.

**OBJECTIVES.** This prospective observational study aims to identify any adverse complications associated with ultrasound guided PICC insertion in a ward based environment.

**METHODS.** An observational audit was employed to review the activities of the PICC Outreach Service within the hospital. Over a period of 11 months, 57 PICC lines were sited. Of these, 89% were performed in the ward environment. For all of the PICC placements a stringent aseptic technique was employed and the team's bespoke PICC line insertion pack used, including the standard Vygon Lifecath PICC Line. The majority of the patients who received PICC lines had difficult venous access in the antecubital fossa due to multiple previous attempts at cannulation, or a low serum albumin concentration (as low as 15 g/L) leading to gross peripheral oedema. For these reasons ultrasound guidance with Sonosite Micromaxx was used in 82% of cases. Data was captured following the insertion of each line with alternate daily follow-up consisting of a visual site inspection and a check of haematological infection markers including white cell count and CRP.

**RESULTS.** Of the 57 lines inserted, 12 yielded complications: 2 lines migrated out of the vein; 1 had to be removed due to thrombophlebitis; 3 were malpositioned on radiological assessment (including 2 in the right internal jugular vein); 3 lines failed to feed to the desired depth and 3 became occluded during use (of which all 3 were successfully made patent using Urokinase). There were no reported cases of bacteraemia. The duration of use of PICC lines ranged from 5 to 52 days with three patients leaving hospital with their line in situ to receive antibiotics in the community. Follow-up of these patients continued until removal of their lines with no complications reported.

**CONCLUSIONS.** The insertion of PICC lines in a ward based environment using a standard equipment bundle and a robust aseptic technique has not been detrimental to this patient group. The use of ultrasound guidance has enabled PICC lines to be inserted into patients where neither peripheral cannulation nor landmark approach PICC insertion would have been possible.

**REFERENCE(S).** 1. J Intensive Care Soc. 2009, 10(2):95–8 Tan R. et al.

2. Radiology. 1998;206:423–8. Neuman ML et al.

## 0882

### PUPIL EXAMINATIONS AND PERIORBITAL EDEMA FOLLOWING ANTERIOR CRANIOTOMY SURGERY

A.C. Torres[1], S. Diccini[1]

[1]Universidade Federal de São Paulo, Nursing School, Sao Paulo, Brazil

**INTRODUCTION.** Periorbital edema consists of subgaleal fluid collection in the palpebrae following anterior craniotomy. It may impair or impede pupil assessments when it gives rise to resistance to manual opening of the palpebra. Patients undergoing craniotomy may evolve with complications that cause intracranial hypertension. Herniation of the uncus of the temporal lobe resulting from decompensation of intracranial hypertension may cause pupil anisocoria or mydriasis. These abnormalities can be detected at an early stage by nurses through pupil assessments in the ICU following the operation.

**OBJECTIVES.** To evaluate the interference of periorbital edema on pupil assessments made by nurses on patients who underwent craniotomy, in the intensive case unit (ICU) during the first 48 h after the operation.

**METHODS.** This was a prospective cohort study conducted in an ICU at a university hospital in the city of São Paulo, Brazil, from February 2007 to March 2008. Patients of both sexes aged over 18 years who underwent elective anterior craniotomy were included. Patients with oculomotor nerve lesions prior to surgery were excluded. Data on the following variables were collected on a form: age, sex, medical diagnosis, presence of periorbital edema and difficulty in making pupil assessments. The patients were evaluated over the first 48 h after the operation, every 12 h.

**RESULTS.** Ninety-seven patients were included: 59 women (60.8%) and 38 men (39.2%). Their mean age was 45.9, ranging from 18 to 82 years. Among the medical diagnoses, 54 patients (55.7%) presented an intracranial tumor, 26 (26.8%) epilepsy, 14 (14.4%) cerebral aneurysm and 3 (3.1%) arteriovenous malformation. Over the first 48 h after the operation, 78 patients (80.4%) presented periorbital edema. Among these patients, pupil assessments were performed without difficulty on 55 (56.7%) and with difficulty on 19 (19.6%), while it was impossible for 23 patients (23.7%).

**CONCLUSIONS.** Periorbital edema interfered with pupil assessments in the ICU over the first 48 h after the operation, in relation to 42 patients (43.3%), among whom the nurse was unable to perform the pupil examination on 23 (23.7%) patients.

**REFERENCE(S).** Oliveira APF, Whitaker YI, Diccini S. Exame pupilar em pacientes com edema peiocular. Acta Paul Enf. 1999;12(3):84–91.

Adoni A, Mcnett M. The pupillary response in traumatic brain injury: a guide for trauma nurses. J Trauma Nurs. 2007;14(4):191–6.

Bullock R. Teasdale GM. Recurrent hematomas follwing craniotomy for traumatic intracranial mass. J Neurosurg 1990;72(1):9–14.

Taylor WA et al. Timimg of postoperative intracranial hematoma development and implications for the best use of neurosurgical intensive care. J Neurosurg 1995;82(1):48–50.

**GRANT ACKNOWLEDGMENT.** The study was conducted without a grant financial support.

## 0883

### SLEEP QUALITY AFTER CARDIAC SURGERY IN THE INTENSIVE CARE UNIT

A. Yava[1], A. Koyuncu[2], M. Kürklüoğlu[2], F. Koyuncu[2]

[1]Gülhane Military Medical Academy, School of Nursing, Ankara, Turkey, [2]Gülhane Military Medical Academy, Cardiovascular Surgery, Ankara, Turkey

**INTRODUCTION.** Sleep disturbance is a common symptom during the recovery period after cardiac surgery. Ineffective or insufficient sleep patterns may have serious effects on morbidity, mortality, and quality of life.

**OBJECTIVES.** The aim of this study was to determine the patients' sleep quality and associated factors in early postoperative period after open heart surgery, and during hospitalization.

**METHODS.** This was a prospective study, conducted in Cardiovascular Surgery Department between September 2009 and February 2010 in a research and trainin hospital in Turkey. After the consent, the study was carried on 52 adult patients undergoing elective open heart surgery, without a history of sleep disorder and who were not use any medications affecting sleep. Data were collected by a demographic questionnaire (age, gender, education, employment, chronic illness), and a sleep questionnaire (preoperative duration of sleep-T1, postoperative duration of sleep-T2, daytime sleep, other factors affecting sleep and sleep quality scoring 0-worst, 10-excellent). The sleep data were collected until discharge. Demographic data were demonstrated as frequencies and percentages. Mann–Whitney U test and Kruskal–Wallis analysis were used for comparing groups.

**RESULTS.** Seventy-two percent of patients (n=38) were male, mean age was 64.73 $\pm$ 11.87, 81% (n=42) of patients were retired and 52% (n=27) were high school graduates. Seventy-nine percent of patients (n=41) underwent coronary artery bypass surgery. Mean mechanical ventilation time was 7.21 $\pm$ 3.46 h (range: 5.5–12.3) and mean intensive care stay was 29.33 $\pm$ 11.98 h (range: 23.36–42.50). The comparison of sleep durations of patients revealed that the patients had more night sleep in the preoperative period (mean T1=7.36 $\pm$ 3.23 h, and T2=4.56 $\pm$ 2.89 h), and the difference in both durations were found to be statistically significant ($z=1.812$, $p<0.05$, Mann–Whitney U test). The mean sleep quality score in the preoperative and postoperative periods were 7.11 $\pm$ 1.23 and 4.56 $\pm$ 3.84 respectively, with a statistically significant difference between them ($z=0.543$, $p<0.01$, Mann–Whitney U test). When compared by means of demographic variables, the sleep duration and sleep qualities of patients were not found to have a statistically significant difference. (Kruskal–Wallis test, $p<0.05$). The most important factors affecting the sleep quality were; sleep position, pain, and nursing staff check for vital signs.

**CONCLUSIONS.** A significant drop in the duration and quality of sleep was noted postoperatively, when compared to the preoperative period. Therefore, proper planning and individualization of the nursing services will be helpful in increasing the sleep quality and duration of patients. Future longitudinal studies comparing the sleep patterns with time will also be helpful.

## 0884

### SLEEP AND NURSING CARE IN THE ICU

M. Ritmala-Castren[1,2], I. Virtanen[3,4], H. Leino-Kilpi[1,5]

[1]University of Turku, Department of Nursing Science, Faculty of Medicine, Turku, Finland, [2]Helsinki University Hospital, Operative Department, Helsinki, Finland, [3]Turku University Hospital, Department of Clinical Neurophysiology, Turku, Finland, [4]University of Turku, Sleep Research Unit, Turku, Finland, [5]South Western Hospital District, Turku, Finland

**INTRODUCTION.** Sleep of the ICU patients is known to be poor: light and fragmented. Arousals and awakenings of 20–63 per hour on patients receiving ventilatory care have been documented. Other causes for sleep fragmentation may be environmental noise, light, nursing care, patient's illness, medication, discomfort or pain (Parthasarathy and Tobin 2004).

**OBJECTIVES.** The aim of this study was to describe how non-intubated patients sleep in an ICU and how nursing care affects their sleep. The research questions are (1) how do patients sleep and (2) how much does nursing care interfere with their sleep.

**METHODS.** One night's sleep was registered by polysomnography on five medical and 16 surgical patients. Patients with neurological problems or continuous sedation were excluded from the study. Nurses recorded simultaneously all nursing care that required touching the patients.

**RESULTS.** Length and quality of sleep varied largely. Patients slept from none to 10.4 h (mean 5.0 h). Sleep was mostly light (sleep stages N1 and N2). Thirteen patients had no deep sleep (N3) and ten patients had no REM sleep. Arousals and awakenings were numerous, mean being 29 per hour. Nursing care was given 152 times all together, mean 7.3 times per patient and 0.9 times per registered hour. Most commonly it consisted of assisting with position change or taking a blood sample. Other care given included mostly performing different measurements, giving medication or nutrition and assisting with breathing exercises. Longest time between care actions was 4 h 48 min, and the average was 57 min.

**CONCLUSIONS.** Sleep in an ICU is poor. Patients wake up frequently. Most of the awakenings can not be explained by nursing care given. The reasons for poor sleep quality remain mostly elsewhere.

**REFERENCE(S).** Parthasarathy S, Tobin MJ. Sleep in the intensive care unit. Intensive Care Med. 2004;30:197–206.

## 0885

### COMPARISON OF TEMPERATURE MEASUREMENT IN THE BLADDER, RECTUM AND PULMONARY ARTERY IN PATIENTS AFTER CARDIAC SURGERY

H. Wollerich[1], M.W. Nijsten[1], F. Ismael[1]

[1]UMC Groningen, Critical Care, Groningen, Netherlands

**INTRODUCTION.** In many ICU's patient temperature monitoring is performed by rectal temperature (Tr) measurement. Bladder temperature (Tb) measurement may have a number of advantages in the ICU. It has been demonstrated that the reliability of Tb is higher than that of rectal (Tr) or inguinal and axillary temperature measurements [1]. It is not known if the same holds true during the direct post-operative phase in patients admitted after cardiac surgery. This may be particularly relevant given the large regional changes in temperature that occur during cardiac surgery.

**OBJECTIVES.** In a prospective study we compared Tb with Tr and Tpa (pulmonary artery catheter temperature). We also looked at the effect of diuresis on Tb.

**METHODS.** 20 consecutive patients admitted to the department of critical care after cardiac surgery were studied. To be included, patients had to have three temperature sensors in place upon arrival at the ICU: in the urinary bladder (Tb), in the pulmonary artery (Tpa) and in the rectum (Tr). Diuresis was recorded every hour. Data were collected until 24 h after admission or until ICU discharge.

**RESULTS.** In 20 patients with (mean age 62; 10 males; 10 females) during a median observation period of 17 h 401 Tb, 352 Tr and 389 Tpa measurements were recorded. Correlation coefficients between Tr, Tb and Tpa were 0.92, 0.92 and 0.92 respectively ($p < 10E\text{-}9$). The offsets for (Tb–Tr), (Tb–Tpa) and (Tr–Tpa) were $-0.10$°C, $+0.01$°C and $+0.11$°C respectively. The 6 largest offsets with lower Tb than Tr were observed in a single patient undergoing renal replacement therapy. Apart from this effect, Bland–Altman analysis demonstrated no relation between temperature and the (Tb–Tr) offset. No relation of diuresis with (Tb–Tr) or (Tb–Tpa) was observed.

**CONCLUSIONS.** Also after cardiac surgery, bladder temperature measurements performed as well as the currently standard rectal temperature measurements. Diuresis appeared to have no effect on temperature differences. We believe that the bladder temperature measurement has sufficient advantages to be used instead of rectal temperature measurements in these patients.

**REFERENCE(S).** 1. Lefrant JL, Muller L, Emmanuel Coussaye J et al. Temperature measurement in intensive care patients: comparison of urinary bladder, oesophageal, rectal, axillary, and inguinal methods versus pulmonary artery core method. Intensive Care Med. 2003;29:414–418.

## 0886

### NURSING DOCUMENTATION OF SURGICAL WOUNDS IN THE INTENSIVE CARE UNIT

R. Danielsson-Ojala[1], S. Salanterä[1], H. Lundgren-Laine[1]

[1]University of Turku, Department of Nursing Science, Turku, Finland

**INTRODUCTION.** Wound care is an essential part of surgical patients' nursing. Documentation reveals the quality of given care. Consistent documenting of wound healing process is a prerequisite for evaluating the efficiency, cost-effectiveness and outcomes of wound care. Several factors prevent successful wound care such as nurses' different level of knowledge in evaluating and implementing wound care, fragmented wound documentation which makes expedient access to specific information difficult, unspecific descriptions of wounds, and multiple wounds of one patient. This complexity of wound assessment can lead to inconsistent documentation. Unreliable documentation can cause inadequate and inaccurate wound treatment. The consequences will be suffering, prolonged hospital stay, multiple medication, and higher costs for patients.

**OBJECTIVES.** The purpose of this study is to describe the wound care documentation of ICU nurses.

**METHODS.** The study material consisted of 61 patient records of heart operated patients with surgical wounds from which we randomly chose 24. The inclusion criteria were an operation in 2006, age 16 years or older and length of stay more than 5 days in one University Hospital ICU. These chosen records were nursing documents written during the actual inpatient period from the patient admission to the discharge. We performed a retrospective quantitative content analysis. The categories to which information of wounds were designed, were formed inductively from the data. We counted how often the same expressions were mentioned and measured the headings which were used in surgical wound care context.

**RESULTS.** We found 133 notes of surgical wounds written during 191 inpatient days in the ICU. They described the manner and frequency of bandage changes, the names of bandages, the amount and quality of leakage and the appearance and place of wounds. The descriptions of nurses and doctors actions in wound care were also present.The language was unstructured and many words of colloquial language or out of focus were used. There were documents without any mention of a surgical wound (n=5) or it was only mentioned in the discharge note (n=1). Brand names were used instead of generic names for the bandages.The nurses wrote about surgical wounds generally without a heading (n=42) or under heading "Other" (n=22). Also 22 respective 8 different other headings were used in daily and discharge notes.

**CONCLUSIONS.** The nursing documentation in the ICU does not complete the quality requirements for good wound care and patient safety. It is probably adequate and specific enough in the process of giving information from one caregiver to another when face to face communication can fill the gap. However, much further and precise facts are needed in hand-overs to the other wards or to the patient and patient's family. Improvements could be achieved by supporting the electronic documenting with obligatory templates for standardised documentation.

## 0887

### SLEEP QUALITY OF PATIENTS HOSPITALIZED IN THE CORONARY CARE UNIT AND OF THE AFFECTING FACTORS

B. Armutcu[1], H. Cicek[2], A. Yava[2], N. Tosun[2], T. Celik[1]

[1]Gulhane Military Medical Academy, Corener Care Unit, Ankara, Turkey, [2]Gulhane Military Medical Academy, School of Nursing, Ankara, Turkey

**OBJECTIVES.** The aim of this study is to determine if any change occurs or not occurs in the sleep quality of patients hospitalized in Coronary Care Unit (CCU) unit and to define the affecting factors

**METHODS.** After the literature review realized in order to collect data, a developed data collection form has been used. Besides the questions intended to the patients sociodemographic characteristics and the proprieties of the disease a scala (1–10) has been used for the sleep quality and the affecting factors.

**RESULTS.** The research has been performed in the CCU of a training and research hospital over a total of 100 patients hospitalized and that not have any problem of communication. The average age of the patients was 55.5 $\pm$ 16.59 (21–93) years old, the 65% was composed by men. It has been realized that 95% of the patients had a health insurance and they were not feeling anxious for the hospital expenses. 35% of the patients were hospitalized for AMI, 29% of them for CHF and 13% of them for arrhythmia and they were hospitalized with an average of 4.7 $\pm$ 1.16 days. I has been detected that 45% of the patients were hospitalized in CCU for the first time that 8% of them were getting antidepressants. While the patient sleep quality score in their home is in average 7.39 $\pm$ 1.87 (median 8) it has been determined that the first night after the hospitalization the score reaching the lowest level was 5.42 $\pm$ 2.39 (median 6) and that the average of the CCU was 6.83 $\pm$ 2.15 (median 8) and that after the transfer to the clinic the score was reaching (7.39 $\pm$ 2.18) the same score as the sleep quality at home. While the change in sleep quality related to the diagnostic of the patients was not considered as statistically meaningful ($p < 0.05$), surprisingly the sleep quality was detected to be more higher in the first night in patients having AMI diagnostics than in patients having CHF diagnostic but this has not been evaluated as important statistically (p=0.59).It has been determined that while sleeping situation of patients was more longer within the first day of hospitalization in CCU, the awake and alert situations were increasing towards the end of the hospitalization. The factors affecting and disturbing the sleep were defined to be the cardiac monitor alarm, the light, the ventilator alarm, the nursing activities and the ring of telephone.

**CONCLUSIONS.** While the sleep quality of patients hospitalized in CCU was showing a slight decrease during the first night of hospitalization in CCU, after the transfer to the clinic it was reaching the same sleep quality existing at home. It has been in the opinion that this situation was generated by important factors which affect the sleep quality of patients such as light, noise existing in the CCU and as well as by the nursing activities. This is important to manage CCU environment and nursing activities in order to provide patients with resting opportunity during night time.

## 0888

### FACTORS ASSOCIATED WITH EARLY DEVELOPMENT OF PRESSURE ULCER IN ICU

I.Y. Whitaker[1], M.F. Cremasco[2], F. Wenzel[1], F. Cohrs[3], S.S.V. Zanei[1]

[1]Federal University of São Paulo, UNIFESP, Nursing, São Paulo, Brazil, [2]São Paulo Hospital, UNIFESP, ICU, São Paulo, Brazil, [3]Federal University of São Paulo, São Paulo, Brazil

**INTRODUCTION.** Multiple factors are related to pressure ulcer (PU) development in critical patients.

**OBJECTIVE.** To verify association between early pressure ulcer development and severity of illness, nursing workload, risk for pressure ulcer, lenght of stay and therapies in critical patients in the ICU.

**METHODS.** In this cross-sectional study, data from 160 patients were collected prospectively in three ICUs of a University Hospital located in São Paulo city, Brazil, from November 2007 to April 2008. Inclusion criteria were: being in the ICU at least 24 h and not present pressure ulcer on admission. Severity of illness was measured using Simplified Acute Physiology II (SAPSII) applied at admission. Risk factors for PU were determined using Braden Scale applied daily in the ICU, until the appearance of the PU. Nursing workload was measured daily using Nursing Activities Score (NAS).Sedation, mechanical ventilation and inotropic support during ICU stay were considered as therapies. Skin lesion developed until 7 days was considerated early PU. SAPSII, NAS and Braden average scores were compared using Student *t* test. Chi-square test was used to compare groups considering sedation, mechanical ventilation and inotropic support.

**RESULTS.** SAPSII average was 39.9 (SD=15.1), NAS average was 62.9 (SD =12) and Braden average was12 (SD =2.4). 47.5% patients had Braden scores between 10 and 12 which represent high risk for PU and 20.6% had Braden scores <9, indicating the highest risk. Average length of stay in the group of patients without PU (9.7 days), with early UP (19.5 days) and late PU (29.01 days) was statistically different ($p < 0.05$). The average length of stay was higher in patients with early UP compared with patients without UP. Braden scores average indicated high risk in patients without PU (12.3), with early UP (11.0) and late UP (10.4). The mean Braden scores of the group without PU was statistically superior to other groups ($p < 0.05$). However the difference was not clinically significant. SAPSII scores average of patients with early PU was not different from patients without PU (p=0.076) and with PU late (p=0.173). NAS scores average of patients with early PU was not different from patients without PU (p=0.355) and with PU late (p=0.112). In this sample, more patients with PU were sedated and mechanically ventilated than patients without PU, and more patients with PU late had inotropic support.

**CONCLUSIONS.** In this study sample, development of early PU was not associated with severity of illness, nursing workload, risk for PU and inotropic support.

**REFERENCE(S).** Yepes D, Molina F, León W, Pérez E. Incidence and risk factores associated with the presence of pressure ulcers in critically ill patients. Med Intensiva. 2009;33(6):276–81.

Nijs N, Toppets A, Defloor T, Bernaerts K, MIlisen K, Van Den Berghe G. Incidence and risk factors for pressure ulcers in the intensive care unit. Clin Nurs 2009; 18(9): 1258-66.

## 0889

### QUALITY IN THE MANAGEMENT OF INTRAVASCULAR DEVICES: AN OBSERVATIONAL STUDY

I. Comisso[1], S. Raimondi[2], V. Christ[2], G. Della Rocca[2]

[1]Azienda Ospedaliero Universitaria 'Santa Maria della Misericordia', Clinica di Anestesia e Rianimazione, Udine, Italy, [2]Azienda Ospedaliero-Universitaria 'Santa Maria della Misericordia', Udine, Italy

**INTRODUCTION.** The adoption of bundle has been associated to a significant decrease in the incidence of infections of intravascular devices. [1]

**OBJECTIVES.** The aim of this study is to evaluate the adherence to the recommendations of international guidelines for the management of intravascular devices.

**METHODS.** We observed the behaviours of healthcare workers regarding the care of central and peripheral venous catheters in four wards (three intensive care units and a semi intensive care unit), concerning the following aspects: handwashing; use of gloves; asepsis keeping during catheter manipulation; hub decontamination; catheter dressing according to the conditions of the inserction siteand of the dressing. We only observed the adherence to the guidelines of the nurses belonging to the ward. We calculated the percentage of adherence to the single behaviour.

**RESULTS.** Globally, 247 observations were collected in the 4 units. *Use of gloves*: gloves were not used in 26% of observations; there is a low adherence to the use of gloves during the start or the change of a continuous infusion, or the administration of drugs through the catheter. *Handwashing* has not been performed in 55% of cases before and in 43% of cases after the device was manipulated (globally in 49% of the observed procedures). The highest adherence to handwashing has been observed before the administration of blod components (100%) and before the dressing of the cathether(70%). The lowest adherence to handwashing has been observed before drug administration (32%). Alcoholic solution has been used in 95% of observations. *Handwashing and use of gloves*: in 19% of observations hands were not washed nor gloves were used. *Asepsis* was mantained in 98% of observations. The highest adherence to the asepsis keeping has been observed during the collection of blood samples (100%) and the management of transfusions (100%). The lowest adherence to asepsis keeping has been observed during the deconnection (89%) of an infusion. *Hub decontamination* has been observed only in 2% of cases, before the substitution of the infusion. *Catheters* were dressed with semipermeable film in 94% of observations. Dressing-type was appropriate in 49% of observations. Dressing time substitution was not appropriate in 71% of observations.

**CONCLUSIONS.** Globally, we observed many points susceptible of improvement regarding the care of the vascular catheters. Some of the behaviour may be corrected through the introduction of an hospital protocol for the management of intravascular devices an the improvement of the documentation.

**REFERENCE(S).** 1. Pronovost P. Interventions to decrease catheter-related bloodstream infections in the ICU: the keystone Intensiva Care Unit Project. Am J Inf Contr. 2008; 36 (10):S171.e1–5.

### 0890

**EVALUATION OF THE PREVENTIVE INTERVENTIONS USED BY NURSES IN PATIENTS WITH HIP FRACTURES**

S. Açiksöz[1], S. Uzun[1]

[1]Gulhane Military Medical Academy,School of Nursing, Department of Fundamentals of Nursing, Ankara, Turkey

**INTRODUCTION.** Hip fracture patients have a high risk of pressure ulcers. Pressure ulcers can be prevented by proper nursing interventions.

**OBJECTIVES.** The aim of the study was to evaluate the preventive nursing interventions in patients with hip fracture.

**METHODS.** This study was designed as a descriptive study. The study consisted of 32 patients with hip fracture who did not have a pressure ulcer on admission to the hospital. Four forms were used to collect data (1) patient information form; (2) nurse descriptive characteristics form; (3) Braden Pressure Ulcer Risk Assessment Scale; (4) nursing observation form. The forms were filled during face-to-face interview and observation. The patients were evaluated within the first 24 h after admission to the hospital and every patient was followed during hospitalization period.

**RESULTS.** Of the patients, majority were within 60–69 years group (50.0%; n=16); aged 65.8 ± 8.2 years (50–88) and female (81.2%; n=26). Mean duration of hospital stay was 7.2 ± 1.9 days. In the first observation, 43.7% (n=14) of the patients were determined to be in the low risk group and in the second observation 56.2% (n=18) of the patients were determined to be in the high risk group for pressure ulcer development. The third observation of the patients were determined to be highest risk group for pressure ulcer development. In spite of the fact that patients had a high risk for pressure ulcer development, it was determined that the percentage of regularly performed nursing measures for prevention of pressure ulcer development was low and that the percentage of independent nursing actions regularly performed was low. Documented interventions regarding prevention were: changing the position of patient and observation. The lack of nursing documentation regarding prevention and treatment of pressure ulcers may indicate that nurses did not identify pressure ulcers as a prioritized nursing problem for this patient group.

**CONCLUSIONS.** This study demonstrates that orthopedic nurses do not consistently provide preventive care for pressure ulcers. After identifying the patients risk of pressure ulcers by using a validated risk assessment tool for each group different nursing care should be planned and implemented.

## Epidemiology and clinical course of sepsis: 0891–0900

### 0891

**ROLE OF OMEGA-3 FATTY ACID IN SEVERE SEPSIS CASES**

R.K. Das[1], D. Sameer[1]

[1]GSVM Medical College Kanpur, Anaesthesia, Kanpur, India

**INTRODUCTION.** Aim of this study was to evaluate the effects of parenteral supplementation of omega-3 fatty acids on oxygenation and clinical outcomes in patients of sepsis with ARDS (i.e. severe sepsis).

**OBJECTIVES.** Study was conducted on patients of sepsis with ARDS. 70 patients meeting the entry criteria were randomized to TPN using commercial solution with identical amounts of glucose, amino acids and fat but different fatty acid composition. Group 1 received fish oil based solution and Group 2 was supplemented with Soyabean oil based solution.

**METHODS.** Arterial blood gases were measured and ventilator settings were recorded at baseline and study days 4 and 7 to enable calculation of $PaO_2/FiO_2$, a measure of gas exchange. Clinical outcomes were recorded.

**RESULTS.** Significant improvements in oxygenation from baseline to study days 4 and 7 with lower ventilation variables ($FiO_2$, PEEP, and Minute ventilation) occurred in patients on Omega-3 fatty acids compared with controls. Patients on omega 3 fatty acids required significantly fewer days of ventilatory support (10 vs. 14.8 days, p=0.01) and has decreased length of stay in ICU (12.5 vs. 17 days, p = 0.16) compared with controls. Only 3 of 35 (8.5%) patients on omega-3 fatty acids versus 10 of 35 (28.5%) control patients developed new organ failure during the study (p=0.015).

**CONCLUSIONS.** Omega-3 fatty acids has beneficial effects on gas exchange, weaning from mechanical ventilation, length of ICU stay and reduction in new organ failure.

**REFERENCE(S).** 1. Angus DC, Linde-Zwirble WT, Lidicker J, Clermont G, Carcillo J, Pinsky MR. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. Crit Care Med. 2001;29:1303–10

2. Brun-Buisson C, Doyon F, Carlet J, Dellamonica P, Gouin F, Lepoutre A, Mercier JC, Offenstadt G, Regnier B. Incidence, risk factors, and outcome of severe sepsis and septic shock in adults. A multicenter prospective study in intensive care units. French ICU Group for Severe Sepsis. JAMA. 1995;274:968–74

3. van Gestel A, Bakker J, Veraart CP, van Hout BA. Prevalence and incidence of severe sepsis in Dutch intensive care units. Crit Care. 2004;8:R153–62

4. Dombrovskiy VY, Martin AA, Sunderram J, Paz HL. Facing the challenge: decreasing case fatality rates in severe sepsis despite increasing hospitalizations. Crit Care Med. 2005;33:2555–62

5. Finfer S, Bellomo R, Lipman J, French C, Dobb G, Myburgh J. Adult-population incidence of severe sepsis in Australian and New Zealand intensive care units. Intensive Care Med. 2004;30:589–96

6. Aird WC. The hematologic system as a marker of organ dysfunction in sepsis. Mayo Clin Proc. 2003;78:869–88

### 0892

**PATIENTS WITH MULTIPLE ORGAN FAILURE: DIFFERENCES BETWEEN SEPTIC AND NON-SEPTIC PATIENTS**

V.A. Hortigüela Martín[1], M. Sánchez Casado[1], S. Rodríguez Villar[1], C. Marco Shulke[2], M. Quintana Díaz[3], H. Cabezas Martín[2]

[1]Virgen de la Salud Hospital, Intensive Care Units, Toledo, Spain, [2]Virgen de la Salud Hospital, Intensive Care Unit, Toledo, Spain, [3]La Paz University Hospital, Intensive Care Unit, Madrid, Spain

**OBJECTIVES.** To evaluate, in patients with multiple organ failure, the differences between septic and non-septic patients.

**METHODS.** Retrospective study. Included: Patients with MOF admitted to ICU during 2008 and 2009, differentiating between whether the cause of admission was sepsis related or not. Excluded: neurocritical and politrauma patients. Clinical and analytical parameters were evaluated.

**RESULTS.** 390 patients were included. 44.6% were septic. The most frequent causes of admission were community-acquired pneumonia (CAP) (20.7%), secondary peritonitis (15.5%), urological sepsis (14.4%) and nosocomial (hospital-acquired) pneumonia (NP) (10.3%); in the non-septic patients, they were: congestive heart failure (CHF) (20.8%), hemorrhagic shock (15.3%), cardiogenic shock (12%), cardiorespiratory arrest (10.6%) and mesenteric vascular disease (4.6%). There were no differences between septic and non-septic patients in age (62.5 ± 17.6 vs. 64.8 ± 15.5 years), sex (male: 60.6 vs. 61.5%) and length of stay (8.1 ± 36.3 vs. 9.3 ± 18.5 days). There was no significant difference in APACHE* II scores (18.4 ± 8.8 vs. 19.5 ± 7.1), however there was ($p < 0.05$) in SOFA** day 1 (7.6 ± 3.5 vs. 8.4 ± 3.3) and in APACHE* IV (59.5 ± 25.5 vs. 67.4 ± 22.5). On the first day after admission, there are no differences in the use of mechanical ventilation (75 vs. 71.3%), $PaO_2/FiO_2$ ratio (246 ± 136 vs. 240 ± 125), leucocytes (14,045 ± 12,324 vs. 15,017 ± 11,653), serum proteins (5.2 ± 1.1 vs. 4.9 ± 0.9), triglycerides (115 ± 57 vs. 129 ± 64), blood pH (7.32 ± 0.12 vs. 7.33 ± 0.12), D-dimer (3.146 ± 2,490 vs. 3.865 ± 2,432), lactic acid (29 ± 30 vs. 24 ± 25), C-reactive protein (48 ± 35.7 vs. 101 ± 85) y procalcitonin (4.5 ± 5.7 vs. 12.8 ± 19.3); there were differences ($p < 0.05$) in the use of vasoactive drugs (63.9 vs. 79.9%), serum cholesterol (118 ± 45 vs. 96 ± 32), serum glucose (178 ± 102 vs. 145 ± 79) and serum albumin (2.7 ± 0.76 vs. 2.4 ± 0.5) ($p < 0.001$). On day 2 of admission, there are only differences ($p < 0.05$) in the use of vasoactive drugs (52.6 vs. 67.1%), leucocytes (13,135 ± 5,786 vs. 16,297 ± 15,366) and serum albumin (2.6 ± 0.7 vs. 2.3 ± 0.5). On transfer to hospital wards, no difference exists in mortality rates (40 vs. 43.7%).

**CONCLUSIONS.** Septic patients with multiple organ dysfunction present with higher APACHE* IV and SOFA** scores and there is a greater use of vasoactive drugs; they present with lower levels of cholesterol, glucose and serum albumin. There is no difference in mortality or in analytical data related to inflammation.

*APACHE= Acute Physiology and Chronic Health Evaluation **SOFA= Sepsis-related Organ Failure Assessment**MOF=Multi Organ Failure

### 0893

**PATTERNS OF MULTIPLE ORGAN DYSFUNCTION IN THE FIRST 24HRS OF ADMISSION TO POLYVALENT INTENSIVE CARE UNITS AND MORTALITY RATES**

V.A. Hortigüela Martín[1], M. Sánchez Casado[1], C. Marco Shulke[1], S. Rodríguez Villar[1], M. Quintana Díaz[2], H. Cabezas Martín[1]

[1]Virgen de la Salud Hospital, Intensive Care Unit, Toledo, Spain, [2]La Paz University Hospital, Intensive Care Unit, Madrid, Spain

**OBJECTIVES.** To study what patterns of multiple organ dysfunction occur in the first 24 h of admission to ICU.

**METHODS.** Retrospective study. SOFA* score was used to evaluate multiple organ dysfunction, with its 6 components: cardiovascular (CARD), respiratory (RESP), neurological (NEU), hepatic (HEP), coagulation (COAG) and renal (REN). All patients with failure of two or more organs, admitted to ICU in 2008 and 2009 were included. Excluded: neurocritical and politrauma patients.

**RESULTS.** 390 patients were included. General admissions data: 61% male; age 63.5 ± 16.8 years; APACHE** II 18.9 ± 8.1; APACHE** IV 63 ± 24.5. Total SOFA* 7.98 ± 3.4, with an average of 8. Failure of 2 organs in 26.5%, 3 organs in 32%, 4 organs in 26.5%, 5 organs in 11.9% and 6 organs in 3.2%; respective mortality rates were 24.2, 38, 49, 60 and 91.7% ($p < 0.05$). Changes in different components of the SOFA* score: 83.9% had altered CARD, 87.9% RESP, 37.3% COAG, 54.4% REN, 43.4% NEU, and 27.3% HEP. Where there was dysfunction of 2 organs, the most common combinations were: CARD-RESP (40%), RESP-NEU (16%), RESP-REN (13%), CARD-REN (7%) and CARD-COAG (5%); respective mortality rates were: 35, 18.8, 23.1, 28.6 and 0% ($p < 0.05$). Where there was dysfunction of 3 organs, the most common combinations were CARD-RESP-NEU (26.4%), CARD-RESP-REN (24%), CARD-RESP-COAG (11.6%), CARD-RESP-HEP (11.6%) and CARD-COAG-REN (7.4%); respective mortality rates were: 46.9, 48.3, 21.4, 50 and 11.1% ($p < 0.05$). Where there was dysfunction of 4 organs, the most common combinations were: CARD-RESP-REN-NEU (35%), CARD-RESP-COAG-REN (27%), CARD-RESP-COAG-HEP (11%), CARD-RESP-REN-HEP (7%) Y CARD-RESP-COAG-NEU (5%); respective mortality rates were: 62.9, 37, 45.5, 28.6 and 80% ($p < 0.05$). Where there was dysfunction of 5 organs, the most common combinations were: CARD-RESP-REN-NEU-HEP (35.6%), CARD-RESP-COAG-REN-HEP (31.1%), CARD-RESP-COAG-REN-NEU (20%), and CARD-RESP-COAG-NEU-HEP (11.1%); respective mortality rates were: 75, 50, 66.7 and 20% ($p < 0.05$). Overall, the most common patterns were: CARD-RESP (10.6%), CARD-RESP-REN-NEU (9.3%), CARD-RESP-NEU (8.5%), CARD-RESP-REN (7.7%) and CARD-RES-COAG-REN (7.1%).

* SOFA= Sepsis-related Organ Failure Assessment
**APACHE = Acute Physiology and Chronic Health Evaluation

**CONCLUSIONS.** The most common altered component of the SOFA* score is the respiratory, followed by the cardiovascular component. The greater number of organs affected, the higher the mortality rate, although many exceptions to this do occur as determined by the different patterns in which the dysfunction presents itself.

## 0894

### INTRAABDOMINAL HYPERTENSION IN SEVERE SEPSIS PATIENTS

Z. Drvar[1]

[1]Clinical Hospital Centre Zagreb, Anesthesiology, Reanimatology and IC, Zagreb, Croatia

**INTRODUCTION.** Intraabdominal hypertension (IAH) in severe sepsis patients with consequent splanchnic hypoperfusion and multiple organ failure is associated with increased lactate levels in arterial blood. IAH is defined by sustained or repeated elevation of intraabdominal pressure (IAP) for >12 mmHg. Abdominal compartment syndrome (ACS) is defined as a sustained IAP >20 mmHg that is associated with a new organ dysfunction.

**OBJECTIVES.** We are presenting results of 1 year duration of prospective, nonrandomized, control trial conducted in Department of anaesthesiology, reanimatology and intensive care at Zagreb University Hospital Center.

**METHODS.** Thirty-eight patients undergoing great abdominal surgery with clinical and laboratory confirmed severe sepsis (severe sepsis patients group), control group included 38 patients undergoing elective abdominal surgery with at least two risk factors for IAH. Patient groups included patients of different age and sex. APACHE II SCORE was 19.3 ± 1.5.Circulatory instable patients had vasoactive pharmacology support as well as SOFA score.Patients in both groups had PiCCO hemodynamic monitoring. IAP was assed in both groups of patients every 6 h in first 72 h, through Foly catheter placed in urinary bladder. IAH was diagnosed with 2 consecutive measurements of IAP >12 mmHg.At the same time lactate levels in arterial blood, $SvO_2$ and CVP were assessed.

**RESULTS.** In sepsis group 25 patients (65.8%) had IAP >12 mmHg, 10 patients (26.3%) IAP > 16 mmHg and 3 patients (7.9%) IAP >20 mmHg. In control group all patients had IAP up to 7 mm Hg. Lactate levels in arterial blood were significantly increased in severe sepsis patients with IAP > 16 mmHg (4.2 vs. 1.2 mmol/L, $P < 0.05$) compared to control group.Mortality in severe sepsis patients with IAH was 36.8% (14 patients).

**CONCLUSIONS.** Continuous IAP monitoring in severe sepsis patients is important for early detection of splachnicus hypoperfusion and consequent multiorgan failure as well as for timely application of efficacious therapeutic procedures. Lactate levels in arterial blood were significantly higher in severe sepsis patients with IAH >16 mmHg compared to control group patients without IAH. However it is late indicator of irreversible systemic hypoxia.

**REFERENCE(S).** 1. Cheatham M, Malbrain M, Kirkpatrick A et al. Results from the international conference of experts on intra-abdominal hypertension and abdominal compartment syndrome. Intensive Care Med. 2007;33:951–62.

2. Regueira T, Hasbun P, Rebolledo R, Galindo R, Galindo J, Aguirre M, Romero C, Castillo L, Bugedo G, Hernandez G. Intraabdominal Hypertension in patients with septic shock. Am Surg. 2007;73:865–70.
3. Hunter J, Damani Z. Intra-abdominal hypertension and the abdominal compartment syndrome. Anaesthesia. 2004;59:899–907.

## 0895

### SOURCE CONTROL STRATEGIES IN PATIENTS WITH SEVERE SEPSIS AND SEPTIC SHOCK

M.L. Martinez[1], R. Ferrer[1], A. Navas[1], G. Goma[1], G. Gili[1], A. Artigas[1]

[1]Hospital de Sabadell. CIBER-ER. Fundació Parc Taulí. University of Barcelona, Critical Care Center, Barcelona, Spain

**INTRODUCTION.** The management of patients with severe sepsis and septic shock includes early antibiotic therapy, adequate resuscitation, specific treatment of sepsis, and source control.

**OBJECTIVE.** The objective of the study is to evaluate the source control incidence and techniques that are used for this in patients with severe sepsis and septic shock, as well as their implication on the global management of these patients.

**METHODS.** Prospective, observational study in a medical-surgical ICU. All adult patients admitted to the ICU between years 2006–2009 with severe sepsis and septic shock were consecutively included. Epidemiologic and treatment data using sepsis bundles, frequency of source control and techniques used for this were collected. The incidente of source control in these patients was studied using ×2 and Student's t test. The results were expresed as percentages, medians and standard deviations.

**RESULTS.** 334 patients with severe sepsis and septic shock were included (age 67 ± 15 years, men 65%, septic shock 90%, initial lactate 44 ± 29 mg/dl, APACHE 19 ± 8). A total of 48% of these patients required source control and the techniques more frequently employed were: laparotomy 45%, nephrostomy 14%, debridement of soft-tissue 11%, biliar percutaneous drainage 9%, chest tube 6%. 18% of patients with source control needed a rescue procedure, specially laparotomy and debridement of soft-tissue. Comparing patients that required source control with patients that did not require source control we found the following differences: they were mainly women (44 vs. 26%; p = 0.001) with abdominal (64 vs. 7%; p = 0.001) and soft-tissue (8 vs. 2%; p = 0.001) sepsis and were less compliant with the resuscitation bundle: early antibiotic therapy (38 vs. 54%; p = 0.005), initial fluid resuscitation (70 vs. 79%; p = 0.079) and to achieve correct $SvcO_2$ (11 vs. 20%; p = 0.043). No difference was observed in mortality (33 vs. 31; p = 0.84), in ICU lenght of stay (12 ± 14 vs. 12 ± 12 days; p = 0.708) and hospital lenght of stay (28 ± 29 vs. 28 ± 38 days; p = 0.84).

**CONCLUSION.** Half of patients with severe sepsis and septic shock required source control and usually a rescue procedure. These patients needed special attention due to frequently exists a delay on administration of antibiotics and in hemodynamic resuscitation.

## 0896

### HLA-DRB POLYMORPHISM IS ASSOCIATED WITH SEVERITY OF ACUTE KIDNEY INJURY IN SEVERE SEPSIS AND SEPTIC SHOCK

A.-C. Lukaszewicz[1,2], M. Legrand[1,2], E. Gayat[1,3], P. Loiseau[4,5], V. Faivre[2], B. Megarbane[2,6], E. Azoulay[2,7], F. Fieux[8], M. Busson[4,5], D. Charron[4,5], D. Payen[1,2]

[1]Hopital Lariboisiere, APHP, Département Anesthésie Réanimation SMUR, Paris, France, [2]Paris 7 Diderot Université, EA 3509, Paris, France, [3]Hôpital Saint Louis, APHP, Biostatistiques et Informatique Médicale, Paris, France, [4]Hôpital Saint Louis, APHP, Immunologie et Histocompatibilité, Paris, France, [5]INSERM, UMR 940, Paris, France, [6]Hôpital Lariboisière, APHP, Réanimation Médicale, Paris, France, [7]Hôpital Saint Louis, APHP, Réanimation Médicale, Paris, France, [8]Hôpital Saint Louis, Département Anesthésie Réanimation, Paris, France

**INTRODUCTION.** Severe sepsis is a leading cause of acute kidney injury (AKI) in ICU patients. The role of hypoperfusion and "immunotoxicity" from systemic inflammation remains under debate in its pathophysiology.

**OBJECTIVES.** To study the association between HLA-DR genotype as a key molecule of the immune response and the severity of acute kidney injury in sepsis.

**METHODS.** Prospective multicentre study (4 centres, ethical agreement Hôpital Cochin#2061), patients were included with severe sepsis or septic shock, with at least 2 organ failure (SOFA scoring) for less than 24 h. Patients with chronic renal insufficiency were excluded. Early AKI was diagnosed on SOFA scale for kidney within the first 48 h: with mild AKI= $SOFA_{kidney}$ 1–2 (creatinine 110–299 µmol/l) and severe AKI $SOFA_{kidney}$ 3–4 (creat >300 µmol/l or renal replacement therapy (RRT)). Genotyping of 13 DRB1 alleles in blood leukocytes with Polymerase Chain Reaction-Sequence Specific Primers. DRB1 gene is constitutively present on each chromosome 6, both encoding the $\beta$ chain of HLA-DR molecule. Presence of an associate second gene (DRB3, DRB4 or DRB5) on each chromosome 6 was deducted from their known association with DRB1 alleles (linkage desequilibrium). Results were expressed in median [25$^{th}$–75th percentiles], non parametric tests, $p < 0.05$ was significant.

**RESULTS.** 200 patients were included. Two patients with brain death without relation to sepsis and 23 patients who died during the first 48 h were excluded from the analysis. Genotyping failed for 5 patients. Final analysis was performed on the lasting 170 patients with the following characteristics: age 63 [51–73] years, 23% had a surgical sepsis and 57% a pneumonia, 80% were in shock, the score SOFA was 8 [6–11] and the SAPS II score 46 [34–56]. 35 patients did not present AKI, 66 had a mild AKI and 69 a severe AKI, including 40 requiring RRT. The SOFA score was 11 [9–14] in the group with severe AKI, 7 [6–9] with mild and 6 [4–7] with no AKI ($p < 0.0001$). At day 0, the 133 patients (78%) with 4 DRB alleles presented a lower SOFA (7 [5–10]) compared to patients with 2 or 3 alleles (8 [6–14], p=0.01). 66% of the patients with 2–3 alleles had severe AKI versus 47% of patients with 4 alleles (p=0.06). RRT was needed in 52% of patients with 2–3 alleles versus 24% of patients with 4 alleles (p=0.004).

**CONCLUSIONS.** We found an association between HLA-DRB polymorphism and severe AKI suggesting that systemic inflammation promotes the development of sepsis-related AKI.

**GRANT ACKNOWLEDGMENT.** PHRC AP-HP AOR02006

## 0897

### OUTCOME AND PROGNOSTIC FACTORS IN PATIENTS WITH SEVERE SEPSIS AND SEPTIC SHOCK IN THE GENERAL WARD

Y. Chang[1], S. Choi[2], J.S. Son[2], W.Y. Kim[1], Y. Koh[1], C.-M. Lim[1], J.W. Huh[1], S.-B. Hong[1]

[1]Asan Medical Center, University of Ulsan College of Medicine, Department of Pulmonary and Critical Care Medicine, Seoul, Korea, Republic of, [2]Asan Medical Center, University of Ulsan College of Medicine, Medical Emergency Team, Seoul, Republic of Korea

**INTRODUCTION.** Early goal-directed therapy (EGDT) has been reported to reduce mortality when it was applied in the emergency department before admission to the intensive care unit (ICU). However, the management of severe sepsis and septic shock in the general ward (GW) is not well defined.

**OBJECTIVES.** The purpose of this study was to evaluate the outcome and prognostic factors in the patients with severe sepsis and septic shock managed in the GW with the transfer to the ICU withheld.

**METHODS.** We retrospectively identified total 305 patients with severe sepsis and septic shock contacted to the medical emergency team (MET) from a single tertiary referral center with 28-bed medical intensive care unit between March 2008 and February 2010.

**RESULTS.** Among the 305 enrolled patients, 79 were severe sepsis and 226 were septic shock. Of the 79 patients with severe sepsis, 47 remained in the GW and 32 were transferred to the ICU. Of the 226 with septic shock, 77 in the GW and 149 to the ICU. The patients in the GW had a significantly lower respiratory rate (23 ± 6 vs. 25 ± 7, p=0.021), mean APACHE II (18.0 ± 7.0 vs. 25.3 ± 9.0, $p < 0.001$) and SOFA score (7.1 ± 3.4 vs. 10.3 ± 3.7, $p < 0.001$) than the patients to the ICU. 28-Day mortality was 19.4 percent in the GW, as compared with 33.1 percent in the ICU (p=0.008).

**CONCLUSIONS.** 59 percent of the patients with severe sepsis and 34 percent with septic shock were managed by MET according to EGDT in the general ward without transferred to the ICU.

**REFERENCE(S).** 1. Rivers E, Nguyen B, Havstad S et al. Early Goal-Directed Therapy Collaborative Group. Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Engl J Med. 2001;345(19):1368–77.

2. Lundberg JS, Perl TM, Wiblin T et al. Septic shock: an analysis of outcomes for patients with onset on hospital wards versus intensive care units. Crit Care Med 1998;26:1020–4.
3. Esteban A, Frutos-Vivar F, Ferguson ND, Peñuelas O, Lorente JA, Gordo F, Honrubia T, Algora A, Bustos A, García G, Diaz-Regañón IR, de Luna RR. Sepsis incidence and outcome: contrasting the intensive care unit with the hospital ward. Crit Care Med. 2007;35:1284–9.

## 0898

### EPIDEMIOLOGY OF SEVERE SEPSIS AND SEPTIC SHOCK IN INTENSIVE CARE UNITS. RESULTS OF A PROSPECTIVE, NATIONWIDE STUDY DURING ONE YEAR

E. Vesteinsdottir[1], S. Karason[1], S.E. Sigurdsson[2], M. Gottfredsson[3], G.H. Sigurdsson[1]

[1]Landspitali University Hospital, Department of Anaesthesia and Intensive Care, Reykjavik, Iceland, [2]Akureyri Hospital, Department of Anaesthesia and Intensive Care, Akureyri, Iceland, [3]Landspitali University Hospital, Department of Infectious Disease, Reykjavik, Iceland

**INTRODUCTION.** Recent, prospective, epidemiological studies on severe sepsis and septic shock have been based on sub-populations rather than nationwide populations, which carries the possibility of error. Furthermore, they have been conducted during a small part of a year and thus allowing bias due to seasonal variations of sepsis.

**OBJECTIVES.** The aim of our study was to describe epidemiology of sepsis in a whole country population during a whole year.

**METHODS.** This was a prospective, observational study of all adult patients admitted to Icelandic ICUs, who were screened for the ACCP/SCCM criteria for severe sepsis or septic shock at admission. Data were collected from April 1st 2008 to March 31st 2009.

**RESULTS.** A total of 1,425 patients were admitted to the ICUs, 115 of them were admitted because of severe sepsis or septic shock. The incidence in Iceland is 0.48/1000 inhabitants. The mean age was 65.4 years and males were 53%. The mean APACHE II score was 20.7, SAPS II: 44.1 and SOFA: 8.7. 28-day mortality was 25%, 90-day: 29% and 1-year mortality was 40%. The main sources of sepsis were: pulmonary (37%), abdomen (28%) and urinary tract (8%). Infections were microbiologically documented in 70% of cases and 39% of patients had positive blood cultures. Pathogens were gram-positive (39%), gram-negative (30%) and mixed (28%). Multi-resistant pathogens were found in 9%. No patient had sepsis caused by MRSA or fungi. Empirical initial antibiotic therapy was deemed inadequate in 21% of cases.

**CONCLUSIONS.** The incidence of severe sepsis and septic shock in Icelandic ICUs is approximately 0.5 per 1000 inhabitants, which is similar to other recent epidemiological studies. Mortality rates are in the lower range of reported. The types of pathogens are consistent with current trends, with the exception of sepsis caused by MRSA and fungi, which are rare in Iceland.

## 0899

### THE PROGNOSTIC VALUE OF TRANSFECTION IN PATIENT WITH SEVERE ABDOMINAL SEPSIS MANAGED WITH LAPAROSTOMY. A PROSPECTIVE CLINICAL STUDY

N. Michalopoulos[1], I. Pliakos[2], T. Papavramidis[2], I. Soultati[3], G. Paroutsidou[3], E. Thomaidou[3], O. Vasilaki[4], S. Papavramidis[2]

[1]Aristotele University, 3rd Department of Surgery, Thessaloniki, Greece, [2]Aristotele University, 3rd Department of Surgery, AHEPA Hospital, Thessaloniki, Greece, [3]Aristotele University, Anesthesiology Department, AHEPA Hospital, Thessaloniki, Greece, [4]Aristotele University, Microbiology Department, AHEPA Hospital, Thessaloniki, Greece

**INTRODUCTION.** Laparostomy is an effective method to manage initially patients with severe abdominal sepsis. The age and the primary cause of sepsis have been evaluated as prognostic factors for these patients outcome.

**OBJECTIVES.** The aim of this study is to evaluate the primary microbial factor and the super-infection of peritoneal cavity in order to assess the correlation with morbidity and mortality in patients with severe peritonitis.

**METHODS.** From January 2007 until Mars 2010, 35 patients (21 male, 14 female with mean age 59.45 years, range from 22 to 87 years) managed initially with laparostomy for severe peritonitis. In all patients have been used the Vacuum Assisted Closure technique (VAC) for cover the open abdomen. Sepsis evaluation made preoperatively with Manheim peritonitis score and SOFA score. Exclusion criteria from the study was the use of other temporary technique to close laparostomy, Manheim peritonitis score preoperatively $< 29$ and death before the first dressing change of VAC. VAC dressing changes and transvaluation of abdominal sepsis was made every 2–4 days in operation theater. In every change we evaluated SOFA score and took peritoneal fluid and blood samples for culture. We evaluated the influence of the positive primary culture and the transfection of peritoneal cavity of patients with severe sepsis in mortality, in intensive care unit hospitalization, in complications and in the definitive closure of abdomen.

**RESULTS.** The primary causes of abdominal sepsis were: purulent peritonitis 37.2%, fecal peritonitis 20%, secondary peritonitis 22.9%, necrotizing pancreatitis 11.5% and necrotizing fasciitis 8.4%. The overall mortality was 48.6%. Positive primary culture had no influence in patients' outcome. The patients with peritoneal super-infection had prolonged ICU hospitalization (p: 0.001), delayed definitive open abdomen closure (p: 0.01) and significant increasing mortality rate 60% (p: 0.02).

**CONCLUSIONS.** Transfection of peritoneal cavity in patients with severe abdominal sepsis and laparostomy delay the final abdomen closure and increase patients' morbidity and mortality.

## 0900

### GENDER DIFFERENCES IN INFLAMMATORY BIOMARKERS DURING HUMAN ENDOTOXEMIA

E. Rengers[1], L.T. van Eijk[1], M.J. Dorresteijn[1], T. Sprong[2], J.G. van der Hoeven[1], P. Pickkers[1]

[1]Radboud University Nijmegen Medical Centre, Intensive Care, Nijmegen, Netherlands, [2]Radboud University Nijmegen Medical Centre, Internal Medicine, Nijmegen, Netherlands

**INTRODUCTION.** Since mortality of sepsis increases with the progression of the disease and early detection improves clinical course and outcome, early recognition of sepsis is of major importance [1]. Hence, there is a need for sensitive and specific diagnostic markers to identify sepsis quickly and accurately. In the recent years various new inflammatory markers have emerged, including lipopolysaccharide-binding protein (LBP), the long pentraxin (PTX3) and procalcitonin (PCT). Although early reports of the use of these biomarkers seem promising, relatively little is known about the kinetics of these hormones, especially with regard to possible differences between sexes. Females have been reported to show a more pronounced pro-inflammatory innate immune response. Although the gender differences in the inflammatory response are clearly recognized, there are no data on the possible differences in kinetics of the previously mentioned later markers of inflammation LBP, PTX3 and PCT.

**OBJECTIVES.** To determine the kinetics and possible gender differences in LBP, PTX3 and PCT during human endotoxemia.

**METHODS.** Thirteen male and 13 female subjects were admitted for 24 h to the intensive care unit of the Radboud University Medical Centre, the Netherlands. At t=0 h a single dose of 2 ng/kg U.S. standard reference *E. coli* O:113 lipopolysaccharide (LPS) was infused intravenously. Besides several cytokines LBP, PCT, PTX3 were measured at regular time intervals.

**RESULTS.** The administration of LPS resulted in a marked immune response as represented by clinical signs, hemodynamic changes and cytokine response. There was a large gender difference in all investigated biomarkers. LBP rose to $21.4 \pm 1.8$ and $32.9 \pm 4.2$ at t=24 h for males and females respectively. PCT levels were $8.4 \pm 1.0$ and $6.8 \pm 1.0$ respectively at t=24, and PTX levels were $5.1 \pm 0.6$ and $18.2 \pm 10.1$ at t=24 in males and females respectively.

**CONCLUSIONS.** There is a clear gender difference in the response of biomarkers LBP, PCT and PTX3 during inflammation. This is relavant to the implementation of these markers in the diagnostic proces of systemically inflamed patients.

**REFERENCE(S).** 1. Kumar A, Roberts D, Wood KE et al. Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. Crit Care Med. 2006;34:1589–96.

# Sepsis: Procalcitonin and routine biomarkers: 0901–0914

## 0901

### SALIVARY CORTISOL CAN REPLACE FREE SERUM CORTISOL MEASUREMENTS IN SEPTIC SHOCK

R.M. Estrada-Y-Martin[1], P.R. Orlander[1]

[1]The University of Texas-Health Science Center at Houston, Medicine, Divisions Critical Care, Pulmonary and Sleep Medicine, Houston, USA

**INTRODUCTION.** The balance between inflammation and anti-inflammation is essential for survival during severe infections. There is renew interest in adrenal function during sepsis. Most of serum cortisol is bound to cortisol binding globulin and albumin. However, only the free serum cortisol is active. The method to measure free serum cortisol is technically demanding and poorly reproducible.

**OBJECTIVES.** Correlation between salivary cortisol and free serum cortisol in patients with septic shock. Correlation between free serum cortisol and total serum cortisol in patients with septic shock.

**METHODS.** Simple correlation were use to calculate the sample size. First, between free serum cortisol to total serum cortisol of 0.55 and second, between free serum cortisol and salivary cortisol of 0.80 using two-sided Z test with a significance level of 0.05 and achieving 0.81 power. A sample size of 37 was determined. Only adult patients with septic shock as per ATS/ESICM criteria were included. Saliva and blood were collected simultaneously from 8 to 10 AM as per protocol. Patients with nasal or oral bleeding were excluded. The samples were storage and sent in batches to the reference laboratory. Salivary cortisol was measure by enzyme immunoassay. Cortisol binding globulin by radio-immunoassay. Total serum cortisol by LC–MS liquid chromatography. Free serum cortisol by equilibrium analysis.

**RESULTS.** 38 patients were included in the first correlation, salivary cortisol to free serum cortisol and 57 patients in the second correlation, free serum cortisol to total serum cortisol. There were less patients in the salivary group due to factors such as contamination with blood or not enough saliva to analyzed. The correlation for salivary cortisol to free serum cortisol was 0.79, 95% CI 0.63–0.089, $p < 0.0001$ with a regression equation for free serum cortisol = 0.8889 + 0.4481 * salivary cortisol.The correlation for free serum cortisol to total serum cortisol was 0.86, 95% CI 0.78–0.92, $p < 0.0001$. The regression equation for free serum cortisol was = (-1.2346) + (0.1628) * total serum cortisol.

**CONCLUSIONS.** Salivary cortisol may replace serum cortisol for the determination of free serum cortisol in the majority of patients with septic shock. Salivary cortisol is less labor intensive and can be performed daily in septic shock patients. Salivary cortisol correlates better with free serum cortisol when the level of serum cortisol is lower, which may have therapeutic relevance.

**REFERENCE(S).** Annane D et al. Effect of treatment with low doses of hydrocortisone and fludrocostisone on mortality in patients with septic shock. JAMA. 2002;288:862–71

Sprung CL et al. Hydrocortisone therapy for patients with septic shock. NEJM 2008;358:111–24

Gozansky WS et al. Salivary cortisol determined by enzyme immunoassay is preferable to serum total cortisol for assessment of dynamic hypothalamic–pituitary–adrenal axis activity. Clin End. 2005;63:336–41

**GRANT ACKNOWLEDGMENT.** NIH MO1-RR 02558.

## 0902

### PROGNOSTIC VALUE OF ENDOTOXIN ACTIVITY ASSAY (EAA) IN COMPLEX INTENSIVE CARE FOR SEPSIS AND SEPTIC SHOCK IN PATIENTS AFTER CARDIAC SURGERY

M. Yaroustovsky[1], M. Abramian[1], Z. Popok[1], M. Plusch[1], E. Nazarova[1], O. Stupchenko[1]

[1]Center for Cardiovascular Surgery, Moscow, Russian Federation

**INTRODUCTION.** Infective and septic complications are serious problems of intensive care. According to the data of several randomized trials (EPISEPSIS, SOAP, Finnsepsis, EPIC II) there is a significant increase in the frequency of sepsis, as well as of hospital mortality (up to 70%). A crucial role in the pathogenesis of sepsis is playing by the lipopolysaccharide of gram-negative bacteria (endotoxin).

**OBJECTIVES AND METHODS.** In 2008-2009, 29 patients with assumed infective and septic complications after cardiac surgery were evaluated during the randomized HAEMOSEPSIS trial led in Bakoulev Scientific Center for Cardiovascular Surgery.All patients had SIRS, bacteriologically proven gram-negative infection, unstable hemodynamics requiring inotropic support (epinephrine 0.1–0.15 mcg/kg/min, norepinephrine 0.05–0.07 mcg/kg/min), SOFA score corresponded to 12–18 and APACHE II score was from 21 to 38. Complex intensive care was carried out in accordance with *Surviving Sepsis Campaign Guideline*. Selective Polymyxin-B hemoperfusion using Toraymyxin—PMX-F (Toray, Japan) cartridges was used in 62% of patients.A new technique for the determination of endotoxin activity (*Endotoxin Activity Assay—EAA Spectral Diagnostics*, Canada) was introduced for the diagnostics of endotoxemia and the evaluation of hemoperfusion effectiveness.

**RESULTS.** Low EAA level (<0.4; 0.31 ± 0.04) was revealed in 2 out of 29 patients (6.9%); moderate EAA level (0.4 to 0.59; 0.52 ± 0.07)—in 8 patients (27.6%), while 19 patients (65.5%) had EAA over 0.6 (0.73 ± 0.09). No lethal outcomes were seen among patients with low EAA level, in the group of patients with moderate EAA 28-days mortality was 50%, and in the group with high EAA—73.7%. Besides, this index allowed for the determination of the effectiveness of selective hemoperfusion using Polymyxin B cartridges.

**CONCLUSIONS.** the values of EAA can be used as a marker for the evaluation of the severity of state of patients, as an index for the prediction of the outcome of infective and septic process, as well as for the evaluation of the effectiveness of complex intensive care.

**REFERENCE(S).** None

## 0903

### THE ROLE OF INTERLEUKIN 6 IN INNATE IMMUNE RESPONSE AND SURVIVAL DURING SEPTIC SHOCK IN CRITICALLY ILL ADULTS

R. Fuchs[1], S. Noel[2], A. Navas-Acien[2], R. Thimmulappa[2], S. Biswal[2]

[1]Johns Hopkins University School of Medicine, Anesthesiology and Critical Care Medicine, Baltimore, USA, [2]Johns Hopkins Bloomberg School of Public Health, Environmental Health Sciences, Baltimore, USA

**INTRODUCTION.** Sepsis is characterized by an inappropriate host immune-inflammatory response. Murine model studies have demonstrated a critical role of interleukin 6 (IL-6) in improving survival during sepsis.

**OBJECTIVES.** We hypothesize that gene expression of IL-6 is protective and could be correlated with an improved survival outcome in patients with septic shock. Peripheral blood mononuclear cells (PBMC) from adult patients in the intensive care unit (ICU) who are in septic shock were isolated in order to measure IL-6 gene expression. We aimed to determine the association of IL-6 gene expression with hospital mortality, days of vasopressor support, and ventilator days in the ICU.

**METHODS. DESIGN.** Prospective cohort study.
**SETTING.** Adult patients with septic shock in the medical and surgical ICU at a tertiary care center.
**Sample:** Subjects were screened into the cohort study within 24 h of diagnosis. Forty-eight patients with septic shock were enrolled between January and June 2008. Adults greater than 18 years of age were eligible.
**Exposure Measure:** Patients were divided into low IL-6 level (n=27) and high IL-6 level (n=21) groups based on the median IL-6 gene expression level. IL-6 was measured in PBMC by reverse transcription polymerase chain reaction (RT–PCR).
**Outcome Measures:** The primary outcome measure was hospital mortality. Secondary outcome measures included ventilator days and days of vasopressor support.
**Statistics:** To assess the prospective association of IL-6 expression levels with mortality, we used Kaplan–Meier survival curves and Cox proportional hazard models.

**RESULTS.** 29.6% (8/27) deaths in the low IL-6 level group and 61.9% (13/21) deaths in the high IL-6 level group were identified. Survival curves comparing subjects with low versus high IL-6 gene expression levels were statistically significant different (Wilcoxon rank sum test P=0.01). The unadjusted hazard ratio for IL-6 level above versus below the median was statistically significant different (HR = 3.6; 95% C.I. 1.4, 9.7). After adjustment for body mass index (BMI), smoking and severity of illness (Apache 2 score) the HR for mortality in patients in the higher IL-6 mRNA group was 1.9 (95% CI 0.6, 5.9) and it was not statistically significant. For every increase in one unit of either BMI or Apache score there was a 7% increased risk of dying keeping all other variables the same. Ventilator days and days of vasopressor support were not statistically different between the low and high IL-6 mRNA groups.

**CONCLUSIONS.** The survival analysis of the preliminary findings shows that higher IL-6 mRNA expression at enrollment is associated with higher hospital mortality in unadjusted analysis. In analysis adjusted for BMI and Apache score the results are uncertain. Additional analysis with larger statistical power and including stratification by BMI and Apache are needed once more patients have been enrolled.

**GRANT ACKNOWLEDGMENT.** International Anesthesia Research Society.

## 0904

### PROGNOSTIC VALUE OF ROUTINELY ASSESSED SERUM BIOMARKERS IN SEVERE SEPSIS AND SEPTIC SHOCK

S. Salma[1], D. Raymond[1], P.V. Louis[1]

[1]Medical Trust Hospital, Critical Care Medicine, Kochi, India

**INTRODUCTION.** More than 100 biomarkers have been claimed useful in sepsis, however results from trials are varied and inconclusive. Whether any of them will prove a valid surrogate outcome measure is not known [1]

**OBJECTIVES.** To assess the usefulness of routinely measured biomarkers namely CRP, NT pro BNP, serum lactate, albumin and total cholesterol in outcome prediction in severe sepsis and septic shock

**METHODS.** This was a prospective observational study on 100 consecutive adult patients admitted with a diagnosis of severe sepsis/septic shock (ACCP/SCCM definition) to the medical ICU of a tertiary Indian teaching hospital between September 2009 and March 2010. On admission, data pertaining to baseline characteristics including admitting APACHE II & SOFA scores were documented and serum levels of CRP, NT pro BNP, lactate, albumin and total cholesterol were measured using standard assays. Serial SOFA scores were calculated during ICU stay. Patients were followed up to evaluate the primary and secondary outcomes, namely mortality and 1. new organ failure 2. ICU length of stay (LOS), 3. ICU free days, 4. MV days and 5. MV free days respectively. All patients were treated along lines of the ICU's SOP

**RESULTS.** The mean age of the study group was 57.5 ± 17.2 years with 67% men and 33% women. The admitting APACHE II & SOFA scores were 28.1 ± 11.1 and 10 ± 3.7 respectively. Respiratory infections (30%), Leptospirosis (23%) and UTI (18%) were the major admitting diagnosis followed by others. Overall mortality was 62% (SMR 1.1). Values of biomarkers and their correlation with primary outcome is summarized in Table 1. High admitting values of NT pro BNP, serum lactate and low serum albumin were associated with a statistically significant increase in the risk of death ($p < 0.05$). The secondary outcomes analysed were ICU LOS (8.2 ± 9.3 days), ICU free days (8.6 ± 7.1), MV days (6.9 ± 7.7), MV free days (9.1 ± 9.2) and serial SOFA scores. With respect to the secondary outcomes, only elevated serum lactate levels showed a significant correlation with prolonged ICU and hospital LOS and MV days. New organ failure was identified in 37% of patients while in 30% there was only one value for SOFA score (day 0). In 29% of patients there was an improvement in SOFA score and no change in 4%. High levels of NT pro BNP and serum lactate, and low admitting serum cholesterol were significant risk factors for additional/new organ failures ($p < 0.05$).

**CONCLUSIONS.** While some biomarkers do have a prognostic role, the significance of one isolated value is dubious. Their incorporation into a formal scoring system might prove more meaningful.

SERUM BIOMARKERS; SUMMARY OF FINDINGS

| Biomarker | Admitting value (mean ± SD) | Area under ROC | 95% Confidence interval | Standard error | Sensitivity | Specificity | Likelihood ratio (positive test) | Likelihood ratio (negative test) |
|---|---|---|---|---|---|---|---|---|
| CRP | 377 ± 855 mg/L | 0.48 | 0.37–0.59 | 0.06 | 0.225 | 0.895 | 2.14 | 0.87 |
| NT pro BNP | 17,123 ± 14,084 pg/ml | 0.74 | 0.64–0.84 | 0.05 | 0.903 | 0.578 | 2.14 | 0.17 |
| Serum Lactate | 4.7 ± 3.24 mmol/L | 0.77 | 0.69–0.86 | 0.04 | 0.613 | 0.842 | 3.88 | 0.46 |
| Serum Albumin | 2.7 ± 0.6 g/dl | 0.65 | 0.54–0.76 | 0.06 | 0.387 | 0.842 | 2.45 | 0.73 |
| Serum Total Cholesterol | 147.5 ± 44.9 mg/dl | 0.48 | 0.37–0.6 | 0.06 | 0.419 | 0.737 | 1.59 | 0.79 |

**REFERENCE.** Marshall J C: Biomarkers of Sepsis. Crit Care Med. 2009;37:2290–8

## 0905

### KINETICS OF INFLAMMATORY BIOMARKERS AND PROGNOSIS IN SEPTIC SHOCK

A.M. Japiassu[1,2], R.N. Gomes[3], E.F. Assis[3], R.C. Carnevale[3], P.T. Bozza[3], H.C. Castro-Faria-Neto[3], F.A. Bozza[1,4]

[1]Instituto de Pesquisa Clinica Evandro Chagas, Rio de Janeiro, Brazil, [2]Casa de Saúde São José, Rio de Janeiro, Brazil, [3]Instituto Oswaldo Cruz, Rio de Janeiro, Brazil, [4]Instituto de Ensino e Pesquisa D'Or, Rio de Janeiro, Brazil

**INTRODUCTION.** Many biomarkers were identified as elevated in patients with septic shock, and their performance vary depending on risk stratification of sepsis severity and/or prognosis. Kinetics of many biomarkers beyond the first day of severe sepsis diagnosis can be heterogeneous and there is a lack of identification of key biomarkers for risk stratification and prognosis of septic shock patients.

**OBJECTIVES.** To analyze the kinetics of several biomarkers on the first week of septic shock and to identify the best accuracy of these biomarkers for prediction of early and 28th day mortality.

**METHODS.** Sixty-seven septic shock patients were included from 3 ICUs. Clinical and laboratory data were collected on the 1st, 3rd, 5th and 7th days after septic shock diagnosis. Daily SOFA score was calculated. We performed a multiplex cytokine analysis, including a panel of 17 cytokines during the first week of septic shock: interleukin [IL] 1 beta, IL-2, IL-4, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12, IL-13, IL-17, interferon [IFN] gama, granulocyte colony-stimulating factor [G-CSF], granulocyte–macrophage colony-stimulating factor [GM-CSF], monocyte chemoattractant protein [MCP] 1, macrophage inflammatory protein-1 [MIP] beta, and tumour necrosis factor [TNF] alpha (Luminex, Bio-Rad, Hercules, CA, USA). We also measured the plasma cortisol and C reactive protein and Macrophage migration inhibitory factor (MIF) levels. The kinectics of all biomarkers were compared between survivors ans nonsurvivors groups. The accuracy of 1st day, maximum and median levels of cytokines, cortisol and SOFA score was plotted on ROC curves for prediction of early (3 days) and 28th day mortality.

**RESULTS.** Highly significant levels of cytokines persisted beyond the first day of septic shock. Four patterns of kinetics were established during the first 7 days of septic shock: exponential decay (ex. IL-6), Gaussian curve (ex. IL-10), increasing levels (ex. IL-8) and stable levels (ex. MIF). There was good correlation of organ dysfunction severity and MIF (r=0.41; p=0.002), IL-8 (r=0.38; p=0.004), and cortisol (r=0.37; p=0.005) levels. IL-8, IL-10, and MCP-1 showed good accuracy for prediction of early mortality (AUROC 0.84, 0.79 and 0.78, respectively). Maximal cortisol levels and day 1 MIF levels had the best accuracy for prediction of 28th day mortality (AUROC 0.81 and 0.73, respectively). Across all clinical scores and biomarkers, day 1 MIF levels > 3201 pg/ml, mean IL-6 > 206 pg/ml, and maximal cortisol level > 59 mcg/ml in the first week of septic shock were predictors of 28th day mortality in a multivariate analysis.

**CONCLUSIONS.** The kinetics of biomarkers during the 1st week of septic shock revealed different accuracy for prediction of early and 28th day mortality. Day 1 MIF, maximal cortisol and mean IL-6 levels showed the best performance for 28th survival.

**GRANT ACKNOWLEDGMENT.** CNPq, Faperj

## 0906

### DELTA-PROCALCITONIN AS SEVERE SEPSIS PROGNOSTIC BIOMARKER

J.C. Ruiz-Rodriguez[1], J. Caballero[1], E. Francisco[1], A. Ruiz[1], A. Salgado[2], J.L. Boveda[1], J. Rello[1]

[1]Vall d'Hebron Hospital, Critical Care Department, Barcelona, Spain, [2]Vall d'Hebron Research Institute, Barcelona, Spain

**INTRODUCTION.** Procalcitonin (PCT) has been reported as a specific biomarker of bacterial infectious processes. Normal levels of PCT are considered between 0.1 and 0.5 ng/ml. While in colonization or local infection PCT levels are lower than 2 ng/ml, concentrations above 3 ng/ml are associated with severe bacterial infections with sepsis. In septic shock and multiple organ dysfunction PCT levels are even higher.

**OBJECTIVES.** To analyse the prognostic value of PCT and PCT clearance (delta-PCT) in the course of severe sepsis with organ dysfunction.

**METHODS.** Prospective study of adults patients with severe sepsis and organ dysfunction admitted to a University Hospital Intensive Care Unit (ICU). The study was authorized by the Ethical and Clinical Investigation Committee of our hospital. Serial PCT determinations were made at ICU admission and subsequently at 12, 24, 48 and 72 h and 7 days. In order to value the PCT clearance we defined delta-PCT as the difference between the levels of PCT at admission and at 24, 48 and 72 h (delta-PCT 24 h, 48 h and 72 h respectively). Lumitest ® PCT (Brahms Diagnostica GMBH, Berlin, Germany) was used as biochemical method. Continuous variables with normal distribution (age, APACHE II) were expressed as mean (±standard deviation) while these with not normal distribution (PCT) were expressed as median (interquartil rank, 25/75). U de Mann–Whitney was used for mean comparations. SPSS v18 was used for statistic analysis. A p value $< 0.05$ was considered statistically significant.

**RESULTS.** 27 consecutive adults patients with severe sepsis as ICU admission diagnostic were enrolled (age 65 ± 14 years old, 19 men/8 women). The APACHE-II score was 25.9 (± 8.3) points, the SOFA score was 11.5 (± 3.3) points and the ICU mortality was 66%. No significant differences were found in the levels of PCT in terms of patient outcome. However, the delta-PCT at 48 and 72 h in the surviving patients was higher than in non survivors (Delta PCT 48 h: −30 (−84–[−4]) ng/ml in survivors vs. −5 (−22–[33.1]) in non-survivors, p = 0.011; Delta PCT-72 h: −53 (−250–[−10]) ng/ml in survivors vs. −5 (−33.7–19.2) in non-survivors, p = 0.045).

**CONCLUSIONS.** In severe sepsis with multiorgan dysfunction although a significant increase in PCT levels occurs this have not prognostic value. However, in surviving patients PCT levels decreased more than non-survivors. This PCT clearance can be evaluated as delta-PCT at 48 and 72 h. Delta PCT at 48 and 72 h have prognostic value because they were significantly higher in survivors compared to non-survivors**.** Therefore, the persistence of high levels of PCT was associated with poor prognosis.

**REFERENCES.** 1. Marshall JC, for the International Sepsis Forum. Biomarkers of sepsis. Crit Care Med

2. Castelli GP et al. Procalcitonin and C-reactive protein during systemic inflammatory response syndrome, sepsis and organ dysfunction. Crit Care 2004;8:234–42. 2009;37: 2290–8.

## 0907

### PROCALCITONIN AND C-REACTIVE PROTEIN. ARE USEFUL AS PROGNOSTIC MARKERS IN SEPTIC PATIENTS?

G.E. Seller-Pérez[1], L. Álvarez-Montero[1], M. Arrebola-Ramírez[2], R. Lozano-Sáez[1], M.-J. Díez-de-los-Rios-Carrasco[1], M.E. Herrera-Gutierrez[1]

[1]Complejo Hospitalario Carlos Haya, ICU, Málaga, Spain, [2]Complejo Hospitalario Carlos Haya, Laboratory, Málaga, Spain

**INTRODUCTION.** Different parameters have been proposed to evaluate prognosis of septic patients at admission in the ICU.

**OBJECTIVES.** We intend to evaluate C-Reactive Protein (CRP) and procalcitonin (PCT) as prognostic factors in these patients.

**METHODS.** Preliminary data of a prospective observational single centre study (polyvalent ICU in a third level University Hospital).We included all patients admitted because sepsis since June-09. We measured markers at days 1, 2 and three and analyzed their relation with 28-day ICU mortality. Chi-square, ANOVA and ROC curves with a confidence level of 95% has been applied for the analysis.

**RESULTS.** 64 patients were included, 57.8% males, mean age 58.3 ± 14.9 years, Apache II at admission 24.6 ± 8.3 and SOFA 8.9 ± 4.3. Microbiological diagnosis was confirmed in 67.2%. ICU stay was 11.1 ± 13.4 days and 28-day mortality was 32.8% and ICU mortality 39.1%. PCT levels at admission were higher in survivors but without significance (p ns) (Fig. 1) with an AuC for mortality of 0.59 (0.43–0.76). Lactate at admission showed an Auc of 0.57 (0.41–0.74) and base deficit of 0.64 (0.49–0.78). CRP levels were significantly higher at admission in survivors (274.5 ± 21.3 vs. 165.9 ± 17.1, $p < 0.005$), AuC of 0.74 (0.49–0.78) and in this group a decrease by day 3 was detected as well (92.1 ± 21.6 vs. 14.9 ± 32.4 in non survivors, $p < 0.005$) with an AuC 0.74(0.57–0.92) (Fig. 2).

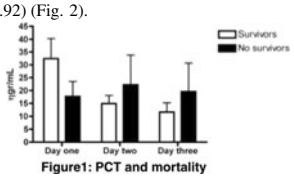


Figure1: PCT and mortality

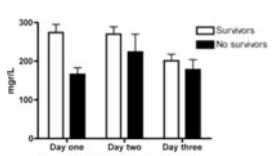


Figure 2: RcP and mortality

**CONCLUSIONS.** In our experience, and against others previous reports, in septic patients a higher level of CRP at admission can be a marker for better prognosis but is the decrement in the next few days what better predicts a good outcome. This trend is also shown by PCT but in this case the relationship is less evident

## 0908

### EFFECT PREDICTION LABORATORY PARAMETERS FOLLOWING POLYMYXIN B-IMMOBILIZED FIBER TREATMENT IN SEPTIC SHOCK

Y. Sakamoto[1], K. Mashiko[2], T. Ito[1], T. Iwamura[1], A. Nakashima[1], M. Yahata[1], T. Obata[3], H. Yokota[4]

[1]Emergency and Critical Care Medicine, Saga University Hospital, Saga, Japan, [2]Emergency and Critical Care Medicine, Nippon Medical School Chiba Hokusoh Hospital, Chiba, Japan, [3]Microbial Chemistry Research Foundation, Tokyo, Japan, [4]Emergency Medicine, Nippon Medical School, Tokyo, Japan

**INTRODUCTION.** Direct hemoperfusion using a polymyxin B-immobilized fiber column (DHP-PMX; Toray Industries Inc., Tokyo Japan) was first developed 1994 and has been used for the treatment of septic shock. Positive clinical data, such as an increase in systolic blood pressure (SBP) and an improved $PaO_2/FIO_2$ ratio, have also been reported. And most general effect is an increase in SBP.

**OBJECTIVES.** 43 septic shock patients using DHP-PMX were retrospectively reviewed to examine improved rate of any sepsis related factors after DHP-PMX and to analyze relationship between increase of SBP and sepsis related factors.

**METHODS.** The patients were separated into two other groups for analysis: those whose SBP increased by more than 30 mmHg immediately after DHP-PMX (25 cases), and those whose SBP did not increase by more than 30 mmHg after DHP-PMX (18 cases).

**RESULTS.** There was not significantly difference of severity score between two groups. High mobility group box 1, Interleukin-6, N-arachidonoylethanolamine (AEA), 2-arachidonoyl glycerol (2-AG), plasminogen activator inhibitor (PAI-1), protein C and Antithrombin III were not significantly correlation of an increase in SBP. There was significantly correlation between Group A and value of Sphingosine-1-phosphate (S1P) (p = 0.0193). Group A was 71.0 ± 110.0 and Group B was 174.1 ± 167.8.

**CONCLUSIONS.** S1P is a biologically active metabolite of plasma-membrane sphingolipids that is essential for immune-cell trafficking. Its concentration is increased in many inflammatory conditions, such as asthma and autoimmunity. We observed a relationship between hemodynamic improvement effect of DHP-PMX and S1P value.

## 0909

### DELTA NEUTROPHIL INDEX AND DISEASE SEVERITY OF PATIENTS WITH SEPSIS

S.J. Lee[1], S.N. Lee[1], M.K. Lee[1], H.Y. Kim[1], S.-H. Kim[1], S.J. Yong[1], K.C. Shin[1], W.-Y. Lee[1]

[1]Yonsei University Wonju College of Medicine, Department of Internal Medicine, Wonju, Korea, Republic of

**INTRODUCTION.** neutrophil index(DNI) is an indirect marker that reflects the number of immature granulocytes measured by an automated cell analyzer(ADVIA 120, Siemens, Inc.). A recent study reported that DNI might represent severity of sepsis.

**OBJECTIVES AND METHODS.** To determine usefulness of DNI as an inflammatory marker or a prognostic factor of sepsis, we reviewed the medical records of 122 nonoperative sepsis patients who admitted at intensive care unit from 1-Oct-2009 to 30-Mar-2010. We investigated correlations between DNI and C-reactive protein(CRP), procalcitonin(PCT), erythrocyte sedimentation rate(ESR), prothrombin time(PT), activated partial thromboplastin time(aPTT), antithrombin III(AT III) and mortality.

**RESULTS.** Increase of DNI correlated with increase of CRP ($r=0.326$, $p < 0.001$) and PCT ($r=0.415$, $p < 0.001$) and decrease of AT III ($r=-0.316$, $p=0.001$). Other laboratory findings did not correlate with DNI. Overall mortality is 37.7% (n=46). We found that mortality related with the DNI as well as APACHE II score. Patients with higher DNI(≥20%) showed higher mortality compared to those with lower DNI (<20%) (90.0 vs. 33.0%, p=0.001). The positive predictive value and negative predictive value of DNI for mortality were 90.0 and 67.0% (cutoff value=20%). Meanwhile, those of APACHE II score for mortality were 50.0 and 63.4% (cut-off value=30).

**CONCLUSIONS.** Collectively DNI may be an inflammatory marker as CRP, PCT and AT III, and a predictor of prognosis of sepsis as APACHE II score.

## 0910

### HEAD-TO-HEAD COMPARISON BETWEEN PROCALCITONIN AND PROTEIN C AS BIOMARKERS TO PREDICT RAPIDLY FATAL OUTCOMES IN SEPTIC PATIENTS AT MEDICAL INTENSIVE CARE UNIT: A PRELIMIARY STUDY

T.-Y. Chuang[1], C.-J. Lin[1], H.-H. Huang[1], S.-W. Lee[1]

[1]Taoyuan General Hospital, Taoyuan, Taiwan, Republic of China

**INTRODUCTION.** The characteristics of rapidly fatal outcomes in septic patients are not yet fully explored. Previous study suggested elevated procalcitonin or decreased protein C levels could predict severity of sepsis, effect of antimicrobial treatment and prognosis [1, 2].

**OBJECTIVES.** The objective of this study was to explore serum procalcitonin and protein C levels at admission to medical intensive care unit (MICU) as biomaerkers to predict rapidly fatal outcomes in septic patients.

**METHODS.** We measured serum procalcitonin and protein C levels in 68 patients with main diagnosis of severe sepsis at their admission to MICU in 2009. These patients were divided into rapidly fatal outcome (RFO) group, late fatal outcome (LFO) group and 28-day survival group. The rapidly fatal outcome was defined as patients died within 48 h of MICU admission. Data of patient's characteristics, results of blood culture, serum procalcitonin level, serum protein C level and 28-day mortality were collected and analyzed.

**RESULTS.** Seventeen patients died within 28-day admission to MICU and the 28-day mortality was 24.9% (17/68). Among those who died within 28-day admission to MICU only 4 patients (23.5%) belonged to RFO group. There was significant difference in serum procalcitonin level (90.5 ± 60.5 ng/ml vs. 28.4 ± 31.9 ng/ml, p=0.015) between RFO group and LFO group, respectively. There was no difference in serum protein C level (41.5 ± 15.8% vs. 44.7 ± 25.5%, p=0.816) between RFO group and LFO group, respectively. There was no difference in serum procalcitonin level (43.0 ± 46.8 ng/ml vs. 31.5 ± 48.0 ng/ml, p=0.392) between 28-day mortality group and 28-day survival group, respectively. There was significant difference in serum protein C level (43.9 ± 23.2% vs. 62.0 ± 30.2%, p=0.029) between 28-day mortality group and 28-day survival group, respectively. There was significant difference between bacteremic group and non-bacteremia group in increased serum procalcitonin level (>10 ng/ml, 84.2 vs. 26.5%, $p < 0.001$) and serum procalcitonin level (71.4 ± 49.7 ng/ml vs. 20.0 ± 38.6 ng/ml, $p < 0.001$), respectively.

**CONCLUSIONS.** Our results suggest elevated serum procalcitonin level might predict rapidly fatal outcomes and bacteremia in septic patients. Decreased serum protein C level might predict 28-day mortality and bacteremia in septic patients. However, the case numbers could be increased for further evaluation.

**REFERENCE(S).** 1. Jensen JU, Heslet L, Jensen TH, Espersen K, Steffensen P, Tvede M. Procalcitonin increase in early identification of critically ill patients at high risk of mortality. Crit Care Med. 2006;34(10):2596–602.

2. Macias WL, Nelson DR. Severe protein C deficiency predicts early death in severe sepsis. Crit Care Med. 2004;32(5 Suppl):S223–8.

**GRANT ACKNOWLEDGMENT.** This work was supported by Taoyuan General Hospital, Taiwan (Grant number: PTH9828 and 9837).

## 0911

### PROCALCITONIN LEVELS ARE LOWER IN ICU PATIENTS WITH H1N1 INFLUENZA A VIRUS PNEUMONIA THAN IN THOSE WITH COMMUNITY-ACQUIRED BACTERIAL PNEUMONIA

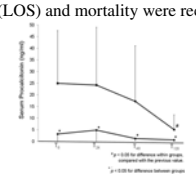
B. Sánchez[1], E. Piacentini[1], V. Arauzo[1], E. Calbo[2], E. Cuchi[3], J.M. Nava[1]

[1]Hospital Mutua Terrassa, Critical Care Unit, Terrassa, Spain, [2]Hospital Mutua Terrassa, Internal Medicine Department, Terrassa, Spain, [3]Hospital Mutua Terrassa, Microbiology Department, Terrassa, Spain

**INTRODUCTION.** During the 2009 H1N1 influenza A virus pandemic, the vast majority of patients had mild, self-limiting infections. A small percentage developed severe pneumonia leading to acute respiratory distress syndrome requiring prolonged stays in intensive care units (ICUs) and resulting in high (17–54%) mortality. Many severe cases occurred in healthy young adults, an age group rarely seriously affected by seasonal influenza [1]. The roles of the host immune response and of simultaneous co-infection with bacterial pneumonia in the pathogenesis of severe respiratory symptoms in H1N1 infections are poorly understood. Many inflammatory parameters have been studied to predict the etiology (bacterial vs. viral) and the severity of pneumonia in critical ill patients. Elevated C-reactive protein (CRP) has been reported in patients with H1N1 pneumonia, but is a nonspecific marker that is also normally increased in bacterial pneumonias. Serum procalcitonin (PCT) has been studied in a variety of patients with pneumonia. PCT levels are lower in viral infections than in bacterial infections and correlate well with the severity and evolution of pneumonias [2]; however, data about PCT in patients with H1N1 influenza A virus infection are lacking.

**OBJECTIVES.** To know the kinetics of PCT, CRP and white blood cell (WBC) in critically ill patients with H1N1 influenza A virus pneumonia and to compare levels of these inflammatory mediators with patients with acute community-acquired bacterial pneumonia.

**METHODS.** This was an observational study in a mixed ICU at a university hospital. We included all consecutive patients admitted to the ICU with a diagnosis of severe acute community-acquired pneumonia from September 2009 to December 2009. Viral (H1N1 influenza A) and bacterial microbiological diagnoses were done in every patient. At admission, demographics, comorbidities, Simplified Acute Physiology Score (SAPS II), Sequential Organ Failure Assessment (SOFA), Lung Injury Score (LIS), and $PaO_2/FiO_2$ were recorded. At admission and after 24, 48, and 120 h WBC, CRP and PCT levels were recorded. Finally, hospital and ICU length of stay (LOS) and mortality were recorded.



Serum procalcitonin levels

**RESULTS.** No differences in CRP or WBC were found between H1N1-positive patients and H1N1-negative patients. PCT levels at admission were lower in H1N1-positive patients (PCT = 0.4 [0.1–6.1] ng/ml) than in the H1N1- negative patients (24.8 [13.1–34.5] ng/ml). PCT significantly decreased with time but remained lower in the H1N1-positive group at all measurements ($p < 0.05$).

**CONCLUSIONS.** Among patients admitted to the ICU with pneumonia, the PCT level could help identify H1N1 influenza A virus pneumonia and thus enable earlier antiviral therapy.

**REFERENCES.** 1.Dominguez-Cherit G et al. Critically ill patients with 2009 influenza A (H1N1) in Mexico. JAMA. 302:1880–7.

Okimoto N et al. Procalcitonin and severity of community-acquired pneumonia. J Infect Chemother 15:426–7

## 0912

### BIOMARKERS IN CRITICAL CARE SEPTIC PATIENTS

E. Viegas[1,2], E. Tomás[2], E. Filipe[2], E. Lafuente[1], M. Fernandes[1], F. Santos[1], J. Silva[1], F. Moura[1], R. Lopes[1], P. Santos[1], L. Antunes[2]

[1]Centro Hospitalar Tamega e Sousa, Penafiel, Portugal, [2]Clínica Sagrada Esperança, Luanda, Angola

**INTRODUCTION.** Sepsis is a leading cause of death in many intensive care units[1]. Validated biomarkers of sepsis may improve diagnosis and therapeutic decision making for high-risk patients [2].

**OBJECTIVES.** To evaluate which biomarkers have influenced the outcome of critical patients with severe sepsis and septic shock.

**METHODS.** A retrospective study analysing medical records of patients with either severe sepsis or septic shock admitted to a general ICU of North Portugal from 1st January 2008 to 31st October 2009. Data on demographics, physiologic scores and biomarkers were collected at admission comparing variables for the group of survivor and non survivor patients. The delta values are the difference between the third and admission day for SOFA score, platelets, cholesterol, lactate, reactive protein C and functional protein C. Continuous data were presented by mean ± standard deviation. The paired student's t test was used to compare the numerical data for all the groups. Correlation coefficient and logistic multiple regression analysis was performed between SAPS II, cholesterol, lactate, reactive protein C (RPC), functional protein C (FPC) and mortality. $P < 0.05$ was considered significant.

**RESULTS.** 97 patients were enrolled. The mean age was 61.4 ± 15.5. Fifty-two were males. The anatomic site of infection was predominately abdomen (52%) followed by lung (31.6%). The length of stay was 8.9 ± 9 days. The mean SAPS II was 43.4 ± 19.1 and the mean SOFA was 8.2 ± 4. The ICU mortality was 29.5%. The mean ± standard deviation for the biomarkers was platelets: 195.3 ± 134, RPC: 182.7 ± 114.3, cholesterol: 86.5 ± 54.7, lactates: 3.4 ± 2.8, FPC: 47.8 ± 23.5.

COMPARISON BETWEEN SURVIVOR AND NON-SURVIVOR

| | Survivors | Non-survivors | P | Delta (Δ) | |
|---|---|---|---|---|---|
| | (n=68) | (n=29) | | Survivors | Non-survivors |
| Age | 61.2 ± 15.7 | 62.0 ± 15.7 | 0.83 | _ | _ |
| LOS | 9.1 ± 9.1 | 8.5 ± 9.8 | 0.78 | _ | _ |
| SAPS II | 36.5 ± 12.4 | 60.2 ± 21.7 | <0.0001 | _ | _ |
| SOFA | 6.7 ± 3.3 | 11.6 ± 3.6 | <0.0001 | −2.5 ± 3.2 | −3.5 ± 8.0 |
| Platelets | 228 ± 139 | 116 ± 77 | <0.0001 | −34 ± 87.5 | −59.5 ± 47.2 |
| Cholesterol | 86.3 ± 43.3 | 87.2 ± 74.3 | 0.95 | +4 ± 43.8 | −35.3 ± 68.3 |
| Lactates | 2.4 ± 1.8 | 5.4 ± 3.4 | <0.0001 | −0.45 ± 1.6 | −0.7 ± 5.2 |
| RPC | 103.8 ± 114.7 | 182.3 ± 113.5 | 0.97 | +36.9 ± 122.9 | −32.6 ± 129 |
| FPC | 51.1 ± 21.4 | 39.3 ± 26.4 | 0.03 | +5.5 ± 37.3 | −2.7 ± 17.5 |

**CONCLUSIONS.** Out of biomarkers analysed, those that had a negative influence in outcome, stratifying the individual risk, were platelets, lactates and functional protein C.

**REFERENCE(S).** 1. Hotchkiss RS et al. N Engl J Med. 2003.

2. Marshall JC et al. Crit Care Med. 2009.

## 0913

### ASSOCIATION BETWEEN SERUM CORTISOL LEVELS AND APACHE II SEVERITY INDEX IN CRITICALLY ILL PATIENTS

F. Perez[1], L.V. Sanchez[1], E.T. Ramos[1], L.A. Fernandez[1], E. Hernandez[1], J. Gomez[2], A. Martinelli[3]

[1]Centro Medico de Caracas, Department of Critical Care Medicine, Resident, Caracas, Venezuela, [2]Centro Medico de Caracas, Department of Critical Care Medicine, Assistant Director, Caracas, Venezuela, [3]Centro Medico de Caracas, Department of Critical Care Medicine, Director, Caracas, Venezuela

**INTRODUCTION.** The cytokines released in critically ill patients have been related to corticotroph cells damage leading to diminished adrenocorticotropic hormone (ACTH) production and adrenal insufficiency. Refractory hypotension and persistent hyponatremia should raise the suspicion of adrenal insufficiency. Previous studies have tried to determine the prognostic value of adrenal hormones levels. It is important to evaluate the association between serum cortisol levels (SCL) and severity indexes used for critical care patients.

**OBJECTIVES.** To evaluate the association between SCL and Acute Physiology and Chronic Health Evaluation (APACHE) II score in critically ill patients admitted to a general intensive care unit.

**METHODS.** A prospective observational case series study was undertaken including 50 patients between January 2010 and April 2010; SCL were measured on admission and APACHE II score was determined. Exclusion criteria were: diagnosis of Addison's disease, HIV infection, Acquired Immune Deficiency Syndrome, tuberculosis or primary autoimmune adrenalitis, chronic use of steroids and pregnancy. Statistical analyses were performed using Pearson's correlation.

**RESULTS.** Fifty (50) patients were enrolled in this study; the mean age was 64.6 ± 19.0 years and 33 (66.6%) were male. Mean SCL was 38.37 mcg/dL ± 22.44 (range 5 to 63.44 mcg/dL) and mean APACHE II score 13.94 ± 6.58. It was found a significant correlation between SCL and APACHE II score ($P = 0.002$). Of the total of patients, 21 (42%) had SCL >36.24 mcg/dL; out of this later group 10 (47.6%) patients died, as compared to none fatalities in the former group. There was also observed that SCL were higher with increasing age; this finding was statistically significant ($P = 0.007$).

**CONCLUSIONS.** Patients with SCL >36.24 mcg/dL on admission were more critically ill and had higher risk of death. More studies with larger sample size are needed to confirm these results.

**REFERENCE(S).** 1. De Jong MF. Relative adrenal insufficiency: an identifiable entity in nonseptic critically ill patients? Clin Endocrinol; 2007. 66(5): 732–9.

2. Dimopoulou I. A prospective study on adrenal cortex responses and outcome prediction in acute critical illness: Results from a large cohort of 203 mixed ICU patients. Intensive Care Med, 2007; 33(12):2116–21.

3. Jenn.Yu Wu. Adrenal Insufficiency in prolonged critical illness. Critical Care. 2008.

4. Mark S. Corticosteroid Insufficiency in Acutely Ill Patients. N Engl J Med. 2003;348:727–34

### 0914

**BED- SITE BIOMARKERS: IL6, IL8 AMD S100B-IN DIAGNOSTIC AND TRATMENT DECISION MAKING PROCESS OF SEPSIS**

M.A. Mikaszewska-Sokolewicz[1], R. Tomasiuk[2], T. Łazowski[2]

[1]Medical University Warsaw, Department of Anesthesiology and Intensive Care, Warsaw, Poland, [2]Medical University Warsaw, Warsaw, Poland

**INTRODUCTION.** Early detection of sepsis is essential for implementation of diagnostis and treatment of sepsis. Clinical picture of sepsis sometimes is not evident and organ failure symptoms might be interpreted variably. Newly aviable bed site diagnostic Kits for IL-6 IL-8 and protein S-100B were used in diagnostic process of sepsis.

**OBJECTIVES.** Clinical biomarkers of sepsis can be easily detected by bed site diagnostic tools. This proces can add useful message to decision making process. The study was performed to determin if additional bed site tests can accelerate impelementation of septic bundles and influence duration of treatemnt in the ICU

**METHODS.** Study was performed on the group of 92 adult patients (45 male and 47 female aged 18–93 years) with symptoms of infamatory reaction and multiple organ failure, admitted to general ICU. Milenia Quick bed site diagnostic kits for IL-6 IL8 and S100B were used. Standard inflamatory clinical markers assesed include determination of concentration of: White Blood Count, C Reactive Protein, Procalcytonin Fibrynogen. Patients were divided in two group: (1) group I—diagnosed with sepsis, (2) group II—suspected to have sepsis. IL-6 IL-8 and S100B tests were performed in both groups. The analysis was performed to determin if results of bed site tests have influence on decision of prescribed antibiotics, start of renal replacement therapy and length of stay in the ICU.

**RESULTS.** There were 33 patients diagnosed with sepsis—GROUPI and 59 patients suspected to have sepsis. IL6 level was increased in 63 patients (Group I=25 Group II= 38) IL8 level was increased in 58 patients (group I 29 Group II=29) Protein S100B was elevaed in 55patients. There were only 20 patients were all 3 biomarkers were elevated and in 12 immunocompromised patients S100B was the only marker which was elevated. Bed site tests influenced decision of antibiotic treatment in 27 patients from Group II. Renal replacement therapy was started because of additional informaton from bed site tests in 6 cases. Mean length of ICU stay was 13 days and did not differ between groups.

**CONCLUSIONS.** Bed site diagnostic tests can provide additional confirmation of inflamatory reaction and may help in making tratment decision in the ICU. Due to pathophysiology of sepsis and variations individual responce single determination of those biomarkers must be very cautiously interpreted.

### 0916

**IMPACT OF PREVENTION AGAINST ACUTE KIDNEY INJURY FOR THE PATIENTS WITH SEVERE SEPSIS: EFFECTIVENESS OF HUMAN ATRIAL NATRIURETIC PEPTIDE**

T. Niwa[1], R. Hasegawa[1], M. Kawase[1], Y. Nakashima[1], T. Ichihara[1]

[1]Tosei General Hospital, Emergency and Intensive Care Medicine, Seto, Japan

**INTRODUCTION.** Patients with severe sepsis, including septic shock, often lead to multiple organ failure. Especially, acute kidney injury (AKI) is associated with high morbidity and mortality in severe sepsis. Human atrial natriuretic peptide (hANP) is a potent endogenous natriuretic, diuretic, and vasorelaxant peptide and thought to be effective for protection against kidney injury. Therefore we think that hANP has the possibility of improving prognosis in severe sepsis by preserving renal function.

**OBJECTIVES.** This study examined the effectiveness of hANP for severe sepsis with multiple organ failure, especially AKI or acute respiratory failure.

**METHODS.** A historical cohort study was conducted in the patients with severe sepsis. From 2006 onward we treated the patients with severe sepsis following Surviving Sepsis Campaign guidelines (SSCG) and from 2008 onward we additionally administered hANP after the recovery from septic shock. The patients who received hANP (hANP group) were compared with those treated before without hANP infusion as historical control (control group). Trends for serum concentration of creatinine and estimated glomerular filtration rate (e-GFR) were recorded during hospital days (on ICU admission, just before hANP infusion, on ICU discharge and hospital discharge). We have investigated mortality at 30 days, renal function, the percentage of introduction for maintenance hemodialysis and ventilator free days (VFD).

**RESULTS.** Forty-eight patients were enrolled. hANP group included 16 patients and control group did 32 patients. The mean age was 74.9 ± 11.3 in hANP group and 71.2 ± 11.1 in control group. Except the percentage of ventilator use (higher rate in hANP group), there was no significant difference in patient characteristics between two groups. The mean serum concentration of creatinine in both groups exceeded 2 mg/dl and was not significantly different at ICU admission. Trends for mean serum concentration of creatinine and e-GFR improved day by day, but there were no significant differences between hANP group and control group (p=0.86 and 0.30, respectively). Furthermore there were no patients who were introduced maintenance hemodialysis in both groups. On the contrary, VFD tended to be longer in hANP group than control group (p=0.069). Univariate analysis did not identified predictors of survival, but multivariate analysis showed that hANP infusion, APACHE II and mean serum concentration of creatinine at the last time tended to be associated with 30 days mortality (odds ratio: 0.20, 1.10 and 5.45, respectively; p=0.125, 0.056 and 0.002, respectively).

**CONCLUSIONS.** The effectiveness of hANP for renal function was still unclear, but hANP may have the possibility of decreasing ventilator days and improving the prognosis. Further studies are needed to assess the effectiveness of hANP for severe sepsis.

## Sepsis therapies: 0915–0928

### 0915

**EVALUATING THE EFFECT OF THE AGE OF LEUKOREDUCED BLOOD TRANSFUSIONS ON OUTCOMES AFTER INJURY: A PROSPECTIVE COHORT STUDY**

H.A. Phelan[1], K. Aldy[1], E. Carroll[1], A.L. Eastman[1], P.A. Nakonezny[2], T. Jan[1], J. Howard[1], Y. Chen[1], R.S. Friese[3], J. Hill[1], J.P. Minei[1]

[1]University of Texas Southwestern Medical Center, Surgery, Division of Burns/Trauma/Critical Care, Dallas, USA, [2]University of Texas Southwestern Medical Center, Clinical Sciences, Division of Biostatistics, Dallas, USA, [3]University of Arizona Health Sciences Center, Surgery, Division of Trauma, Critical Care, and Emergency Surgery, Tuscon, USA

**INTRODUCTION.** We have retrospectively shown that filtering packed red blood cells (PRBCs) of donor white cells before banking (prestorage leukoreduction or PS-LR) not only blunts the known detrimental effect of aging of banked PRBCs on transfused trauma patients, but that the receipt of older PS-LR blood was associated with a protective effect on survival as well[1]. We sought to duplicate these results with a prospective cohort study.

**OBJECTIVE.** To evaluate PS-LR's impact on the detrimental effects of aged PRBCs on outcomes in transfused trauma patients.

**METHODS.** For 19 months, all trauma patients admitted to our urban Level I trauma center who were transfused ≥4 units PRBCs, survived 24 h post-injury, and were ≥18 years old were enrolled. Data on demographics, amount of PRBCs transfused in the first 24 h, age in days of each unit, and outcomes were collected. Logistic regression was performed with patient age, injury severity score (ISS), head abbreviated injury score (AIS), and total units of PRBCs transfused as covariates. In model 1, mean age of blood for each patient was entered as a continuous independent variable. In model 2, mean age was dichotomized as ≥ or <14 days as an independent variable. In model 3, the absolute number of PRBC units <14 days old were counted for each patient and entered as an independent variable as a percent of total PRBC transfusion. Models 2 and 3 were repeated using blood age of 21 days as a break point. Dependent variables were death, multiple organ dysfunction syndrome (MODS), and infection.

**RESULTS.** In the 153 patient cohort (age=40 ± 16 years, ISS=26 ± 15, total PRBC= 10 ± 9 units, head AIS=1.3 ± 1.9, 78% male, 70% blunt), mortality was 11% (n=17), 18% had MODS (n=28), and 37% had ≥1 infection (n=56). Mean age of transfused blood was significantly associated with decreased odds of death when considered as a continuous variable (OR: 0.92; 95% CI: 0.84–0.99, p=0.04). When examining the absolute number of PRBC units <14 days old as a percentage of total transfusion burden, the protective effect of age was no longer significant (OR: 0.98; 95% CI: 0.96–1.00, p=0.13) nor was it after dichotomization at 14 days (OR: 0.19; 95% CI: 0.03–1.04, p=0.06). Odds ratios for a protective effect of increasing PRBC age that did not reach significance were universally seen through all analyses of MODS and infection. Model repetition using a 21 day break point showed the same results as the 14 day analysis. AUCs for models 1–3: survival: 0.85, MODS: 0.75, infection: 0.72.

**CONCLUSION.** These results duplicate our group's previous work by finding a small protective effect of advancing mean PRBC age on survival and at a minimum an abrogation of the detrimental effects of age on transfused PRBCs.

**REFERENCE.** 1. Phelan HA et al. PS-LR ameliorates the detrimental effect of age on stored blood. J Trauma (in press)

**GRANT ACKNOWLEDGMENT.** NIH/NCRR 5-UL1 RR024982-03, "North-Central Texas Clinical & Translational Science Initiative" (Milton Packer MD, PI)

### 0917

**TLR-9 AGONIST FOR PREVENTION OF POST-HEMORRHAGE PNEUMONIA MORTALITY**

A. Roquilly[1,2], L. Gautreau[3], J.P. Segain[4], P. de Coppet[4], R. Josien[3], K. Asehnoune[1,2]

[1]EA 3826 Thérapeutiques anti-infectieuses Faculté de médecine, Nantes, France, [2]SAR Hotel Dieu H.M.E., Nantes, France, [3]INSERM U643, Nantes, France, [4]UMR PhAN 1280, Nantes, France

**INTRODUCTION.** Immunoparalysis (IS)-induced pneumonia (PN) is the leading cause of morbidity after hemorrhagic shock (HS). IS is characterized by a decreased ability of dendritic cells (DC) for cytokines transcription and antigen presentation. Plasmacytoid DC (pDC) produce large amount of Interferon (IFN)$\beta$, a key regulator of antigen presentation. Conventional DC (cDC) enable bacterial controled during sepsis *via* Interleukin-12 production that drives lymphocyte Th1 response.

**OBJECTIVES.** (1) test a Toll-Like Receptor (TLR)-9 agonist (CpG) to prevent morbidity and mortality of IS-induced PN, (2) investigate CpG ability to correct functional alterations of DC.

**METHODS.** *Animals*: Male Balb c/Jr mice. *HS model*: 30% of the blood volume withdrawn by cardiac puncture. At 60 mn, resuscitation with the shed blood volume. *PN model*: Intratracheal instillation of *Meticilline susceptible Staphylococcus aureus*. *Groups:* Sham (S), Pneumonia (P), HS followed by PN (HP), HS followed by an iv. Infusion of CpG and 24-hr latter by PN (HP-CpG). 7-days mortality; other assessments performed 24 h after PN onset*: Bacterial burden:* in lungs and spleen (CFU/g); *Lungs*: neutrophil accumulation (myeloperoxydase assay: MPO), endothelial permeability (%alb-FITC); *Spleen DC analysis*: mRNA: Quantitative RT–PCR of sorted DC (relative expression). *Statistical analysis*: results as median [IQ] or %, comparisons using Kruskall-Wallis and Tukey for post-hoc analysis or logrank ($P \leq 0.05$ for significance). *Ethic:* approved by the committee of ethics of Nantes University. .

**RESULTS.** The increased PN mortality observed in HP (45%) versus P (25%, $P < 0.05$) was prevented by CpG (5%, $P < 0.05$ vs. P and HP). Lung bacterial loads were 6.2 (5.7–6.5) CFU/g, 6.4 (5.9–7.1) and 6.2 (6.0–7.1) respectively in groups P, HP and HP-CpG (NS for all) (CFU< 0.69 in S). Increased spleen burden in group HP (3.8 [3.1–4.2]) vs. P (2.5 [1.9–2.8], $P < 0.05$) was prevented by CpG (2.8 [2.1–3.2], $P < 0.05$ vs. group HP) (CFU/g< 0.69 in S). The overwhelming neutrophil accumulation in group HP (14 [10–16], $P < 0.05$ vs. 1 [1–2] in S and 8 [7–11] in P) was dampened in HP-CpG (2 ([1–5], $P < 0.05$ vs. HP). Endothelial permeability, that was 5 [4–7] in group S and 12 [8–14] in P, rose up to 20 [16–24] in HP ($P < 0.05$ vs. group P) but decreased to 10 [7–14] in HP-CpG ($P < 0.05$ vs. HP). In pDC, mRNA of IFN$\beta$ was 1 [0.8–1.1] in group S. This level was downregulated in HP group as compared with group P (3 [2.4–4.2] vs. 18 [13–22], $P < 0.01$), but was restored by CpG (12 [10–15], $P < 0.01$ vs. HP). In cDC, the increased transcription of IL-12p40 gene in group P (19 [5–28] vs. 1 [0-1] in group S, $P < 0.01$), was not observed in HP (4 [2–5], $P < 0.01$ vs. group P), but was restored by CpG (8 [4–12], $P < 0.01$ vs. HP).

**CONCLUSIONS.** In this model of post-IS pneumonia, CpG prevented mortality, decreased lung inflammatory lesions, and restored transcription of IFN$\beta$ in pDC as well as IL12p40 in cDC.

**GRANT ACKNOWLEDGMENT.** Supported by Société Française d'Anesthésie Réanimation.

## 0918

### FISH OIL IN TREATMENT OF SEVERE TRAUMA PATIENTS

O. Ignatenko[1,2], A. Yaroshetskiy[1,2], S. Masolitin[1], D. Protsenko[1,2], B. Gelfand[1]

[1]State Medical University of Russia, Moscow, Russian Federation, [2]City Hospital #7, Moscow, Russian Federation

**INTRODUCTION.** Trauma is still one of the main reasons for death among the population worldwide. Massive injury leads to activation of the immune system and the early inflammatory immune response after trauma (SIRS). The initial pro-inflammatory response is followed by an anti-inflammatory response and can result in immune suppression with high risk of infection and sepsis [1]. Some data shows that inclusion of fish oil in parenteral nutrition provided to septic patients increases plasma eicosapentaenoic acid, modifies inflammatory cytokine concentrations and improves gas exchange. These changes are associated with a tendency towards shorter length of hospital stay [2]. But the effects of parenteral fish oil in trauma patients is not widely studied.

**OBJECTIVES.** To investigate the effects of omega-3 fatty acid parenteral supplementation on clinical outcomes and immunomodulation in severe trauma patients

**METHODS.** A prospective randomized trial of a parenteral omega-3 fatty acid emulsion (Omegaven, Fresenius Kabi) in comparison with placebo in trauma patients. The protocol was approved by the local ethics committee. 34 patients were randomized to «fish oil» (n=17) or control (n=17) groups. IL-4 and IL-6 levels, PCT and triglycerides in plasma were measured on 1, 2, 3, 5 and 7 days after admission in ICU. Frequency of ALI (AECC criteria) and VAP were evaluated. The end point of this study were LOS in ICU and outcome on 28 days.

**RESULTS.** The levels of IL-4 at 3 day in was significantly higher in "fish oil" group (175.6 ± 66.1/15.5 ± 2.1, p=0.0007). The levels of IL-6 at day 2 and 3 was higher in control group (84.8 ± 17.7/244.4 ± 44.3; p=0.0034 and 42.6 ± 7.6/122.1 ± 22.9; p= 0.004). The level of plasma PCT was significantly higher in control group at day 7 (1.08 ± 0.22/ 2.27 ± 1.73; p = 0.031). No differences were found in triglycerides, $paO_2/FiO_2$, LIS, frequency of VAP, the length of mechanical ventilation and 28-day mortality. But the LOS in ICU in «fish oil» group was significantly less than in control (17.8 ± 2.3/21.3 ± 1.4; p= 0.015)

**CONCLUSIONS.** Omega-3 fatty acid parenteral supplementation in severe trauma patients modifies inflammatory cytokine concentrations and associated with shorter LOS in ICU

**REFERENCE(S).** 1. Lenz A, Franklin GA, Cheadle WG. Systemic inflammation after trauma. Injury. 2007; 38(12):1336–45.
2. Barbosa VM et al. Effects of a fish oil containing lipid emulsion on plasma phospholipid fatty acids, inflammatory markers, and clinical outcomes in septic patients: a randomized, controlled clinical trial. Crit Care. 2010;14(1):R5.

**GRANT ACKNOWLEDGMENT.** Fresenius Kabi.

## 0919

### EFFECT OF PRE-BYPASS METHYLPREDNISOLONE ON POST-OPERATIVE RENAL FUNCTION IN CARDIAC ICU FOLLOWING CORRECTION OF ATRIAL SEPTAL DEFFECT UNDER CARDIOPULMONARY BYPASS

Z. Rahman[1], S. Dhar[1], K. Hasan[2], A. Sultana[2]

[1]Bangabandhu Sheikh Mujib Medical University, Department of Anesthesia, Analgesia and Intensive Care Medicine, Dhaka, Bangladesh, [2]Bangabandhu Sheikh Mujib Medical University, Department of Anaesthesia Analgesia and Intensive Care Medicine, Dhaka, Bangladesh

**INTRODUCTION.** Conventional open heart surgeries with cardiopulmonary bypass (CPB) is associated with transient post-operative renal dysfunction which is caused by systemic inflammatory response induced by CPB. Corticosteroids are administered to attenuate the systemic inflammatory response.

**OBJECTIVES.** The purpose of this study was to compare the effects of pre-bypass and post-bypass methylprednisolone on postoperative renal function after correction of ASD under CPB.

**METHODS.** Forty(40) patients were selected in the University cardiac centre of BSMMU undergoing ASD correction under CPB. Patients were randomized into two group to receive pre-bypass (Group-A) or post-bypass (Group-B) methylprednisolone 30 mg/kg markers of glomerular function (BUN, serum creatinine, creatinine clearance) and damage (microalbuminuria) and tubular function (glucosuria) were evaluated 24 h operation.

**RESULTS.** Transient impairment of glomerular and tubular function of kidney was observed in patients those received post-bypass metylprednisolone (group-B) while group-A patients shown no significant difference between baseline and post-operative renal function.

**CONCLUSIONS.** Use of pre-bypass metylprednisolone has a protective effect on post-operative renal function after correction of ASD under CPB.

**REFERENCE(S).** 1. Andersen LW, Baek L, Thomsen BS, Rasmussen JP. Effect of methylprednisolone on endotoxemia and complement activation during cardiac surgery. J Cardiothorac Anesth. 1989;3:544.
2. Bronicki Ra, Backer CL, Baden HP, Mavroudis C, Crawford SE, Green TP. Dexamethasone reduces the inflammatory response to cardiopulmonary bypass in children. Ann Thorac Surg. 2000;69:1490
3. Chaney MA. Corticosteroids and cardiopulmonary bypass: a review of clinical investigations. Chest. 2002;121:921.
4. Elliot BG. Systemic inflammation. In: Joel AK, David LR, Carol L, Kaplan's cardiac anaesthesia, 5th edn. USA, Saunders, 2006; p 154.
5. Selmonosky CA. Early detection of renal failure after cardiopulmonary bypass. Arch Surg. 1969;99:64–8.
6. Inaba H, Kochi A, Yorozu S. Suppression by methylprednisolone of augmented plasma endotoxin like activity and interleukin-6 during cardiopulmonary bypass. Br J Anaesth. 1994;72:348.
7. Varan B, Tokel K, Mercan S, Donmez A, Aslamaci S. Systemic inflammatory response related to cardiopulmonary bypass and its modification by methyl predisolone: high dose versus low dose. Pediatr Cardiol 2002;23:437–41.
8. Richard PW, Simon C, Devereaux PJ, Jack Sun, Fraser DR, Kristian T, Kevin HTT. Clinical benefit of steroid use in patients undergoing cardiopulmonary bypass: a meta-analysis of randomized trials. Retrieved 10 November 2008 from http://www.euheartj.oxfordjournals.org/egi/content/abstract/29/21/2592

**GRANT ACKNOWLEDGMENT.** This study was an approved thesis in Basngabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh in 2008.

## 0920

### N-ACETYLCYSTEINE FOR SEPSIS AND SYSTEMIC INFLAMMATORY RESPONSE: SYSTEMATIC REVIEW AND META-ANALYSIS

T. Szakmany[1], B. Hauser[2], P. Radermacher[3]

[1]Royal Glamorgan Hospital, Anaesthetics, Theatres and Critical Care, Llantrisant, UK, [2]Semmelweis University, AITK, Budapest, Hungary, [3]Universitat Ulm, Universitatsklinik fur Anasthesiologie, Sektion APV, Ulm, Germany

**INTRODUCTION.** Death is common in systemic inflammatory response syndrome (SIRS)/ sepsis induced multisystem organ failure and it has been thought that antioxidants such as N-acetylcysteine (NAC) could be beneficial [1].
**OBJECTIVES.** We assessed the clinical effectiveness of NAC for the treatment of patients with SIRS/sepsis.
**METHODS.** Search method: We searched the following databases: Cochrane Central Register of Clinical Trials (CENTRAL) (*The Cochrane Library* Issue 4 2009); MEDLINE (January 1950 to January 2010); EMBASE (January 1980 to January 2010); CINAHL (1982 to January 2010); the NHS Trusts Clinical Trials Register and Current Controlled Trials (http://www.controlled-trials.com); LILAC; KoreaMED; MEDCARIB; INDMED; PANTELEIMON; Ingenta; ISI Web of Knowledge and the National Trials Register to identify all relevant randomized controlled trials available for review. We included only randomized controlled trials (RCTs) in the meta-analysis. Data collection and analysis: We independently performed study selection, quality assessment and data extraction. We estimated odds ratios (OR) for dichotomous outcomes. We measured statistical heterogeneity using $I^2$ statistic.
**RESULTS.** We included 43 fully published studies (2,660 patients). Mortality was similar in the NAC and in the placebo group (OR 1.02 95% CI 0.82–1.28). After excluding those studies with high risk of bias, NAC appeared to increase the risk of mortality (OR 1.31 95% CI 1.01–1.72). NAC did not also show any significant effect on length of stay, duration of mechanical ventilation or incidence of new organ failure. In a planned subgroup analysis early NAC treatment did not affect outcome, however late administration of NAC (after 24 h of initial presentation of symptoms) was associated with increased mortality OR 1.59 95% CI 1.05–2.38.
**CONCLUSIONS.** Overall, this meta-analysis puts serious doubt on the safety and utility of intravenous NAC as an adjuvant therapy in SIRS/sepsis. At best NAC is ineffective in reducing mortality and complications in this patient population. At worst, the sensitivity analysis suggest that it can be harmful, especially when administered later than 24 h after the onset of symptoms. Unless future RCTs provide evidence of treatment effect, clinicians should not routinely use intravenous NAC in SIRS/sepsis and academics should not promote its use.

**REFERENCE(S).** 1. Pinsky MR. Antioxidant therapy for severe sepsis: promise and perspective. Critical Care Medicine 2003;31:2697–8.

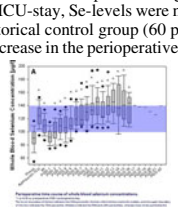
## 0921

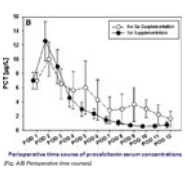
### THE EFFECTS OF HIGH DOSE SELENIUM SUPPLEMENTATION ON PERIOPERATIVE SYSTEMIC INFLAMMATION IN PATIENTS UNDERGOING OPEN HEART SURGERY

C. Stoppe[1,2], A. Wildenhues[2], S. Metzelder[1], G. Schälte[1], A.K. Menon[3], R. Rossaint[1], G. Marx[2], S. Rex[1,2]

[1]University Hospital, RWTH Aachen, Department of Anaesthesiology, Aachen, Germany, [2]University Hospital, RWTH Aachen, Department of Intensive Care, Aachen, Germany, [3]University Hospital, RWTH Aachen, Department of Thoracic, Cardiac and Vascular Surgery, Aachen, Germany

**INTRODUCTION.** Low serum levels of selenium (Se) have been observed in critically ill patients with systemic inflammation and are associated with oxidative stress, the development of multi-organ dysfunction and an increased mortality [1]. Cardiac surgery with the use of cardiopulmonary bypass (CPB) is known to trigger an intense systemic inflammatory response and to decrease Se levels [2]. As previous studies have demonstrated beneficial effects of Se-supplementation during septic shock [3], we hypothesized that the pre-emptive administration of Se in cardiac surgery attenuates perioperative systemic inflammation.
**OBJECTIVES.** To assess the effects of high dose Se supplementation on whole blood Se concentrations and on perioperative inflammation.
**METHODS.** 100 patients [mean age (±SD) 65 ± 12 years;EuroScore: 5.8 ± 3.8] who underwent cardiac surgery with the use of CPB were enrolled in this prospective open-label trial. Patients received 2 mg sodium-selenite i.v. after induction of anesthesia and 1 mg on every further day during their ICU stay. Whole blood Se-concentrations of Se were measured after induction of anesthesia, 4 h after admission to the ICU and on every further day on ICU.Results were statistically analysed using appropriate ANOVA-testing.
**RESULTS.** Prior to surgery, Se-concentrations were already below the reference range [Fig. 1A]. Preoperative high-dose Se-supplementation increased Se-concentrations to normal values upon ICU-admission, but was unable to prevent a significant decrease of Se at the first postoperative day. During further ICU-stay, Se-levels were normalized by the supplementation strategy. When compared to a historical control group (60 patients), high-dose Se-supplementation was not associated with a decrease in the perioperative release of procalcitonin [Fig. 1B].





**CONCLUSIONS.** Despite the pre-emptive administration of high-dose Se, cardiac surgical patients still develop a significant Se-deficiency at the first postoperative day which might explain the failure of Se-supplementation to attenuate perioperative inflammation.

**REFERENCES.** 1. Manzanares W, Hardy G et al.: Intensive Care Med (2009) 35:882–889. 2. Stoppe C, Rex S et al.: Intensive Care Med. (2009);35 Suppl.:1067. 3. Angstwurm MW, Zimmermann T et al.: Crit Care Med (2007); 35:118–126.

## 0922

### EFFECTS OF EMPIRIC ANTIBIOTIC TREATMENT ON ENDOTOXIN ACTIVITY IN SEPTIC PATIENTS

F. Mignon[1], M. Piagnerelli[1], J.-L. Vincent[1]

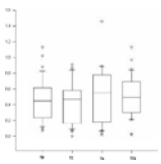
[1]ULB Erasme Hospital, Intensive Care, Brussel, Belgium

**INTRODUCTION.** Although early adequate empirical antibiotherapy is strongly recommended in septic patients, antibiotics may be responsible for a transient deterioration in patient condition provoked by the release of bacterial wall components into the blood. We investigated the effects of empirical antibiotics on endotoxin activity (EAA) by a chemiluminescence technique.

**METHODS.** We studied EAA in septic patients before (T0) and 2, 4 and 24 h after initial antibiotic therapy. We excluded patients who had received antibiotics in the week prior to inclusion. EAA was also studied in ICU patients without sepsis and in healthy volunteers to exclude daily fluctuations [1]. EAA was measured on whole blood using a chemiluminescence technique (EAA$^{tm}$, Spectral Diagnostic, Toronto, Canada). An EAA value above 0.4 is considered to indicate a high risk of Gram negative infection [2]. Data are expressed in median values [25–75th interquartiles] and were compared by the Kruskal–Wallis and Mann–Whitney tests with Bonferroni correction. The time course of EAA was analyzed by the ANOVA test. A p value $< 0.05$ was considered as statistically significant.

**RESULTS.** We studied 33 septic patients, 15 non-septic patients and 15 volunteers. Sources of infection were pulmonary (15/33), abdominal (7/33), urinary (4/33) and others (cellulitis, mediastinitis, unknown). Gram negative infection was documented in 19 patients. ICU mortality was 27% (9/33). The length of time during which EAA was greater than 0.4 was longer in septic compared to non-septic patients and healthy volunteers (21.6 [10.3–24.0] vs. 1.3 [0–14.5] vs. 0 [0–13.5] h, $p < 0.05$). Empiric antibiotic therapy in septic patients had no effect on EAA (pic_01).

**CONCLUSIONS.** EAA was higher in septic than in non-septic ICU patients and healthy volunteers, and empirical antibiotic therapy did not significantly effect EAA values over 24 h.



Septic patients EAA evolution

**REFERENCE(S).** 1. Klein DJ et al. Shock 2007; 28(5): 524–9
2. Marshall JC et al. J Infect Dis 2004, 190:527–34.

**GRANT ACKNOWLEDGMENT.** Material support from Spectral Diagnostic.

## 0923

### THE EFFECT OF RECOMBINANT HUMAN ERYTHROPOIETIN (RHUEPO) ON SUBLINGUAL MICROCIRCULATION AND SPLANCHNIC CENTRAL VENOUS OXYGEN SATURATION IN PATIENTS WITH SEVERE SEPSIS AND SEPTIC SHOCK

C. O'Neill[1], A. Xenocostas[1], C.M. Martin[1], T. Rui[1], N. Parry[1], D. Gray[1], A. Badhwar[1], K. Shah[1], R. Kao[1]

[1]University of Western Ontario, London, Canada

**INTRODUCTION.** Erythropoietin (EPO) has anti-inflammatory and hemodynamic effects in addition to erythropoiesis. We recently reported a single dose rHuEPO acutely improves skeletal muscle microcirculation and tissue bioenergetics in a murine sepsis model.[1]

**OBJECTIVES.** The effect of rHuEPO on the sublingual microcirculation[2] and the splanchnic central venous oxygen saturation and splanchnic central venous oxygen saturation ($ScVO_2$) in severely septic patients will be evaluated. The study is performed in two stages: (1) to determine the optimal rHuEPO dose that induces a change in sublingual microcirculation and splanchnic $ScVO_2$ and its safety in patients with severe sepsis; (2) to perform a randomized controlled trial to evaluate the efficacy of rHuEPO as an adjuvant treatment for patients with severe sepsis.

**METHODS.** For the current stage 1 study, nine patients with severe sepsis will be enrolled to receive a single dose of rHuEPO of 200, 400 or 600 U/kg. The sublingual microcirculation is assessed using the noninvasive orthogonal polarizing spectral imaging and measured using a semi-quantitative microvascular flow index. The continuous splanchnic $ScVO_2$ is measured by inserting a femoral oximetry thermodilution catheter at the level of the hepatic vein and the signal is processed and displayed by a Vigilance monitoring system.

**RESULTS.** To date, 6 patients have been enrolled, 3 patients in the 200U/kg and 3 patients in the 400U/kg dose group. Two patients in the 200U/kg group demonstrated modest improvement in microcirculatory perfusion. No improvement was observed for the remaining 4 patients. Modest $ScVO_2$ improvement observed at 1-h post EPO injection from the baseline for all 3 patients in the 200 U/kg group and 1 patient in the 400U/kg group. No improvement for the remaining 2 patients in the 400 U/kg group.

**CONCLUSIONS.** To date there have been no adverse effect attributed to treatment with rHuEPO. We have not reached the threshold rHuEPO dose required to observe a significant change in the sublingual microcirculation and $ScVO_2$ in septic patients in the ICU. Enrollment continues at 600 U/kg dose.

**REFERENCE(S).** 1. Kao R, Xenocostas A, Rui T, Yu P, Huang W, Rose J, Martin CM. Erythropoietin improves skeletal muscle microcirculation and tissue bioenergetics in a mouse sepsis model. Available online at: http://ccforum.com/content/11/3/R58. Accessed May 18, 2007.
2. Groner W, Winkelma JW, Harris AG et.al: Orthogonal polarization spectral imaging: A new method for study of the microcirculation. Nat Med. 1999;5:1209–12.

**GRANT ACKNOWLEDGMENT.** This study was supported by a grant from the Department of National Defence, Canadian Forces Health Services Research and Development.

## 0924

### SEDATION WITH KETAMINE REDUCES THE VOLUME OF FLUID RESUSCITATION IN SEPTIC SHOCK PATIENTS

S. Wiramus[1], J. Textoris[1], F. Antonini[1], V. Blasco[1], J. Albanèse[1], C. Martin[1], M. Leone[1]

[1]Assistance Publique Hopitaux de Marseille, Université de la Méditerranée, Service d'Anesthésie Réanimation, Marseille, France

**INTRODUCTION.** Ketamine has anti-inflammatory effects in experimental models. It inhibits norepinephrine recapture, which may be interesting in patients with shock. Our hypothesis was that the use of ketamine may reduce the volume of fluid needed in the resuscitation of patients with septic shock.

**OBJECTIVES.** The first objective was to determine the fluid volume within the first 24 h of resuscitation of septic shock. The secondary objectives were to assess the impact of ketamine in terms of vasopressor's doses, hemodynamic, ventilatory, gastrointestinal responses and agitation.

**METHODS.** This observational study was conducted in an intensive care unit of a tertiary hospital (2005–2008). The choice of sedation with midazolam and either ketamine or sufentanil was decided by the attending physician in charge of the patient. Among 200 patients with septic shock, 38 patients treated with ketamine were matched to 38 patients treated with sufentanil according to SAPS II at admission. The hemodynamic data have been collected over the first 48 h after septic shock onset. The volume of intravenous fluids and doses of norepinephrine were recorded every hour within the study period. Agitation was assessed through administration of antipsychotics and anxiolytics after the arrest of sedation. Tolerance of enteral nutrition was assessed by the volume of gastric residues. The results are expressed as median and interquartile differences. The interpretation of differences was assessed using a Wilcoxon test or Fisher's test on the variables. A $p$ value $< 0.05$ was considered significant.

**RESULTS.** The two groups were comparable in age, body mass index, severity score (SOFA and SAPS II at day 1). The volume of fluid administered during the first day (4 L [3–5] vs. 5 L [3–7], $p = 0.02$) and during the shock (6 L [3–9] vs. 10 L [7–17], $p = 0.003$) were significantly reduced in the ketamine group. The duration of sedation was similar in both groups (2 days [1–5] ketamine group vs. 3.5 days [2–7] sufentanil group ($p = 0.5$)). The doses of midazolam administered were similar in both groups ($p = 0.8$). There was a trend toward a reduction of the doses of norepinephrine in the ketamine group. No difference was found between the groups in terms of oxygen consumption, compared $PaO_2/FiO_2$ ratio, incidence of agitation, and volume of gastric residues. The duration of ICU stay and mortality were similar in both groups.

**CONCLUSIONS.** The use of ketamine for the sedation of patients in septic shock reduces the volume of fluid and seems to decrease the dose of vasopressors. No significant side effect was observed in our cohort.

## 0925

### LANDIOLOL THERAPY IN SEPTIC PATIENTS: THE FEASIBILITY STUDY OF ULTRASHORT ACTING BETA1 ADRENOCEPTOR BLOCKADE

T.M. Ueda[1], S. Yajima[1], Y. Misonoo[1], T. Suzuki[1], H. Morisaki[1]

[1]Keio University School of Medicine, Anesthesiology, Tokyo, Japan

**INTRODUCTION.** We previously found that beta adrenergic blockade could regulate the excessive inflammatory responses in a septic animal model (1), but due to its negative inotropic effects, the clinical use for septic patients still remains controversial. In an effort to reduce tachycardia in septic patients requiring inotropic therapy, we have been using landiolol, an ultrashort acting beta1 blocker, with care.

**OBJECTIVES.** This retrospective analysis aimed to clarify the feasibility, and safety of landiolol administration for septic patients with tachyarrythmia.

**METHODS.** Twenty-nine septic patients who were given the infusion of landiolol during at least 24 h were investigated. Hemodynamic data and variables from blood gas analysis in all patients were extracted from medical charts and documented before and 12 h after the landiolol infusion. At that time, prevalence of atrial fibrillation (Af) and/or ventricular tachycardia within previous 6 h was also documented for patients without the history of Af. Adverse cardiovascular events (decline in blood pressure and bradycardia) during the period of landiolol infusion were documented. Categorical and continuous variables were compared using Fisher's exact test and paired t test, and a p value less than 0.05 was considered statistically significant.

**RESULTS.** Heart rate control (below 95 bpm) was achieved within 12 h from the initiation of landiolol infusion in 69% of patients. The average heart rate was significantly decreased ($126 \pm 20$ bpm to $91 \pm 12$ bpm; $P < 0.001$), without significant effect on mean arterial blood pressure, central venous pressure, $SpO_2$ and $PaO_2/FiO_2$ ratio. Furthermore, new-onset Af (n=11) and ventricular tachycardia (n=3) were not recorded after 12 h ($P < 0.001$). Decline in blood pressure (systolic blood pressure <90 mmHg) was observed in some patients during treatments (0.28 incidences per person-days), although few cases were recognized as the adverse effect of landiolol. No bradycardia events were recorded.

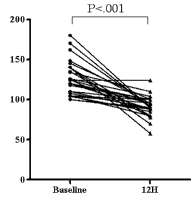



Fig. Heart rate before and after the administration of landiolol

**CONCLUSIONS.** Continuous infusion of landiolol demonstrated both rhythm- and rate-controlling effects without severe adverse cardiac events in septic patients with tachyarrhythmia.

**REFERENCES.** 1. Suzuki T et al. Crit Care Med 2005;33:2294

## 0926

### FLUID BALANCE IN SEPTIC PATIENTS RECEIVING ONLY CRYSTALLOID OR SYNTHETIC FLUIDS PLUS CRYSTALLOIDS

O. Bayer[1], M. Kohl[1], B. Kabisch[1], N. Riedemann[1], M. Bauer[1], U. Settmacher[2], K. Hekmat[3], C. Hartog[1], K. Reinhart[1]

[1]Friedrich Schiller University, Department of Anesthesiology and Intensive Care Medicine, Jena, Germany, [2]Friedrich Schiller University, Department of General and Visceral Surgery, Jena, Germany, [3]Friedrich Schiller University, Department of Cardiac and Thoracic Surgery, Jena, Germany

**INTRODUCTION.** It is commonly stated that fourfold volumes or more of crystalloid than of colloid solutions are necessary to achieve effective resuscitation. This precludes crystalloid use for fear of fluid overload or edema formation. Large-scale clinical volume trials with 5% albumin or 10% HES 200/0.5 and crystalloid controls have recently found much lower crystalloid-colloid ratios around 1.4 [1, 2].

**OBJECTIVES.** We intended to analyse the crystalloid-colloid volume ratio for HES 130/0.4 or gelatin versus crystalloids in septic patients.

**METHODS.** Controlled before-and-after study of volume therapy in 346 patients with severe sepsis on a surgical ICU. Between January 2005 and June 2006, patients in the SynColl (synthetic colloid, n=205) group received predominantly 6% HES130/0.4 (n=118) or 4% gelatin (n=87). Between September 2008 and June 2009, patients in the Crys (crystalloid, n=141) group received only crystalloid solutions. We calculated daily fluid balances and total fluid input (all i.v. solutions including parenteral feeding) for the first 7 treatment days. Statistical analysis was done by SPSS 17.0 with the Mann–Whitney U Test to detect non-parametric statistical significance.

**RESULTS.** Groups were comparable at baseline concerning SAPS2 and SOFA scores, age and renal function. From day 0–7, total fluid requirement was 129 [IQR 51-253] ml/kg bodyweight in the Crys group and 102 [IQR 27–212] ml/kg in the SynColl group, p=0.025; crystalloid-colloid volume ratio of 1.3.

Median cumulative fluid doses were 25 ml/kg [IQR 13–50] synthetic colloids plus 225 [IQR 132–318] ml/kg in the SynColl group and 244 [IQR 157–388] ml/kg crystalloids in the Crys group (p=0.075).

Daily fluid input and fluid balances differed significantly only on days 0 and 1 (p>0.001). Daily fluid needs differed most on day 1 where the crystalloid-colloid volume ratio was 2.2 to 1.

ICU and hospital morbidity and mean maximal SOFA scores were similar between groups.

**CONCLUSIONS.** Patients with severe sepsis who receive only crystalloid solutions do not have a much higher fluid need than patients receiving synthetic colloids. This confirms previous studies [1, 2].

**REFERENCE(S).** 1. Finfer et al. N Engl J Med 2004;350:2247–56
2. Brunkhorst et al. N Engl J Med 2008;358:125–39

## 0927

### POTENTIATING EFFECT OF NITROGLYCERIN ON THE MICROCIRCULATORY ACTIVITY OF MAGNESIUM SULPHATE IN PATIENTS WITH SEPTIC SHOCK

A. Pranskunas[1], V. Pilvinis[1]

[1]Hospital of Kaunas University of Medicine, Department of Intensive Care, Kaunas, Lithuania

**INTRODUCTION.** The vascular effects of magnesium therapy relate to its ability to induce endothelium independent vasodilation by a direct action on vascular smooth muscle and endothelium dependent vasodilation by release of NO from endothelium cells. Schauf and colleagues showed that intravenous magnesium therapy increases RBC-deformability in pregnancies. Also intravenously administered magnesium reduced platelet aggregation. But magnesium infusion effect on the septic patient's vessels, especially small ones, is unknown. However Boerma's et al. randomized double-blind clinical trial fall to show any additional microvascular blood flow improvement as a result of treatment with nitroglycerin in patients with severe sepsis or septic shock.

**OBJECTIVES.** We hypothesized that nitroglycerin additional infusion after the start of magnesium sulphate infusion can potentiate improvement of microcirculation in patients with septic shock.

**METHODS.** Prospective randomized study. Twenty septic patients who had already been fluid resuscitated randomly assigned to one of two groups. One group receives magnesium sulphate 2 g/h infusion alone. Another group receives magnesium sulphate infusion 2 g/h with nitroglycerin 1 mg/h infusion added after 30 min. If required we added crystalloids and norepinephrine. Sublingual microcirculation was evaluated using side dark field videomicroscopy (MicroScan®, MicroVisionMedical). Simultaneously we assessed systemic hemodynamic parameters (MAP, mean arterial pressure, HR, heart rate, CVP, central venous pressure, CI, cardiac index). In all patients measurements were obtained at baseline, at 30 min. and at 60 min. Each patient's microcirculation was evaluated by examining 5 different sublingual areas (10–20 s/image). Images were analyzed by semiquantitative scores of flow (MFI, Mean flow index; PPSV, proportion of perfused small vessels) and density (TVD, total vascular density; PSVD, perfused small vessels density). Capillaries were defined as microvessels with a diameter <20 μm. Data are presented as median values (percentiles 25–75).

**RESULTS.** HR, MAP, CI, noradrenaline dose did not change significantly intragroup and between groups during study's time periods. All groups at 30 min. study time with magnesium sulphate alone has tendency to be higher in microcirculatory flow and density. In comparison at 60 min. magnesium alone group to magnesium with nitroglycerin group TVD and PSVD was significantly higher (TVD, 10.8 (9.8; 11.0) n/mm vs. 12.0 (11.9; 13.6) n/mm, p=0.03; PSVD, 6.8 (5.9; 7.4) n/mm vs. 9.3 (8.6; 11.0) n/mm, p=0.002) in magnesium with nitroglycerin group, but there was no significant difference between groups in PPSV and MFI.

**CONCLUSIONS.** Nitroglycerin additional infusion after the start of magnesium sulphate infusion can potentiate improvement of microvascular density and does not influence flow state in patients with septic shock. Further studies are needed to obtain more detailed results.

## 0928

### THE EFFECTS OF SYNTHETIC COLLOIDS ON THE RENAL FUNCTION OF PATIENTS WITH SEVERE SEPSIS

O. Bayer[1], M. Kohl[1], B. Kabisch[1], N. Riedemann[1], M. Bauer[1], U. Settmacher[2], K. Hekmat[3], C. Hartog[1], K. Reinhart[1]

[1]Friedrich Schiller University, Department of Anesthesiology and Intensive Care Medicine, Jena, Germany, [2]Friedrich Schiller University, Department of General and Visceral Surgery, Jena, Germany, [3]Friedrich Schiller University, Department of Cardiac and Thoracic Surgery, Jena, Germany

**INTRODUCTION.** Synthetic colloids hydroxyethyl starch (HES) and gelatin are often used in septic patients. Occurrence of renal impairment did not decrease after we changed our standard colloid from HES to gelatin [1].

**OBJECTIVES.** We therefore abolished synthetic colloids altogether and used only crystalloids on our ICU. We hypothesized that rates of AKI (acute kidney injury) would drop.

**METHODS.** Controlled before-and-after study of volume therapy in 346 patients with severe sepsis on a surgical ICU. Between January 2005 and June 2006, patients in the SynColl (synthetic colloid, n=205) group received predominantly 6% HES130/0.4 (n=118) or 4% gelatin (n=87). Between September 2008 and June 2009, patients in the Crys (crystalloid, n=141) group received only crystalloid solutions. We used development of renal replacement therapy (RRT) or RIFLE criteria to define AKI [2]. Statistical analysis was done by SPSS 17.0, with the Mann–Whitney U Test to detect non-parametric statistical significance and the Fisher's exact test, as appropriate.

**RESULTS.** Groups were comparable at baseline concerning SAPS2 and SOFA scores, age and serum creatinine. The Crys group had significantly less AKI (30 vs. 51%, $p < 0.001$) and less positive criteria denoting "RIFLE Failure" (38 vs. 21%, p=0.001). Fewer patients receiving crystalloid needed RRT in the context of AKI (20 vs. 34%, p=0.011 compared to HES, 34% compared to gelatin, p=0.019). Median cumulative doses were 46 ml/kg [IQR 18–92] HES and 43 [IQR 18–76] ml/kg gelatin. Median cumulative fluid doses over the whole ICU stay were 581 [IQR 247–952] ml/kg in the SynColl group and 355 [IQR 173–911] in the Crys group (p=0.047). Patients receiving synthetic colloids had a trend towards a longer length of ICU stay (14 [IQR 6–27] vs. 10 [IQR 5–20] days; p=0.055). ICU and hospital mortality were similar.

**CONCLUSIONS.** Both synthetic colloids 6% HES 130/0.4 and 4% gelatin are associated with a considerably increased risk of renal failure in septic patients, confirming similar findings for older starches [3].

**REFERENCE(S).** 1. Schabinski et al. Intensive Care Med 2009;35:1539–47. 2. Lopes et al. Critical Care 2008;12:R10. 3. Brunkhorst et al. N Engl J Med 2008;358:125–39

# Oral Sessions
# H1N1 pneumonia: Experience across the world: 0929–0933

## 0929

### CRITICALLY ILL PATIENTS WITH 2009 INFLUENZA A (H1N1)V IN SPAIN

A. Rodriguez[1,2,3], M. Marín[4], J. Bonastre[5], R. Granada[6], L. Vidaur[7], L. Socias[8], J.E. Guerrero[9], N. López de Arbina[10], J. Almirall[11], L. Lorente[12], A. Albaya-Moreno[13], L. Cordero[14], B. Gil-Rueda[15], A. Jareño[16], P. Luque[17], M. Palomar[18], J. Rello[18,19], H1N1 SEMICYUC Working Group

[1]Joan XXIII University Hospital, Tarragona, Spain, [2]CIBER Enfermedades Respiratorias, Tarragona, Spain, [3]Universidad Rovira and Virgili, IISPV, Tarragona, Spain, [4]Hospital N.S. de Valme, Sevilla, Spain, [5]Hospital La Fe, Criticeal Car, Valencia, Spain, [6]Hospital Universitario de Bellvitge, Barcelona, Spain, [7]Hospital Donostia, San Sebatian, Spain, [8]Hospital Son Llàtzer, Palma de Mallorca, Spain, [9]Hospital Universitario Gregorio Marañón, Madrid, Spain, [10]Hospital Universitario Dr Josep Trueta, Girona, Spain, [11]Hospital de Mataró, Mataró, Spain, [12]Hospital Universitario de Canarias, Tenerife, Spain, [13]Hospital Universitario de Guadalajara, Guadalajara, Spain, [14]CHUAC, A'Coruña, Spain, [15]Hospital Morales Meseguer, Murcia, Spain, [16]Hospital SAS, Jerez, Spain, [17]Hospital Lozano Bleza, Zaragoza, Spain, [18]Hospital Universitario Vall d'Hebron, Barcelona, Spain, [19]CIBER Enfermedades Respiratorias, Barcelona, Spain

**INTRODUCTION.** In April 2009, an outbreak of respiratory illness by novel swine-origin influenza A (H1N1)V virus(S-OIV)was identified in Spain.

**OBJECTIVES.** To describe the clinical and epidemiologic characteristics and outcome of consecutive critically ill patients hospitalized with laboratory-confirmed S-OIV infection in Spain.

**METHODS.** Prospective, observational study of ICU patients at 148 hospitals between April 23 and December 31, 2009. We used medical chart reviews to collect data on ICU adult patients reported in a standardized form (GTEI/SEMICYUC database).

**RESULTS.** A total of 956 patients were admitted to ICU with confirmed influenza A (H1N1). Patients were young(median 44.0 [IQR 33–54] and 55% were males. Mean APACHE II was 13.8 (SD 7.2) and mean SOFA was 5.5 (SD 3.6). Six-hundred ninety-two (72.4%) were admitted with respiratory failure and 106(11.1%) with bacterial co-infection. Obesity (BMI>30) was the most common comorbid condition (36.2%), following by COPD (16%) and asthma (12%). Twenty-eight percent of patients have no comorbidities. Time from symptoms onset to hospital admission was long (median, 4 days [IQR 2–6 days]) but the time from hospital to ICU admission was short (median, 1 day [IQR 1–2]). Seventy-one percent required mechanical ventilation (46.2% invasive and 24.8% noninvasive) and 14.2% of patients received prone ventilation. Forty-four percent of patients required vasoactive drugs due to shock and 11.2% received renal replacement therapy. Time from symptoms onset to first dose of antiviral therapy was longer (median, 4.5 days [IQR 3–6 days]). Ninety-nine percent was treated with Oseltamivir (68.4% of then with 300 mg/day), 73.5% as empiric initial treatment. Only 4 patients received intravenous Zanamivir. Antibiotic therapy was administered in 99% of patients and 40.3% received steroids. The mortality rate in 632 patients with complete data was 22.3% (n=141). However, the mortality rate in patients with invasive mechanical ventilation was 35.2% (135/384). Patient who died were more likely to have a higher APACHE II (19.4 ± 8.4 vs. 12.4 ± 6.0; $p < 0.01$), higher SOFA (8.4 ± 4.4 vs. 4.9 ± 3.0; $p < 0.01$), more quadrants infiltrates in thorax X-ray (2.9 ± 1.0 vs. 2.1 ± 1.2; $p < 0.01$), more need of MV (97.9 vs. 63.3%; $p < 0.01$) and higher presence of shock (73.9 vs. 36.3; $p < 0.01$). When these variables were included in multivariable analysis (MLR) only APACHE II (OR= 1.09; 95% CI 1.04–1.15); pulmonary infiltrates (OR=1.63; 95% CI 1.23–2.15) and MV need (OR= 5.88; 95% CI 1.68–20.6) were independently associated with ICU mortality.

**CONCLUSION.** Critical illness from 2009 influenza A(H1N1)v in Spain occurred in young individuals. The main clinical presentation was respiratory failure and a high case-fatality rate was observed when invasive mechanical ventilation was required. Severity of illness at ICU admission, pulmonary infiltrates and need of mechanical ventilation were variables associated with ICU mortality.

## 0930

### USE OF CORTICOSTEROID THERAPY IN PATIENTS AFFECTED BY SEVERE PANDEMIC (H1N1)V INFLUENZA A INFECTION

I. Martin-Loeches[1], T. Lisboa[1], A. Rhodes[2], R. Moreno[3], E. Silva[4], C. Sprung[5], J. Chiche[6], D. Barahona[7], D. Villabon[8], C. Balasini[9], R. Pearse[10], J. Rello[11], the ESICM H1N1 Registry Contributors

[1]Critical Care Department, Joan XXIII University Hospital, University Rovira i Virgili, IISPV, CIBER Enfermedades Respiratorias (CIBERes), Tarragona, Spain, [2]Critical care Department, St George's Healthcare NHS Trust, London, UK, [3]Unidade de Cuidados Intensivos Polivalente, Hospital de St António dos Capuchos, Centro Hospitalar de Lisboa Central, E.P.E., Lisboa, Portugal, [4]ICU, Hospital Israelita Albert Einstein, Sao Paulo, Brazil, [5]Department of Anesthesiology and Critical Care Medicine, Hadassah Hebrew University Medical Center, Jerusalem, Israel, [6]Service de Réanimation Médicale, Hôpital Cochin (AP-HP), Université Paris Descartes, Unité Inserm U567, 75014, Paris, France, [7]Unidad de Cuidados Intensivos, Hospital Eugenio Espejo, Quito, Ecuador, [8]Unidad de Cuidados Intensivos, Hospital de San José, Bogota, Colombia, [9]Unidad de Cuidados Intensivos, Hospital San Martín, La Plata, Buenos Aires, Argentina, [10]Barts and The London School of Medicine and Dentistry, Queen Mary's University of London, Royal London Hospital, London, UK, [11]Critical Care Department, Vall d'Hebron University Hospital, Institut de Recerca Vall D'Hebron, University Autonoma Barcelona, CIBER Enfermedades Respiratorias (CIBERes), Barcelona, Spain

**INTRODUCTION.** The use of corticosteroid therapy in patients affected by Pandemic H1N1 Influenza A infection although relatively common remains controversial.

**OBJECTIVE.** To assess the effect on survival of corticosteroid therapy in a cohort of patients hospitalized with a severe presentation of pandemic (H1N1)v Influenza A infection in Intensive Care Unit (ICU). Our goal was to evaluate the rational use of corticosteroid therapy and specially in patients under mechanical ventilation their potential beneficial role.

**METHODS.** Prospective, observational, multi-center study conducted in intensive care (ICU). We reviewed demographic and clinical data reported from June 23 through to February 11, 2009, for all Pandemic H1N1 Influenza A infections reported in the ESICM H1N1 registry.

**RESULTS.** Two hundred and twenty patients with completed outcomes from the ESICM H1N1 registry were analyzed in this study. All patients had either suspected, probable or confirmed pandemic H1N1 Influenza A infection and were being cared for in an ICU. Of these 113 patients were male (51.4%) with a median age of 43 (IQR 32-55) years, and 188 (85.5%) were aged over 60 years. The mean SAPS3 score was 53.02 ± 16.2 and the mean SOFA score was 8.2 ± 4.2 on admission. Mechanical ventilation was being used in 171 (77.7%) of the patients, 155 (70.5%) with invasive modes and 65 (29.5%) non-invasive. 67 of these patients died on the ICU (30.5%) and 75 (34.1%) whilst in hospital.One hundred and twenty-six (57.3%) of the analyzed patients received corticosteroid therapy. The mean duration of corticosteroid therapy in survivors was 10.3 (SD 11.7) days. Patients who received corticosteroid were significantly older and had asthma and COPD more frequently. These patients also had more frequent episodes of hospital acquired pneumonia (13.8 vs. 26.2%, $p < 0.05$ (OR 2.2 (CI 1.1–4.5). Patients who received corticosteroid had significantly higher mortality than patients who did not (46.0 vs. 18.1% $p < 0.01$ OR 3.8 CI 2.1-7.2). In 126 patients receiving corticosteroid therapy, a Cox regression analysis adjusted for severity and potential confounders identified that using corticosteroid was not significantly associated with higher mortality (HR 1.3 95% CI 0.74-2.45, p = 0.32). Moreover, when only patients under mechanical ventilation were analysed (n=155), similar results were observed with the corticosteroid therapy group (HR 1.54 95% CI 0.82-2.91, p = 0.17).

**CONCLUSIONS.** The use of corticosteroids for patients affected by Pandemic H1N1 Influenza A infection did not result in better outcomes and was associated with an increased risk of superinfections.

**GRANT ACKNOWLEDGMENT.** Endorsed by European Critical Care Research Network (ECCRN) of the European Society of Intensive Care Medicine (ESICM).

## 0931

### IMPACT OF CORTICOSTEROID THERAPY ON MORTALITY IN CRITICALLY ILL PATIENTS AFFECTED BY INFLUENZA A (H1N1)V PNEUMONIA IN SPAIN

A. Rodríguez[1,2], R. Zaragoza[3], L. Macaya[4], A. Marques[5], M. Martín[6], F. Fernández[7], B. Santamaria[8], N. Carrasco[9], F. Mariscal[10], A. Rovira[11], J.C. Pozo[12], J. Blanco[13], J. Cambronero[14], A. Canabal[15], I. Catalán[16], J. Montón[17], R. Reig[18], I. Navarrete[19], J. Latour[20], J. Rello[21,22,23], H1N1 SEMICYUC Working Group

[1]Hospital Universitario Joan XXIII, Critical Care, Tarragona, Spain, [2]CIBERes, URV, IISPV, Tarragona, Spain, [3]Hospital Universitario Dr. Peset, Valencia, Spain, [4]Hospital Virgen del Camino, Navarra, Spain, [5]Hospital de la Ribera, Alzira, Spain, [6]Hospital de la Candelaria, Tenerife, Spain, [7]Clínica Delfos, Barcelona, Spain, [8]Hospital Basurto, Bilbao, Spain, [9]Hospital La Princesa, Madrid, Spain, [10]Hospital Infanta Sofía, Madrid, Spain, [11]Hospital General L'Hospitalet, Barcelona, Spain, [12]Hospital Reina Sofía, Córdoba, Spain, [13]Hospital Rio Hortega, Valladolid, Spain, [14]Hospital Príncipe de Asturias, Madrid, Spain, [15]Hospital Virgen de la Salud, Toledo, Spain, [16]Hospital Sant Joan de Deu, Manresa, Spain, [17]Hospital Obispo Polanco, Teruel, Spain, [18]Hospital General de Castellón, Castellón, Spain, [19]Hospital Virgen de las Nieves, Granada, Spain, [20]Hospital de Elche, Elche, Spain, [21]Hospital Universitario Vall d'Hebron, Barcelona, Spain, [22]Instituto de Investigación Vall d'Hebron, Barcelona, Spain, [23]CIBERes, Barcelona, Spain

**INTRODUCTION.** The use of corticosteroid therapy (CT) in patients with pneumonia due to influenza (H1N1)v remains controversial. In addition, the use of *corticosteroids* in septic *shock* has been a subject of continued debate and is oftenly administered as coadjuvant therap. The impact of CT in critically ill patients affected by severe pandemic (H1N1)V influenza A infection might be different according the population assessed.

OBJETIVES: To describe the use of corticosteroids (CS) and its impact on mortality according to the administration either hydrocortisone (HC) or methilprednisolone (MP) in patients affected by severe pandemic (H1N1)V influenza A infection with primary viral pneumonia.

**METHODS.** Prospective, observational, multi-center study conducted in 148 Spanish intensive care units (ICU. We reviewed demographic and clinical data form GTEI/SEMICYUC database reported from April 23 through February 11, 2010, for all Pandemic H1N1 Influenza A infection confirmed by RT PCR assay. Only episodes with primary viral pneumonia were analyzed. Patients who received HC and MP were compared with patients without CS (control group).

**RESULTS.** Four-hundred and twenty-nine patients with completed outcomes were analyzed. All patients received antiviral treatment on admission. Patients were young (median 44.0 [IQR 33–54] and 55.7% were males. Median APACHE II score was 12 (IQR 8–17) and median SOFA score was 4 (IQR 3–7). CS treatment was administered in 40% (n=172) of patients. Patients with CS had higher APACHE II score (14.3 ± 7.5 vs. 12.5 ± 6.6, $p < 0.01$), more need of mechanical ventilation (76.7 vs. 66.9, p=0.02) and asthma more frequently (13.4 vs. 7%, p=0.03) than those who did not. The overall mortality was 21.8% (n=99). Patients who received corticosteroid did not have a significantly higher mortality than patients who did not (23.8 vs. 18.3%, p=0.16). Within patients CS, 34 (19.7%) received HC (mean dose 260 ± 100 mg) for a median of 8 (IQR 4–10 days). One-hundred thirty-eight received MP (mean dose 98 ± 50 mg) for a median of 7 (IQR 5–13 days). Mean APACHE II (18.3 ± 6 vs. 13.1 ± 6.4), mean SOFA (8.4 ± 4.8 vs. 5.0 ± 2.7), presence of shock (67.7 vs. 34.3%) and mortality (48.4 vs. 18.7%) were higher ($p < 0.01$) for HC patients. A Cox regression analysis adjusted for severity (APACHE II and SOFA) and potential confounders' factors (MV and shock) identified that CS use was not significantly associated with mortality (HR=0.74, 95% CI 0.41–1.31; p=0.30).

**CONCLUSIONS.** Mortality in patients with influenza A(H1N1)v pneumonia was not influenced by the use of corticosteroids.

## 0932

### CRITICALLY ILL ADULT PATIENTS WITH 2009 INFLUENZA A(H1N1) INFECTION IN FRANCE

J.-C.M. Richard[1], L. Brochard[2], A. Mercat[3], C. Brun-Buisson[2], for the REVA-GRIPPE-SRLF Registry

[1]CHU Charles Nicolle, Rouen, France, [2]AP-HP CHU Henri Mondor, Créteil, France, [3]CHU Hôtel-Dieu, Angers, France

**OBJECTIVES.** To describe the main characteristics, risk factors, treatment and outcome of ICU patients with severe illness caused by 2009 *Influenza* A (H1N1) infection.

**METHODS.** Prospective observational survey in ICUs affiliated to the French Society of Intensive Care (SRLF); physicians were invited to report on a dedicated web-based registry all patients admitted in ICU with probable or confirmed A (H1N1) *influenza* infection.

**RESULTS.** From July, 25th to February, 10th, 2010, 548 patients aged >15 years with suspected severe A(H1N1) related illness were admitted to 103 ICUs, of which 509 were laboratory confirmed (PCR). An underlying condition was present in 433 of the 548 patients (79%), mostly obesity (BMI >30; 29%); immunodepression (22%); chronic respiratory disease (21%), asthma (10%); and pregnancy (5%). Antiviral therapy (oseltamivir 94%) was administered to 508 (93%) and corticosteroids (for pneumonia or associated shock) to 124 patients (23%). Mechanical ventilation (MV, invasive or noninvasive) was provided to 406/548 (74%) with a mortality of 25%, whereas only 3% of the 142 patients treated without MV died (Table 1). Among patients receiving MV, 318 (78%) presented clinical findings compatible with the acute respiratory distress syndrome (ARDS); their median duration of ICU stay was 23 days, and their hospital mortality 28%; 55 of these ARDS patients (17%) received ECMO, 21 of whom died (38%). Death during *influenza* was associated with age, male sex, immunodepression, higher severity, but not with obesity or pregnancy.

**TABLE 1** RESULTS ARE EXPRESSED AS MEAN + SD

| | N | Age | Female | BMI>30 | Pregnant | Immunodep | No comorb. | SAPS3 | Mortality |
|---|---|---|---|---|---|---|---|---|---|
| All | 548 | 47 ± 16 | 48% | 29% | 5% | 23% | 21% | 53 ± 17 | 19% |
| MV | 406 | 49 ± 15 | 48% | 33% | 4% | 26% | 20% | 57 ± 17 | 25% |
| No MV | 142 | 42 ± 17 | 48% | 17% | 7% | 16% | 24% | 41 ± 13 | 3% |
| ARDS | 318 | 48 ± 15 | 48% | 35% | 4% | 27% | 22% | 58 ± 17 | 28% |
| ECMO | 55 | 41 ± 14 | 62% | 44% | 16% | 25% | 20% | 64 ± 18 | 38% |
| Death | 105 | 53 ± 17 | 45% | 29% | 2% | 44% | 19% | 70 ± 19 | 100% |

**CONCLUSIONS.** This large cohort of critically ill patients with 2009 A(H1N1) *influenza* infection admitted to French ICUs during the pandemic period corroborates risk factors and population characteristics previously described. The high proportion of MV requirements parallels the presence of ARDS associated with a 28% mortality rate in this subgroup, which confirms the severity of 2009 A(H1N1) *influenza* related disease.

**GRANT ACKNOWLEDGMENT.** The registry was made possible thanks to grants from Société de Réanimation de Langue Française (SRLF), the French Agency ANRS and the French Minister of Health.

## 0933

### COMPARATIVE STUDY OF PATIENTS ADMITTED IN INTENSIVE CARE WITH INFLUENZA A (H1N1)V. COMPARATIVE STUDY OF EUROPE VERSUS LATIN AMERICA. RESULTS OF THE ESICM INFLUENZA A (H1N1)V REGISTRY

R.G. Matos[1], R.P. Moreno[1], A.C. Diogo[1], J.M. Pereira[2], I. Martin-Loeches[3], M. Cecconi[4], T. Lisboa[5], A. Rhodes[6], E. Silva[7], J. Rello[8], Steering Committee of the Influenza A (H1N1)v ESICM Registry

[1]Centro Hospitalar de Lisboa Central, E.P.E., UCIP, Lisbon, Portugal, [2]Hospital de Sao João, Intensive Care, Porto, Portugal, [3]Joan XXIII University Hospital, CIBERes Enfermedades Respiratorias IISPV, Critical Care, Tarragona, Spain, [4]St Georges University of London, Intensive Care, London, UK, [5]Hospital das Clínicas de Porto Alegre, Critical Care, Porto Alegre, Brazil, [6]St. George's Hospital, Intensive Care, London, UK, [7]Hospital Albert Einstein, Intensive Care, São Paulo, Brazil, [8]Vall d'Hebron Univ. Hospital, Intensive Care, Barcelona, Spain

**OBJECTIVES.** To compare patients admitted in the Intensive Care Unit (ICU) due to pandemic Influenza A (H1N1)V virus in Latin America versus those from Europe.

**METHODS.** Prospective, multicentre, observational cohort study in patients admitted to ICUs of 23 European countries and 7 Latin American Countries. Data were collected through a web-based eCRF (European Society of Intensive Care Medicine Influenza A (H1N1)V Registry).

**RESULTS.** Out of 512 patients with registered ICU outcome, a total of 503 episodes of pandemic Influenza A (H1N1)v infections in critical care with known origin were analysed: 431 from Europe (235 males and 196 females) and 70 from Latin America (38 males and 32 females). The mean age was 41 (±16) years in Europe and 47 (±20) in Latin America. The mean APACHE II score was 21 (±9) and 26 (±7), with a corresponding probability of death of 26 (±23)% and 36 (±23)%. Comorbidities were common (Table 1) and presentation was more severe in Latin American patients: severe hypoxemia (81.4 vs. 42.0%); ARDS (82.9 vs. 33.3%); shock (62.9 vs. 18.9%) and acute renal failure (ARF) (27.1 vs. 11.8%). Invasive mechanical ventilation was used more frequently in Latin America (90 vs. 67%, $p < 0.001$) and renal replacement techniques (RRT) (19 vs. 5%, p=0.001). NIV; ECMO and prone positioning were more commonly used in Europe (41%; 14 and 18%). Vasopressors (64 vs. 31%, $p < 0.001$), and corticosteroids (50 vs. 41%, p NS) were used more in Latin America. Antiviral and antimicrobial therapy was used in almost all patients in both continents. Mortality rates were higher in Latin America (28 days: 21 vs. 60%; ICU: 21 vs. 60%; Hospital: 31 vs. 67%).

**CONCLUSIONS.** Latin American patients were older, had more co-morbidities (COPD and diabetes) but less cancer and lower values of BMI. They had a greater severity of disease at ICU admission, and a higher incidence of ARDS, ARF and shock with an outcome significantly and consistently worse.

**TABLE 1**

| Patient comorbidities | Europe (%) | Latin America (%) | Total population (%) | p |
|---|---|---|---|---|
| Asthma | 39 (9) | 2 (3) | 41 (8) | <0.001 |
| COPD | 74 (17) | 17 (24) | 91 (18) | NS |
| Diabetes type 1 and 2 | 57 (13) | 12 (17) | 69 (14) | NS |
| Hematological malignancy | 26 (6) | 2 (3) | 28 (6) | 0.001 |
| Metastatic cancer | 3 (7) | 1 (1) | 4 (8) | 0.003 |
| Immunosupression | 32 (7) | 3 (4) | 35 (7) | NS |
| Chronic renal failure | 19 (4) | 4 (6) | 23 (5) | <0.001 |
| Steroids | 127 (29) | 0 | 127 (25) | <0.001 |
| BMI >35 | 98 (27) | 11 (16) | 109 (26) | NS |

**GRANT ACKNOWLEDGMENT.** ECCRN/ESICM

# From cardiovascular monitoring to treatment: 0934–0938

## 0934

### CARDIOVASCULAR DYSFUNCTION INDUCED BY COMBINED BURN AND SMOKE INHALATION INJURY IS ATTENUATED BY MAINTAINING PHYSIOLOGICAL PLASMA LEVELS OF ANTITHROMBIN

S. Rehberg[1,2], E. Bartha[1], Y. Yamamoto[1], L. Sousse[1], L.D. Traber[1], C. Szabo[1], D.L. Traber[1], P. Enkhbaatar[1]

[1]The University of Texas Medical Branch, Department of Anesthesiology, Galveston, USA, [2]University Hospital of Muenster, Department of Anaesthesiology and Intensive Care Medicine, Muenster, Germany

**INTRODUCTION.** Plasma levels of antithrombin (AT) are reduced by 50% in burn patients. Myocardial dysfunction following burn and smoke inhalation injury is mediated via the p38 alpha mitogen-activated protein kinase (app38-MAPK) pathway.[1]

**OBJECTIVES.** We tested the hypothesis that maintaining physiological plasma levels of AT reduces the cardiovascular dysfunction associated with combined burn and smoke inhalation injury in a prospective, randomized study using an established ovine model.

**METHODS.** After 5 days of recovery, a tracheostomy, a 40% total body surface area 3rd degree cutaneous burn and smoke inhalation (48 breaths of cold cotton smoke) were performed in 12 chronically instrumented sheep under deep anesthesia. The sheep were then randomly assigned to receive either an iv infusion of 6 U/kg/h recombinant human antithrombin III (rhAT) started 1 h after injury or normal saline (n=6 each). All sheep were awake, mechanically ventilated and fluid resuscitated according to standard formulas during the 48 h study period. Myocardial tissues were analyzed by immonohistochemistry for app38-MAPK, interleukin-6 (IL-6), IL-8 and tumor necrosis factor alpha (TNF alpha). Data are expressed as mean ± SE.

**RESULTS.** Whereas AT plasma levels decreased to 66% of baseline (BL) in controls, infusion of rhAT maintained AT plasma levels at BL level. No statistical differences among groups could be shown in mean arterial pressure and cardiac index. Heart rate was lower in the rhAT than in the control group (24 h: 132 ± 8 vs. 158 ± 10 beats/min, p=0.012; 48 h: 121 ± 6 vs. 159 ± 9 beats/min, p=0.001). Myocardial contractility was increased in rhAT-treated sheep as represented by higher left ventricular stroke work indexes (24 h: 69 ± 5 vs. 42 ± 7 g•m/m$^2$, p=0.012; 48 h: 68 ± 3 vs. 48 ± 5 g•m/m$^2$, p=0.009) at lower left atrial pressures (24 h: 10 ± 1 vs. 12 ± 1 mmHg, p=0.049; 48 h: 8 ± 1 vs. 16 ± 1 mmHg, p < 0.001). Whereas plasma protein levels (24 h: 4.6 ± 0.1 vs. 4.0 ± 0.0 mg/dL; p=0.009); 48 h: 4.9 ± 0.2 vs. 3.7 ± 0.2 mg/dL; p < 0.001) were higher, cumulative net fluid balance (24 h: 2,179 ± 369 vs. 3,037 ± 155 mL, p=0.007; 48 h: 1,086 ± 572 vs. 4.125 ± 250 mL, p=0.027) was lower in the rhAT group than in control animals. Immunohistological analyses of myocardial tissues revealed that compared to controls the activation of app38-MAPK (p < 0.001) and the concentrations of IL-6 (p=0.012), IL-8 (p=0.009) and TNF alpha (p=0.011) were reduced in rhAT-treated animals. Plasma levels of nitric oxide (NO) were lower in the rhAT than in the control group (24 h: 5.2 ± 1.3 vs. 2.0 ± 0.8 μM, p=0.058; 48 h: 11.0 ± 2.0 vs. 1.8 ± 0.6 μM, p=0.001).

**CONCLUSIONS.** Continuous infusion of rhAT maintains physiological plasma levels of AT, improves myocardial function and reduces systemic vascular permeability after combined burn and smoke inhalation injury. The attenuation of NO production, myocardial app38-MAPK activation and subsequent reduction in inflammatory cytokines might represent potential mechanisms.

**REFERENCE(S).** 1. Carlson et al. 2006;27:669–75

## 0935

### THERMODILUTION-DERIVED INDICES FOR ASSESSMENT OF RIGHT AND LEFT VENTRICULAR CONTRACTILITY IN NORMAL AND IMPAIRED CARDIAC FUNCTION

C. Trepte[1], V. Eichhorn[1], P. Richter[1], M. Goepfert[1], J.C. Kubitz[1], A.E. Goetz[1], D.A. Reuter[1]

[1]University Medical Centre Hamburg-Eppendorf, Hamburg, Germany

**INTRODUCTION.** Assessment of cardiac contractility provides valuable information for management of hemodynamic instability in critically ill patients. Up to now, only few data exits on the validity of thermodilution-derived parameters of cardiac contractility.

**OBJECTIVES.** The aim of this study was to compare pulmonary artery thermodilution derived parameters (right ventricular ejection-fraction) and transcardiopulmonary thermodilution derived parameters (global ejection fraction, GEF; cardiac function index, CFI) of cardiac contractility to direct measurement of left ventricular peak systolic pressure built up over time during normal and acutely impaired cardiac function in different states of intravascular filling.

**METHODS.** The study was approved by the local Governmental Commission on the Care and Use of Animals. Sixteen anesthetized domestic pigs were included in this study. Measurement of left ventricular contractility ($dP/dt_{LV}$) was performed using an electronic mikro-tip manometer (SPC 350, Millar Instruments, Houston, TX, USA), that was placed directly in the left ventricle. RVEF was calculated using pulmonary artery thermodilution, GEF and CFI were assessed by transcardiopulmonary thermodilution. Measurements were performed before and after withdrawal of 20 ml/kg bodyweight blood. After re-transfusion and hemodynamic stabilization cardiac contractility was acutely impaired by continuous infusion of verapamil. Thereafter measurements were repeated during normo- and hypovolemia.

**RESULTS.** During normal cardiac function significant correlations with $dP/dt_{LV}$ could be shown for RVEF(r=0.55; p < 0.005), GEF (r=0.49; p < 0.01) and CFI (r=0.53; p < 0.005). Application of verapamil infusion led to a reduction of $dP/dt_{LV}$ from 2,104 ± 390 mmHg/s to 733 ± 141 mmHg/s. During impaired cardiac function again tight correlations with $dP/dt_{LV}$ were found for RVEF (r=0.57; p < 0.001), GEF (r=0.79; p < 0.001) and CFI (r=0.703;p < 0.001).

**CONCLUSIONS.** In this experimental model both, pulmonary artery and transcardiopulmonary thermodilution derived parameters of cardiac contractility, correlated well with direct measurement of left ventricular peak systolic pressure built up over time during normal and experimentally impaired cardiac function, both, during hypo- and normovolemia.

**REFERENCE(S).** Jabot J et al. Cardiac function index provided by transpulmonary thermodilution behaves as an indicator of left ventricular systolic function. Crit Care Med. 2009;37 (11):2913–8

- Combes A et al. Estimation of left ventricular systolic function by single transpulmonary thermodilution. Intensive Care Med. 2004;(30):1377–83.

## 0936

### PRE-ADMISSION BETA-BLOCKER USE AND 30-DAY MORTALITY AMONG PATIENTS IN INTENSIVE CARE: A COHORT STUDY

S. Christensen[1,2], M.B. Johansen[1], E. Tønnesen[2], A. Larsson[2], S. Lemeshow[3], L. Pedersen[1], H.T. Sørensen[1]

[1]Aarhus University Hospital, Clinical Epidemiology, Aarhus, Denmark, [2]Aarhus University Hospital, Department of Anesthesiology and Intensive Care, Aarhus C, Denmark, [3]Division of Biostatistics, College of Public Health, Ohio State University, Columbus, USA

**INTRODUCTION.** Beta-blockers have cardioprotective, metabolic and immunomodulating effects that may be beneficial in patients in intensive care (1).

**OBJECTIVES.** We examined whether preadmission beta-blocker use was associated with 30-day mortality following intensive care.

**METHODS.** For this cohort study we identified 8087 patients older than 45 years of age admitted for the first time at three multidisciplinary Intensive Care Units (ICUs) within the Aarhus University Hospital network, Denmark between 1999 and 2005. Data on beta-blocker use, use of other cardiovascular medications, diagnosis, comorbidity, surgery, markers of socio-economic status, data on laboratory tests at ICU admission, and complete follow-up for mortality were obtained from medical databases. In a propensity score matched analysis based on the entire covariate profile of study patients we matched all 1,556 beta-blocker users (19.2% of the entire cohort) with 1,556 non-users. We computed probability of death within 30-days following ICU admission for beta-blocker users and non-users, and odds ratio (OR) of death as a measure of relative risk using conditional logistic regression.

**RESULTS.** In the propensity score matched analysis 30-day mortality was 25.7% among beta-blocker users and 31.4% among non-users. This corresponds to an OR of beta-blocker users compared with non-users of 0.74 (95% CI: 0.63–0.87). The OR was 0.69 (95% CI: 0.54–0.88) for surgical ICU patients and 0.71 (95% CI: 0.51–0.98) for medical ICU patients. Among users of non-cardio selective beta-blockers the OR was 0.99 (95% CI: 0.67–1.47), 0.66 (95% CI: 0.35–1.23) among users of non-cardio selective beta-blocker combined with alpha-adrenergic blocker, however, the relatively small number of patients in these categories resulted in risk estimates with low precision. The OR for cardio-selective beta-blockers was 0.70 (95% CI: 0.58–0.83). The OR for new users of beta-blockers was 0.57 (95% CI: 0.38–0.85) and 0.78 (95% CI: 0.66–0.92) for long-term users. Including all 8087 ICU patients in a logistic regression analysis with no matching revealed an overall adjusted OR for beta-blocker use compared with no use of 0.78 (95% CI: 0.68–0.91)].

**CONCLUSIONS.** Preadmission use of beta-blockers was associated with reduced mortality within 30 days following ICU admission.

**REFERENCE(S).** 1. Novotny NM et al. Beta-Blockers in sepsis: reexamining the evidence. Shock. 2009

## 0937

### LOW DOSE OF INTRAVENOUS AMIODARONE FOR THE PREVENTION POST-OPERATIVE ATRIAL FIBRILLATION IN CABG PATIENTS

D. Markovic[1], M. Radovic[1], M. Terzic[1], L. Soskic[1], N. Kovacevic Kostic[1], M. Minic[1]

[1]Clinical Center of Serbia, Anesthesia Department, Belgrade, Serbia

**INTRODUCTION.** Postoperative atrial fibrillation (AF) occurs in 11–40% of patients after coronary-artery bypass grafting. AF is usually transient and benign problem, although it may be associated with an increased risk of mortality and morbidity (stroke, heart failure, myocardial infarction, thromboembolism), and an increased costs and hospital stay.

**OBJECTIVES.** The aim of this study was to investigate whether a low dose of amiodaron could reduce the occurence of atrial fibrillation after coronary artery surgery.

**METHODS.** After obtaining IRB approval and written, informed consent, 140 patients without preoperative history of AF, aged >18 year, scheduled for CABG were included in a prospective, double-blind, randomized study. Patients were randomly assigned to receive either IV amiodarone 450 mg/500 ml saline (n = 70) or 500 ml saline placebo infusion (n = 70) started 24 h after surgery at a constant infusion rate of 30 ml/h. Rhythm, heart rate, and systemic arterial blood pressure were continuously monitored during fist 72 postoperative hours. Occurrence of atrial fibrillation was noted. Values of heart rate and blood pressure were noted 6 h (T1), 12 h (T2), and 24 h (T3) after infusion start. Statistical analysis was performed using Student's *t* test and Fisher's exact test, as appropriate. A $p$ value < 0.05 was regarded as significant.

**RESULTS.** The two groups were similar with respect to demographic, clinical and surgical characteristics. The incidence of atrial fibrillation was significant lower in patients who received amiodarone (4/70; 5.7%) than in placebo group (11/70; 15.7%). There were no differences between the study groups regarding systolic arterial pressure in all of referential times, whereas heart rate was significantly slower at T3 referential time in patients who received amiodarone (Table 1). There were no adverse events related to the study drug, anesthesia or surgical procedure.

**CONCLUSIONS.** Postoperative low-dose intravenous amiodarone (450 mg) significantly reduces the incidence of atrial fibrillation after coronary artery bypass grafting.

**TABLE 1** POSTOPERATIVE ATRIAL FIBRILLATION AND HAEMODINAMIC

| | Amiodarone group (n=70) | Placebo group (n=70) | P value |
|---|---|---|---|
| Atrial fibrillation | 5.7% | 15.7% | p <0.05 |
| TA (mmHg) T1 | 113 ± 15 | 115 ± 12 | p>0.05 |
| TA (mmHg) T2 | 111 ± 10 | 109 ± 13 | p>0.05 |
| TA (mmHg) T3 | 115 ± 15 | 114 ± 15 | p>0.05 |
| HR (b/min) T1 | 85 ± 14 | 86 ± 12 | p>0.05 |
| HR (b/min) T2 | 84 ± 12 | 86 ± 13 | p>0.05 |
| HR (b/min) T3 | 79 ± 10 | 87 ± 17 | p <0.05 |

**REFERENCE(S).** 1. Joel Dunning, Tom Treasure, Michael Versteegh, Samer AM Nashef. Guidelines on the prevention and management of de novo atrial fibrillation after cardiac and thoracic surgery. Eur J Cardiothorac Surg. 2006;30:852–72

2. Erkan Kuralay,Faruk Cingoz, Selim Kilic et al. Supraventricular tachyarrythmia prophylaxis after coronary artery surgery in chronic obstructive pulmonary disease patients (early amiodarone prophylaxis trial). Eur J Cardiothorac Surg. 2004;25:224–30.

## 0938

### PULSE PRESSURE ANALYSIS CARDIAC OUTPUT MONITORING, A META-ANALYSIS

M. Cecconi[1], L. Spagnesi[2], M. Hamilton[3], M. Grounds[3], C.K. Hofer[4], G. Della Rocca[2], A. Rhodes[3]

[1]General Intensive Care, St George's Hospital, London, UK, [2]University of Udine, Department of Anaesthesia and Intensive Care, Udine, Italy, [3]St George's Hospital, General Intensive Care, London, UK, [4]Triemli City Hospital, Institute of Anaesthesiology and Intensive Care Medicine, Zurich, Switzerland

**INTRODUCTION.** Pulse Pressure Analysis refers to monitors that can track stroke volume (SV) and cardiac output (CO) continuously from the analysis of the arterial pressure waveform. There are different monitors available on the market: PiCCO*plus* (Pulsion, Munich, Germany), LiDCO$^{TM}$*plus* and LiDCO$^{TM}$*rapid* (LidCO, Cambridge, UK), Flotrac Vigileo System (Edwards Lifesciences, Irvine, USA) and PRAM (Vytech, Padova, Italy).

**OBJECTIVES.** To analyse validation data for devices based on pulse pressure analysis algorithms.

**METHODS.** We searched on Medline and EMBASE for cardiac output validation studies on pulse pressure analysis. We collected data on bias, limits of agrement (2SD) and where available percentage error (PE). Analysis of the PE based on different levels of precision of the reference technique were performed as described by Cecconi et al. [1] For PiCCOplus and LiDCO$^{TM}$*plus* studies assessing the accuracy and the precision of the calibration technique against the pulmonary artery catheter were also analysed.

**RESULTS.** 75 articles were initially identified: 21 articles for the PiCCO system, 18 for the LiDCO system, 13 for the PRAM and 23 for the Vigileo.

After exclusion of studies not reporting Bland–Altman Analysis in adult patients the following number of studies were selected: 9 for PiCCO system transpulmonary thermodilution, 6 for the PiCCO system pulse contour analysis, 4 for the LiDCO lithium dilution, 5 for the LiDCO PulseCO pulse power analysis, 21 for the Vigileo pulse pressure analysis, 4 for the PRAM pulse pressure analysis. Number of patients and of observation, mean CO, 2SD, PE for each monitor are summarized in Table 1. Estimated coefficient of variation (CV) of the technique based on different levels of CV of the reference technique (5, 10 and 15%) are also reported.

**CONCLUSIONS.** There was acceptable bias for all techniques. PiCCO and LiDCO systems showed the best percentage error. Vigileo. 2nd and 3rd generation of software showed a marked improvement in precision with respect to the 1st generation of software.

**TABLE 1**

| Device | Patients (n) and Data Pairs (n) | Data Pairs (n) | Mean CO L/min | Mean Bias L/min | 2 SD L/min | PE (%) | Estimated CV for CV reference at 5% (%) | Estimated CV for CV reference at 7.5% (%) | Estimated CV for CV reference at 10% (%) |
|---|---|---|---|---|---|---|---|---|---|
| PiCCO Pulse Contour | 196 | 894 | 4.51 | 0.07 | 1.59 | 25.8 | 11.9 | 10.5 | 8.2 |
| LiDCO PulseCO | 58 | 1896 | 5.02 | −0.04 | 1.40 | 27.4 | 12.8 | 11.5 | 9.4 |
| PRAM | 110 | 300 | 3.51 | −0.04 | 0.79 | 42.1 | 20.4 | 19.6 | 18.5 |
| Vigileo 1st generation | 479 | 3657 | 5.69 | 0.36 | 2.09 | 51.7 | 25.4 | 24.8 | 23.9 |
| Vigileo 2nd/3rd generation | 156 | 1207 | 4.74 | −0.18 | 1.29 | 33.5 | 16.0 | 14.9 | 13.4 |
| PiCCO Thermodilution | 347 | 2149 | 5.97 | 0.18 | 1.32 | 25.8 | 11.9 | 10.5 | 8.1 |
| LiDCO Lithium Dilution | 54 | 528 | 4.81 | 0.01 | 1.64 | 15.8 | 5.7 | 1.2 | PE not possible from this combination |

**REFERENCES.** Cecconi M et al. Bench-to-bedside review: the importance of the precision of the reference technique in method comparison studies—with specific reference to the measurement of cardiac output. Critical Care. 2009;13:201

# Vascular and traumatic neuro-emergencies: 0939–0943

## 0939

### RELATIONSHIP BETWEEN CATECHOLAMINES AND COMPLICATIONS IN PATIENTS WITH ANEURYSMAL SUBARACHNOID HEMORRHAGE

M. Hravnak[1], S. Poloyac[1], J.K. Yao[1], E. Crago[1], B. Thampatty[1], Y. Khalil[1], M.B. Horowitz[1]

[1]University of Pittsburgh, Pittsburgh, USA

**INTRODUCTION.** Complications occur frequently after aneurysmal subarachnoid hemorrhage (aSAH), but the role of stress, as evidenced by catecholamine expression, has been difficult to demonstrate when exogenous vasopressors or inotropes are administered.

**PURPOSE.** Using a novel assay for metabolites in endogenous tryptophan and tyrosine pathways upstream from epinephrine and serotonin respectively, we hypothesized that increased levels were related to increased post-aSAH complications [elevated cardiac troponin I (cTnI), ventricular tachycardia or fibrillation (VT/VF), left ventricular wall motion abnormality (WMA), elevated admission glucose, delayed cerebra ischemia (DCI), poorer functional outcomes by the Glasgow Outcome Scale (GOS), and death].

**METHODS.** This prospective longitudinal study recruited 123 Neuro ICU patients with Fisher≥2 or Hunt/Hess≥3. Elevated cTnI was peak cTnI≥0.3 ng/ml days 1–5. Holter monitoring identified VT/VF. Two-dimensional echocardiography days 1–5 determined WMA (16-segment model). Admission serum glucose was obtained. Delayed cerebral ischemia (DCI) was identified by neurological deterioration and evidence of abnormal cerebral blood flow. Glasgow Outcome Score at 3 months identified poor outcomes (scores 1-3) and death. High-pressure liquid tomography coupled with a colorimetric multi-electrode array system yielded metabolites from tyrosine (homovanillic acid; HVA; quartiles 1Q< 678, 2Q678-1046, 3Q1047-1629, 4Q>1629 ng/ml) and tryptophan (5-Hydroxyindole-3-acetic acid; 5-HIAA; quartiles 1Q< 552, 2Q552–943, 3Q944–1434, 4Q>1434 ng/ml) pathways in 24-h urine samples (days 1–5 peak). Analyses of complication prevalence between the metabolite quartiles were performed with Chi-square and Fisher's exact tests.

**RESULTS.** Neither HVA nor 5-HIAA were associated with exogenously administered vasopressors (p=0.852 and 0.993 respectively) or inotropes (p=0.738 and 0.816 respectively). Higher quartiles of HVA were associated with increased prevalence of elevated cTnI (p=0.005) and elevated admission glucose (p=0.010) only. Higher quartiles of 5-HIAA were associated with increased prevalence of elevated cTnI (p=0.036), VT/VT (p=0.020), WMA (p=0.024), and poor GOS at 3 months (p=0.018). Neither metabolite was associated with DCI or death.

**CONCLUSIONS.** Higher quartiles of both HVA and 5-HIAA after aSAH are associated with elevated cTnI and glucose, but only 5-HIAA is associated with other indicators of neurocardiac injury and poorer functional outcomes. This suggests that a stronger relationship exists between complications and the tryptophan pathway.

**GRANT ACKNOWLEDGMENT.** NHLBI R01HL074316

## 0940

### EFFECTS OF SELECTIVE MILD HYPOTHERMIA ON EXPRESSION OF FAS LIGAND MRNA IN RATS AFTER TRAUMATIC BRAIN INJURY

W. Qiu[1]

[1]Hangzhou Second Hospital, College of Medicine, Hangzhou Normal University, Department of Neurosurgery, Hangzhou, China

**INTRODUCTION.** Selective hypothermia is a new method in the management of traumatic brain injury, while the mechanism of it still remains unclear.

**OBJECTIVES.** We study the effects of local mild hypothermia on Fas ligand (Fas-L) mRNA in rats after traumatic brain injury.

**METHODS.** Seventy-two Sprague–Dawley rats were randomly divided into sham-operation group, mild hypothermia group and normothermia group. Feeney's model was used to produce traumatic brain injury. Local therapeutic hypothermia was achieved 30 min post injury by surface cooling and maintained for 6 h. The expression of brain Fas-L mRNA was detected by reverse transcription polymerase chain reaction (RT–PCR).

**RESULTS.** The expression of rat brain Fas-L mRNA in the mild hypothermia group was much lower than that in the normothermia group at 6 h, 24 h after injury (0.54, 0.47, 0.41 and 0.67 versus 1.53, 0.917, 1.33 and 1.56, respectively,($p < 0.05$).

**CONCLUSIONS.** Mild hypothermia can downregulate the Fas-L expression of brain tissue in the acute phase of traumatic brain injury.

**REFERENCE(S).** 1. Adamides AA,Winter CD, Lewis PM et al. Current controversies in the management of patients with severe traumatic brain injury[J]. ANZ J Surg. 2006;76:163–74.

2. Qiu WS, Wang WM, Du HY, Liu WG, Shen H, Shen LF et al. Thrombocytopenia after therapeutic hypothermia in severe traumatic brain injury[J]. Chin J Traumatol. 2006;9:238–41.
3. Gluckman PD, Wyatt JS, Azzopardi D et al. Selective head cooling with mild systemic hypothermia after neonatal encephalopathy: multicentre randomised trial[J]. Lancet. 2005;365:663–670.
4. Dzietko M, Boos V, Sifringer M et al. A critical role for Fas/CD-95 dependent signaling pathways in the pathogenesis of hyperoxia-induced brain injury[J]. Ann Neurol. 2008;64(6):664–73.

**GRANT ACKNOWLEDGMENT.** The present study was supported by the Scientific Research Fund of Zhejiang Health Department, the Scientific Research Fund of Hangzhou Health Department and the Scientific Research Fund of Science and Technology Department of Zhejiang, China

## 0941

### IMPACT OF REDUCED CEREBRAL PERFUSION PRESSURE ON OUTCOME AFTER SEVERE TRAUMATIC BRAIN INJURY IS DEPENDENT ON BRAIN TISSUE OXYGEN PRESSURE

M. Oddo[1], J.M. Levine[2], S. Frangos[3], E. Maloney-Wilensky[3], P.D. Leroux[3]

[1]Lausanne University Hospital (CHUV), Department of Intensive Care Medicine, Lausanne, Switzerland, [2]University of Pennsylvania Medical Center, Department of Neurology, Division of Neurointensive Care, Philadelphia, USA, [3]University of Pennsylvania Medical Center, Department of Neurosurgery, Clinical Research Division, Philadelphia, USA

**INTRODUCTION.** Reduced cerebral perfusion pressure (CPP) may worsen secondary damage and outcome after severe traumatic brain injury (TBI), however the optimal management of CPP is still debated.

**STUDY HYPOTHESIS**: We hypothesized that the impact of CPP on outcome is related to brain tissue oxygen tension ($PbtO_2$) level and that reduced CPP may worsen TBI prognosis when it is associated with brain hypoxia.

**DESIGN.** Retrospective analysis of prospective database.

**METHODS.** We analyzed 103 patients with severe TBI who underwent continuous $PbtO_2$ and CPP monitoring for an average of 5 days. For each patient, duration of reduced CPP (< 60 mm Hg) and brain hypoxia ($PbtO_2$ <15 mm Hg for >30 min [1]) was calculated with linear interpolation method and the relationship between CPP and $PbtO_2$ was analyzed with Pearson's linear correlation coefficient. Outcome at 30 days was assessed with the Glasgow Outcome Score (GOS), dichotomized as good (GOS 4–5) versus poor (GOS 1–3). Multivariable associations with outcome were analyzed with stepwise forward logistic regression.

**RESULTS.** Reduced CPP (n=790 episodes; mean duration 10.2 ± 12.3 h) was observed in 75 (74%) patients and was frequently associated with brain hypoxia (46/75; 61%). Episodes where reduced CPP were associated with normal brain oxygen did not differ significantly between patients with poor versus those with good outcome (8.2 ± 8.3 vs. 6.5 ± 9.7 h; P=0.35). In contrast, time where reduced CPP occurred simultaneously with brain hypoxia was longer in patients with poor than in those with good outcome (3.3 ± 7.4 vs. 0.8 ± 2.3 h; P=0.02). Outcome was significantly worse in patients who had both reduced CPP and brain hypoxia (61% had GOS 1–3 vs. 17% in those with reduced CPP but no brain hypoxia; $P < 0.01$). Patients in whom a positive CPP-$PbtO_2$ correlation (r>0.3) was found also were more likely to have poor outcome (69 vs. 31% in patients with no CPP-$PbtO_2$ correlation; $P < 0.01$). Brain hypoxia was an independent risk factor of poor prognosis (odds ratio for favorable outcome of 0.89 [95% CI 0.79–1.00] per hour spent with a $PbtO_2$ <15 mm Hg; $P$=0.05, adjusted for CPP, age, GCS, Marshall CT and APACHE II).

**CONCLUSIONS.** Low CPP may significantly worsen outcome after severe TBI when it is associated with brain tissue hypoxia. $PbtO_2$-targeted management of CPP may optimize TBI therapy and improve outcome of head-injured patients.

**REFERENCE(S).** 1. Bratton SL et al. Guidelines for the management of severe traumatic brain injury. Brain oxygen monitoring and thresholds. J Neurotrauma. 2007;24 Suppl 1:S65–70

## 0942

### EFFECT OF CSF FROM PATIENTS WITH SUBARACHNOID HEMORRHAGE AND VASOSPASM ON ENDOTHELIN-1-RECEPTORS EXPRESSION AND FUNCTION ON ISOLATED RAT BASILAR ARTERY

B. Assenzio[1], E.L. Martin[1], L. Del Sorbo[1], M. Berardino[1], F. Sizzano[1], G. Muraca[1], E. Stankevicius[2], U. Simonsen[2], M. Fontanella[1], R. Boccaletti[1], A. Ducati[1], L. Mascia[1]

[1]University of Turin, Turin, Italy, [2]University of Aarhus, Aarhus, Denmark

**INTRODUCTION.** Several studies support the involvement of endothelin-1 (ET1) in the development of vasospasm after subarachnoid hemorrhage (SAH). However, it is not clear which of the two ET1 receptors, ET1RA and ET1RB, plays a predominant role in the enhanced contraction.

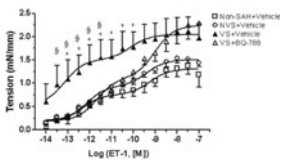
**OBJECTIVES.** Aim of this study was to determine if CSF from patients with or without vasospasm could alter the ET1-receptors expression on isolated cerebral arteries and the individual contribution of ET1RB in the increased contractile sensitivity to ET1.

**METHODS.** CSF collected on day 5 from patients with SAH with (n. 7, VS) or without (n. 7, NVS) vasospasm (diagnosed by angiography) and CSF from patients without SAH (n. 3, Non-SAH), as negative control, were used to stimulate in vitro isolated rat basilar arteries for 24 h. The expression of ET1RA and ET1RB was evaluated by immunofluorescence. In a separate cohort, following CSF incubation, vessels were exposed for 30 min to a specific ET1RB antagonist (BQ-788) or vehicle control, and then mounted on a wire myograph to assess the contractile response to ET1. Significance was determined by a one-way ANOVA with a Tukey post-hoc analysis.

**RESULTS.** Following incubation with CSF from SAH patients with vasospasm, compared to CSF from patients without vasospasm and control CSF, rat basilar arteries showed a significant increased expression of both ET1RA (42.64 $\pm$ 8.52 vs. 30.69 $\pm$ 4.94 vs. 29.41 $\pm$ 8.09 a.u. respectively, $p <$ 0.0.001, expressed as mean $\pm$ SD) and ET1RB (24.14 $\pm$ 2.45 vs. 12.23 $\pm$ 2.27 vs. 8.18 $\pm$ 1.58 a.u. respectively, $p < 0.0.05$), localized on the smooth muscle cell layer. The enhancement of receptors expression corresponded to a bi-phasic increased contractile response of the vessels to ET1, which was significantly prevented during the first phase by the specific inhibition of ET1RB with BQ-788 (Fig. 1, data are expressed as mean±SEM, * $p < 0.05$ VS+Vehicle vs. Non-SAH+Vehicle and NVS+Vehicle, § $p < 0.05$ VS+Vehicle vs. VS+BQ-788).

**CONCLUSIONS.** CSF from patients with vasospasm causes the hyper-expression of both ET1 receptors on the muscle layer of normal cerebral arteries. ET1RB specifically contributes to the increased contractile sensitivity to ET1 at the lowest doses.

**GRANT ACKNOWLEDGMENT.** CIPE, Ricerca Sanitaria Finalizzata-Regione Piemonte




Dose–response curves eliced by ET1.

## 0943

### EFFECT OF INTRAOPERATIVE ADMINISTRATION OF RECOMBINANT ACTIVATED FACTOR VII AND HEMATOMA VOLUME AFTER EARLY SURGERY FOR SPONTANEOUS SUPRATENTORIAL INTRACEREBRAL HEMORRHAGE. A PROSPECTIVE RANDOMIZED SINGLE BLIND STUDY

R. Imberti[1], L. Pietrobono[2], C. Klersy[3], G.A. Iotti[4], G. Cornara[5], D. Radolovich[4], C. Lo Coco[4], B. Mascia[4], C. Arienta[6], C. Bernucci[7], E. Federici[7], G. Ghio[7], F. Della Corte[8], E. Bellotti[8]

[1]Fondazione IRCCS Policlinico S. Matteo, Direzione Scientifica, Pavia, Italy, [2]Fondazione IRCCS Policlinico S. Matteo, Servizio di Radiodiagnostica, Pavia, Italy, [3]Fondazione IRCCS Policlinico S. Matteo, Service of Biometry and Statistics, Research Department, Pavia, Italy, [4]Fondazione IRCCS Policlinico S. Matteo, Anesthesioogy and Critical Care Medicine, Pavia, Italy, [5]Azienda Ospedaliera S. Croce e Carle, Cuneo, Anesthesiology and Critical Care Medicine, Cuneo, Italy, [6]Università di Pavia, Pavia, Italy, [7]Azienda Ospedaliera S. Croce e Carle, Cuneo, Italy, [8]Azienda Ospedaliero-Universitaria "Maggiore della Carità, Novara, Italy

**INTRODUCTION.** Surgery of spontaneous supratentorial intracerebral hemorrhage (ICH), especially if performed early, can be complicated by rebleeding, a condition which can worsen the outcome [1]. Recombinant activated factor VII (rFVIIa) is a potent procoagulant which promotes hemostasis at sites of vascular injury [2, 3].

**OBJECTIVES.** To perform a pilot study to investigate the effect of intraoperative rFVIIa administration on rebleeding in view of a possible, larger study to evaluate the hypothesis that rFVIIa can reduce postoperative rebleeding.

**METHODS.** In this randomized (2:1), open-label, single-blind study, 21 patients with spontaneous supratentorial ICH diagnosed by CT scan were treated with rFVIIa (100 mcg/kg b.w., n=13) or placebo (n=8). Hematoma volume was assessed by CT scan immediately, 18-30 h, and 5–7 days after hematoma evacuation. The primary endpoint was hematoma volume at 18-30 h after surgery. All CT scans were evaluated at one center by the same investigator who was unaware of the treatment. Hematoma volume was measured by dedicated software. The safety of the product was evaluated by performing ECG and venous echoDoppler ultrasound of the lower extremities and by measuring troponin I.

**RESULTS.** At baseline the hematoma volume was 59.2 $\pm$ 27.4 and 71.5 $\pm$ 32.1 ml in the rFVIIa and placebo group, respectively. Hematoma evacuation resulted in significantly smaller ICH volumes, which, however, at 18-30 h after surgery were similar in the rFVIIa and placebo group (15.9 $\pm$ 14.2 ml and 18 $\pm$ 15.1 ml, respectively; mean difference 2.1 ml, 95% confidence interval −12.1 to 16.2, p=0.76). The hematoma volume on the CT scan performed immediately after surgery did not change in the subsequent assessments in any of the patients. The frequencies of deep venous thrombosis, myocardial infarction, troponin I elevation and cerebral ischemia were similar in both groups. As expected from the baseline Glasgow Coma Scale score and hematoma volume, the overall clinical outcome was poor (death or a mRS score of 4-5) and similar in the rFVIIa and placebo group.

**CONCLUSIONS.** This small phase II trial showed that intraoperative rFVIIa administration after early ICH surgery did not modify postoperative hematoma volume. Although our results do not rule out a potential benefit from rFVIIa administration, they do not encourage further investigation of this issue in a larger study.

**REFERENCE(S).** 1. Morgenstern LB et al.: Rebleeding leads to poor outcome in ultra-early craniotomy for intracerebral hemorrhage. Neurology 56:1294–1299, 2001. 2. Mayer SA et al.: Recombinant activated factor VII for acute intracerebral hemorrhage. N Engl J Med 352:777–785, 2005. 3. Mayer SA et al.: Efficacy and safety of recombinant activated factor VII for acute intracerebral hemorrhage. N Engl J Med 358:2127–2137, 2008

# Communication in the ICU: 0944–0949

## 0944

### CAN BURNOUT AMONG CARERS WORKING IN CRITICAL CARE BE AVOIDED BY THE IMPLEMENTATION OF A COMMUNICATION CHARTER?

J.-P. Quenot[1], J.-P. Rigaud[2], K. Chahraoui[3], B. Vallache[4], G. Moutel[5], C. Hervé[5], E. Ferrand[6], P.-E. Charles[1]

[1]University Hospital Dijon, Department of Critical Care, Dijon, France, [2]Centre Hospitalier de Dieppe, Réanimation Polyvalente, Dieppe, France, [3]Université de Bourgogne, Laboratoire de Psychopathologie et Psychologie Médicale, Dijon, France, [4]University Hospital Dijon, Service de prévention des risques psycho-sociaux, Dijon, France, [5]Faculté de Médecine Paris V, Laboratoire d'éthique médicale, Paris, France, [6]CHU Tenon, Département d'Anesthésie et Réanimation, Paris, France

**INTRODUCTION.** Professional burnout syndrome (BOS) was first identified in the 70 s among healthcare workers. It is characterized by a total incapacity to contain stress and emotions at work, or excessive energy expenditure accompanied by feelings of failure or exhaustion. Recent studies have shown that, as well as the high volume of work in critical care units (CCU), BOS can also be caused by communication difficulties in the team, especially when end-of-life decisions need to be made.

**OBJECTIVE.** We evaluated the impact of a communication charter on BOS among healthcare workers (physicians, nurses, nurses' aides) over 2 separate periods.

**METHODS.** The first BOS evaluation took place in 2006 (phase 1), the second in 2008 (phase 2). Between 2006 and 2008, we developed a communication charter based on dialogue between healthcare workers, patients and patients' families. The main points addressed were: daily communication concerning healthcare objectives for each patient; involvement of healthcare workers in the collegiality process defined by French law in 2005 on patients' rights and end-of-life decisions; imparting relevant information to patients (if competent) or their families; entry into palliative care; regular debriefing in order to improve quality of care. In both phases, the Maslach Burnout Inventory (MBI) scale was used to measure BOS, and the Center for Epidemiologic Studies Depression (CES-D) scale to evaluate depression.

**RESULTS.** In total, 53 healthcare workers (84%) participated in phase 1 (4 physicians, 29 nurses, 20 nurses' aides), versus 49 in phase 2 (77%) (4 physicians, 27 nurses, 18 nurses' aides). There was a significant difference between phases 1 and 2 for the three components of MBI: emotional exhaustion (33.4 $\pm$ 4.5 vs. 26.5 $\pm$ 3.9); depersonalization (13.5 $\pm$ 5.3 vs. 9.4 $\pm$ 2.7) and personal accomplishment (41.5 $\pm$ 5.8 vs. 35.4 $\pm$ 4.8), $p < 0.01$. By multivariate analysis, age (>30 years) and number of years working in CCU (>5 years) were the main factors associated with BOS, odds ratios (OR) 1.85 (95% CI 1.34–2.45) and 1.64 (1.45–2.10) respectively. Daily dialogue with physicians (OR 0.87, 95% CI 0.73–0.95), collegial meetings for end-of-life decisions (OR 0.58, 95% CI 0.73–0.95), meetings with patients' families (OR 0.66, 95% CI 0.45–0.76), implementation of palliative care (OR 0.78, 95% CI 0.54–0.87) and daily debriefings (OR 0.42, 95% CI 0.37–0.65) protected against BOS. Symptoms of depression as evaluated by CES-D were significantly lower in phase 2, 14 versus 5% of healthcare workers, phase 1 versus 2 respectively.

**CONCLUSIONS.** Initiating regular, active communication between healthcare workers, paramedical staff, patients and their families seems to be determinant in preventing BOS and depression in critical care.

**GRANT ACKNOWLEDGMENT.** No funding to declare.

## 0945

### IMPACT OF A COLLEGIAL PROCEDURE ON OUTCOME OF PATIENTS HOSPITALISED IN CRITICAL CARE

J.-P. Quenot[1], J.-P. Rigaud[2], K. Chahraoui[3], G. Moutel[4], C. Hervé[4], E. Ferrand[5], P.-E. Charles[1]

[1]University Hospital Dijon, Department of Critical Care, Dijon, France, [2]Centre Hospitalier de Dieppe, Réanimation Polyvalente, Dieppe, France, [3]Université de Bourgogne, Laboratoire de Psychopathologie et Psychologie Médicale, Dijon, France, [4]Faculté de Médecine Paris V, Laboratoire d'éthique médicale, Paris, France, [5]CHU Tenon, Département d'Anesthésie et Réanimation, Paris, France

**INTRODUCTION.** The French law of 22 April 2005 relative to end-of-life decisions [1] stipulates that when a person is unable to express their own wishes, a decision to limit or stop ongoing treatments cannot be made without first implementing a collegial procedure. This procedure must be initiated by the doctor, the patient (pt) (by means of advance directives), close family or a trusted surrogate. The law stipulates that the decision must be reached by the doctor, after consulting the care team, and in concordance with one other doctor, called in as a consultant.

**OBJECTIVE.** We evaluated the impact of this procedure on outcome of patients admitted to the Critical Care Department (ICU) of Dijon University Hospital, France.

**METHODS.** Two period study, January 2000–March 2005 (phase 1) and January 2006-December 2009 (phase 2). Between the 2 phases, our healthcare team (physicians, nurses, psychologist) developed a protocol defining modalities for limiting or stopping treatment in accordance with the 2005 law. It outlines the collegial decision-making procedure, and was implemented at admission or during hospital stay for every patient in the ICU according to clinical severity and expected prognosis. We collected data from all pts who died during ICU stay or in-hospital after discharge from ICU. Data recorded were age, sex, comorbidities, diagnosis at admission, Simplified Acute Physiological (SAPS)-II score, length of stay and ICU or in-hospital mortality. We also noted from medical records whether death was due to limitation or withdrawal of ongoing treatment.

**RESULTS.** In phase 1, 2478 pts were admitted (8-bed ICU); 520(21%) died in the ICU and 158(10%) in-hospital after discharge from ICU. In phase 2, 2940 pts were admitted (11, then 15 bed ICU); 672(23%) died in ICU, and 151(5%) thereafter. Death was more frequently preceded by limitation or withdrawal of treatment in phase 2, be it in ICU (88 vs. 57, $p < 0.01$) or in-hospital (91 vs. 68, p=0.01). The decision to limit/stop treatment was made more rapidly in phase 2 (4.3 [IQR 2–8] vs. 7.5 days [5–17], $p < 0.01$). Length of stay in both ICU and in-hospital was shorter in pts in whom a decision to limit/stop treatment was made (5.8 [IQR 3–12] vs. 12.4 days [IQR 5–36] in ICU, $p < 0.01$ and 9 [IQR 5–17] vs. 17 days [IQR 7–25] in-hospital, $p < 0.01$). Details confirming the collegial nature of the decision were found in the medical record in 63% in phase 1 versus 93% in phase 2 ($p < 0.01$).There was no significant difference in baseline characteristics between the 2 phases.

**CONCLUSIONS.** Our findings show that a formal procedure for deciding to limit or stop ongoing treatment is possible, on condition that the entire caregiving team be involved in the collegial procedure and the ethics of care. Appropriate implementation of this procedure makes it possible to respect current legislation on this point.

**REFERENCE.** Loi no. 2005–370 du 22 avril 2005. http://www.legifrance.gouv.fr

**GRANT ACKNOWLEDGMENT.** No funding to declare.

## 0946

### DOES THE INVOLVEMENT OF RELATIVES AND/OR FAMILY MEMBERS IN THE END OF LIFE DECISION-MAKING PROCESS REDUCE THE OCCURRENCE OF POST-TRAUMATIC STRESS DISORDER?

J.-P. Quenot[1], J.-P. Rigaud[2], K. Chahraoui[3], G. Moutel[4], C. Hervé[4], E. Ferrand[5], P.-E. Charles[1]

[1]University Hospital Dijon, Department of Critical Care, Dijon, France, [2]Centre Hospitalier de Dieppe, Réanimation Polyvalente, Dieppe, France, [3]Université de Bourgogne, Laboratoire de Psychopathologie et Psychologie Médicale, Dijon, France, [4]Faculté de Médecine Paris V, Laboratoire d'éthique médicale, Paris, France, [5]CHU Tenon, Département d'Anesthésie et Réanimation, Paris, France

**INTRODUCTION.** Post-traumatic stress disorder (PTSD) describes a psychological reaction to a traumatic event where a person was exposed to a life-threatening or serious injury or illness that engendered an intense reaction of stress or fear.

**OBJECTIVE.** We sought to determine whether the involvement of relatives and/or family members of patients hospitalised in critical care in the end-of-life decision-making process would reduce the incidence of PTSD.

**METHODS.** The first evaluation of PTSD was performed in 2007 (phase 1) and the second in 2009 (phase 2). Between the two phases, we developed in conjunction with the whole care-giving team, a procedure for communication with patients' families, based on the VALUE approach [1]. In phase 2, relatives and/or family members of patients included in this analysis were met in a specially dedicated family room, by the whole medical team (physician, nurse, nurse's aide). Patients were eligible for inclusion in the analysis if they were hospitalised in the critical care unit and death was considered to be imminent. We contacted a close family member at 3 and 6 months after the patient's death in phases 1 and 2. The primary endpoint was the score on the Impact of Event Scale (IES), which evaluates symptoms related to PTSD [2].

**RESULTS.** In total, 43 families participated in phase 1, and 39 in phase 2. IES score evaluating PTSD was significantly lower in phase 2 ($p < 0.01$). Median scores were respectively 31 [23–44] versus 41 [27–50] at 3 months, and 25 [19–34] versus 32 [23–43], phase 2 versus phase 1 respectively. We observed a significant trend towards decrease PTSD score at 3 and 6 months, regardless of the phase ($p < 0.01$).

**CONCLUSION.** A strategy of communication involving the care-giving team and the family members of patients whose death is imminent in the critical care unit, with a dedicated family room, reduces the incidence of PTSD at 3 and 6 months.

**REFERENCES.** 1. Lautrette A, Darmon M, Megarbane B et al. A communication strategy and brochure for relatives of patients dying in the ICU. N Engl J Med. 2007;356:649–78
2. Yehuda R. Post-traumatic stress disorder. N Engl J Med 2002;346:108–14

**GRANT ACKNOWLEDGMENT.** No funding to declare.

## 0947

### IS THE LEVEL OF SATISFACTION OF FAMILIES OF PATIENTS IN CRITICAL CARE IMPROVED BY THE QUALITY OF THE INFORMATION THEY RECEIVE?

J.-P. Quenot[1], J.-P. Rigaud[2], K. Chahraoui[3], G. Moutel[4], C. Hervé[5], E. Ferrand[6], P.-E. Charles[1]

[1]University Hospital Dijon, Department of Critical Care, Dijon, France, [2]Centre Hospitalier de Dieppe, Réanimation Polyvalente, Dieppe, France, [3]Université de Bourgogne, Laboratoire de Psychopathologie et Psychologie Médicale, Dijon, France, [4]Faculté de Médecine Paris V, Laboratoire d'Éthique Médicale, Paris, France, [5]Faculté de Médecine Paris V, LLaboratoire d'Éthique Médicale, Paris, France, [6]CHU Tenon, Département d'Anesthésie et Réanimation, Paris, France

**INTRODUCTION.** Involving the family in the care-giving process increases satisfaction [1], decreases the futility of care and incidence of conflicts [2] and respects a basic tenet of medical ethics, namely autonomy [3].

**OBJECTIVE.** We evaluated whether improving the quality of information relayed to families during hospitalisation of patients in critical care improved the family's satisfaction with the care given.

**METHODS.** This study was performed over two periods: June 2002–December 2005 (phase 1) and June 2006–December 2009 (phase 2). Between the 2 phases, we developed a communication strategy for patients' families, based on regular meetings in a specially dedicated family room with the physicians, nurses and nurses' aides caring for the patient. In both phases, we evaluated the families' satisfaction using a questionnaire validated by Johnson et al. [4], namely the Critical Care Family Needs Inventory (CCFNI). In total, 14 questions made it possible to judge the quality of the welcome when the families first arrived, the quality of communication between the care-giving team and the families, the level of empathy expressed by the caregivers towards the family, and the feelings of isolation felt by the families during visits and in the waiting room.

**RESULTS.** In total, 165 families participated in phase 1, and 172 in phase 2. The CCFNI satisfaction score was significantly improved during phase 2 (18 [14–22], vs. 29 [23–35] in phase 1, $p < 0.01$). The main factors that predicted family satisfaction were: being met in a specially dedicated family room (+22%), being met at the same time by several members of the care-giving team (+18%), not having to wait in the waiting room (+15%), not having a time limit for their meeting (+13%). Predictors of dissatisfaction were: receiving contradictory information (−25%), receiving information from a junior doctor (−15%), being disturbed when receiving information (−12%) and receiving information in the patient's room (−9%).

**CONCLUSION.** Informing patients and their families is not only a legal obligation, but also makes it possible to reduce conflict, stress, anxiety and depression among family members. A clear information strategy, according sufficient time to patients' families, in a specially dedicated family room, guarantees improved satisfaction among the families of patients hospitalised in critical care.

**REFERENCES.** 1. Sjokvist P, Nilstun T, Svantesson M et al. Withdrawal of life support—who should decide? Differences in attitudes among the general public, nurses and physicians. Intensive Care Med. 1999;25:949–54.
2. Rivera S, Kim D, Garone S et al. Motivating factors in futile clinical interventions. Chest. 2001;119:1944–47
3. Coulter A. After Bristol: putting patients at the centre. BMJ 2002;324:648–51
4. Johnson D, Wilson M, Cavanaugh B et al. Measuring the ability to meet family needs in an intensive care unit. Crit Care Med. 1998;26:266–71

## 0948

### WHAT BENEFIT CAN HEALTH-CARE WORKERS WORKING IN CRITICAL CARE YIELD FROM MEETING WITH PSYCHOLOGISTS?

J.-P. Quenot[1], K. Chahraoui[2], B. Vallache[3], E. Cras[2], F. Gilles[2], A. Laurent[2], J.-P. Rigaud[4], G. Moutel[5], C. Hervé[5], E. Ferrand[6], P.-E. Charles[1]

[1]University Hospital Dijon, Department of Critical Care, Dijon, France, [2]Université de Bourgogne, Laboratoire de Psychopathologie et Psychologie Médicale, Dijon, France, [3]CHU Dijon, Service de Prévention des Risques Psycho-Sociaux, Dijon, France, [4]Centre Hospitalier de Dieppe, Réanimation Polyvalente, Dieppe, France, [5]Faculté de Médecine Paris V, Laboratoire d'Éthique Médicale, Paris, France, [6]CHU Tenon, Département d'Anesthésie et Réanimation, Paris, France

**INTRODUCTION.** The emotional burden of dealing with critical care patients and their families, combined with the ever-increasing technical complexity of critical care can cause significant suffering among caregivers.

**OBJECTIVE.** We evaluated this suffering using a qualitative approach, through directed interviews with two experienced psychologists.

**METHODS.** In total, 18 nurses and 8 nurses' aides accepted to participate in this study, which was performed from December 2008 to March 2009. All participants gave informed consent. Qualitative analysis of the level of suffering was evaluated by means of directed interviews by 2 psychologists. Interviews were recorded and transcribed [1]. The caregiver was invited to develop on their personal experience, and their point of view on 3 predefined themes, namely: 1. Experience of work organisation; 2. Experience regarding their most difficult emotional situations and how they adjust psychologically; 3. Improvements that could be made at work, according to their own positive/negative experience.

**RESULTS.** For theme 1, 55% of caregivers expressed a feeling of pressure at work, requiring a significant capacity to adapt, and considered to be particularly difficult at the beginning of their career (<3 years), or a feeling of tiredness and saturation after 10 years' experience. The remaining 45% felt that the pressure at work was a source of motivation for positive energy. Communication among the healthcare team was considered very important by 95% of caregivers. For theme 2, 100% of caregivers expressed a feeling of emotional suffering arising from their implication in the care of patients who subsequently die, as well as with the families, notably linked to a strong sense of identification. The adjustments used by the caregiving team to deal with this suffering were: need to talk (77%), need to perform sporting activities (44%), need to "get away from it all" (44%), rationalisation and intellectualisation (33%), and getting more involved with the families (27%). Regarding theme 3, 100% of caregivers said they would like to be more involved in the process of care, particularly the decision-making process, whereas 55% were desirous of further training in order to better understand the therapeutic strategies. Lastly, 39% would like to have debriefings with a psychologist after highly stressful emotional situations.

**CONCLUSION.** Working in the critical care environment appears to be especially difficult due to the high emotional burden, which likely requires training more particularly adapted to this discipline.

**REFERENCES.** 1. Chahraoui K, Bénony H. Méthodes, évaluation et recherche en psychologie clinique. Paris Dunod 2003.

**GRANT ACKNOWLEDGEMENT.** No funding to declare.

## 0949

### COMMUNICATION AND PSYCHOLOGICAL DISTRESS SYMPTOMS IN ICU RELATIVES COMPARED WITH EXPECTATIONS OF THE MEDICAL STAFF

H. Myhren[1], Ø. Ekeberg[2,3], S. Karlsson[1], O. Stokland[1]

[1]Oslo University Hospital, Intensive Care Unit, Oslo, Norway, [2]Oslo University Hospital, Department of Acute Medicine, Oslo, Norway, [3]Faculty of Medicine, University of Oslo, Department of Behavioural Sciences in Medicine, Oslo, Norway

**OBJECTIVES.** To examine satisfaction with communication, perceived support and environmental strain in relatives during intensive care unit (ICU) stay and the relationship between communication and psychological distress symptoms post ICU discharge. Further, to compare this with expectations of the nurses and physicians (medical staff).

**METHODS.** A cross-sectional study during 2005–2007 at Oslo University Hospital, an academic, tertiary-care centre in Norway. Participants were 354 (82%) relatives and 145 (74%) staff members. A questionnaire answered by the relatives about 4 weeks post ICU discharge. Degree of satisfaction with communication, perceived support, environmental strain (noise, stress to see other patients or relatives) during ICU stay and psychological distress (anxiety, depression, insomnia and concentration problems) 4–6 weeks post ICU discharge were measured on a five-point scale (0 = low to 4 = high). Employment status; low score; employed, high score; unemployed. In the multivariate linear regression analyses we adjusted for age and gender.

**RESULTS.** The mean score for relatives' satisfaction with communication was 3.4 (3.3–3.5 (95% CI)). This was significantly higher than expected by the staff 2.8 (2.7–2.9), $p < 0.001$. Relatives' degree of psychological distress was 2.5 (2.4–2.6) which was significantly lower than expected by the staff, 2.9 (2.8–3.0), $p < 0.001$. Relatives reported a moderate degree of support (2.7 CI 2.6–2.8), but more than expected by the staff (2.5CI 2.4–2.6) ($p < 0.01$). Relatives of patients who died (n=56) had slightly more psychological distress symptoms than relatives of survivors (n=298), 2.7 (2.4–3.0) versus 2.4 (2.3–2.5) ($p = 0.029$), but they perceived the same degree of support and did not differ in satisfaction with communication or environmental strain. Satisfaction with communication was not found to be a predictor for psychological distress. Environmental strain (beta 0.2), employment status (beta 0.5) and hope for the situation to get better (beta −0.1) were independent predictors of psychological distress among relatives.

**CONCLUSIONS.** Relatives are more satisfied with the communication than expected by the staff. The staff overestimates the relatives' psychological distress. The relatives' reported higher degree of satisfaction with communication than with support. Environmental strain, employment status and less hope were predictors of psychological distress for the relatives. This indicates that more support during and after ICU treatment to relatives may be beneficial.

# ICU management: 0950–0954

## 0950

### SEVERE SEPSIS AND SEPTIC SHOCK: A MULTIDISCIPLINARY RESPONSE TEAM AND WEEKLY FEEDBACK TO CLINICIANS IMPROVE THE PROCESS OF CARE AND REDUCE MORTALITY

G.E. Schramm[1], R. Kashyap[2], J. Mullon[2], O. Gajic[3], B. Afessa[4]

[1]Mayo Clinic, Pharmacy Services, Rochester, USA, [2]Mayo Clinic, Pulmonary and Critical Care Division, Rochester, USA, [3]Mayo Clinic, Pulmonary and Critical Care Division, Rochester, USA, [4]Mayo Clinic, Rochester, USA

**INTRODUCTION.** Despite clearly outlined treatment guidelines to improve patient outcome, compliance with sepsis bundles has remained low.

**OBJECTIVES.** To evaluate the impact of weekly feedback to clinicians and activation of a dedicated sepsis response team (SRT) on the process of care and hospital mortality in patients with severe sepsis or septic shock.

**METHODS.** This prospective observational cohort study was performed in the medical intensive care unit (ICU) of a tertiary, academic medical center. Patients with severe sepsis or septic shock consecutively treated in a medical ICU were included. During the 33-month study period, from January 2007 through September 2009, we performed daily screening of patients who met criteria for severe sepsis or septic shock. Study periods were divided into baseline (screening only), daily auditing with weekly feedback, and activation of SRT. Comparisons between the three periods were made using univariate and multiple logistic regression analyses. Compliance with the overall and each element of the sepsis resuscitation bundle and hospital mortality were used as outcome measures.

**RESULTS.** A total of 984 episodes of severe sepsis and septic shock were identified during the study periods, severe sepsis in 52 (5.3%) and septic shock in 932 (94.7%). Compliance rate with all elements of the sepsis resuscitation bundle increased from 12.7% at baseline to 37.7% and 53.7% during the weekly feedback and SRT activation periods, respectively ($p < 0.001$). Overall hospital mortality rate was 30.3%, 28.3%, and 22.0% during baseline, weekly feedback, and SRT periods, respectively ($p = 0.029$). Multiple logistic regression analysis showed that SRT was independently associated with reduced risk of hospital death (odds ratio, 0.657; 95% confidence interval, 0.456-0.945; $p = 0.023$).

**CONCLUSIONS.** In severe sepsis and septic shock, activation of SRT in combination with weekly feedback, increases the compliance with the process of care and reduces hospital mortality rate.

## 0951

### PHYSICIAN'S ACTIVITIES IN ACADEMIC ICU'S: MUCH ADMINISTRATIVE WORK, TOO LITTLE TEACHING?

M. Siegemund[1], H. Pargger[1], H.U. Rothen[2], for the Swiss ICU Network

[1]University Hospital Basel, Anaesthesia and Intensive Care, Basel, Switzerland, [2]Bern University Hospital, Department of Intensive Care Medicine, Bern, Switzerland

**INTRODUCTION.** In times of limited working hours and restricted financial resources, optimization of workflow in the complex working environment of an ICU is mandatory. Presumably, physicians in training as well as ICU specialists should work a maximum of their time in direct contact with the most severely ill patients and reduce time used for administration and patient's records. The actual time used by physicians for various activities in the ICU is largely unknown. We consider knowledge about the amount of time per activity as a prerequisite to analyse and optimise physician's workflow.

**OBJECTIVES.** To assess effective time used by physicians for pre-defined activities in intensive care medicine.

**METHODS.** Prospective, observational multicentre study. ICU's of five Swiss University hospitals participated. Physician's activities were measured using random work sampling technique [1]. Physician's activities included nine major groups: direct patient care, indirect patient care, administrative work (A), learning (L), teaching (T), research (R), waiting/pause/travel (W), other (O). Each group was further divided in 2–13 items [2]. For the random sampling technique, a personal digital assistant (Palm Z22, Palm Inc, Sunnyvale, USA) and UmtPlus software (Laubrass Inc, Montreal, Canada) was used.

**RESULTS.** We analysed a total of 1,188 shifts. The Median (IQR) duration of the shifts was 9.8 (8.6–11.4) h. During a shift, a physician was responsible for a median (IQR) of 12 (7–29) beds. A total of 28,077 moments were sampled (resident 66.7%, fellow 23.3%, consultant 10.0%; day-shift 63.2%, evening 12.8%, night 24.0%). Overall, the relative time use per major group was (in parentheses: subgroup resident, day-shift): Direct patient care 38.1 (44.3)%, indirect patient care 41.4 (40.1)%, A 6.1 (2.1)%, L 3.0 (3.6)%, T 1.3 (0.6)%, R 1.5 (0.7)%, W 7.9 (7.8)%, O 0.8 (0.8)%. Within indirect care, the largest share of time was used for documentation in patient's file 32.6 (39.8)%, followed by discussion in team, not at bedside 25.3 (24.2)%, formal rounds 10.1 (5.9)%, evaluating lab and X-ray results 8.4 (7.8)% and discussions with consultants 8.2 (9.2)%.

**CONCLUSIONS.** The relative share of physician's activities for indirect patient care is almost as high as the time used in direct contact to the patient. Further, the relative amount of time used for documentation is high. For residents during day-shift, it is 1/6 of the total shift time. On the other hand, time used for learning is markedly lower than required in most contracts of employment (formal learning should include 8%). Workflow optimisation in ICU's should aim at a marked reduction in time used for documentation. This will produce time for direct patient care and training.

**REFERENCE(S).** 1. Oddone E et al. Acad Med. 1993;68:859–61
2. Siegemund M et al. ICM. 2006;32(Suppl 1):S215.

**GRANT ACKNOWLEDGMENT.** Support was received from the Swiss ICU network and the Swiss Society of Intensive Care Medicine

## 0952

### PHYSIOTHERAPY MANAGEMENT OF CRITICALLY ILL PATIENTS GUIDED BY AN EVIDENCE BASED PROTOCOL IS SAFE AND EFFECTIVE: A PRELIMINARY STUDY

S. Hanekom[1], Q. Louw[1], A. Coetzee[2]

[1]Stellenbosch University, Physiotherapy, Stellenbosch, South Africa, [2]Stellenbosch University, Anesthesiology and Critical Care, Stellenbosch, South Africa

**INTRODUCTION.** How intensive care services are delivered may have a greater impact on patient outcome than the individual therapies. Uncertainty regarding the optimal physiotherapy service provision model in a surgical intensive care unit (ICU) exists.

**OBJECTIVES.** To establish the safety and estimated effect of protocol care compared to usual care on clinical (ventilation, mortality) and economical (nursing workload, length of stay) outcomes.

**METHODS.** Four–three week time blocks were allocated to usual care or protocol care in a sequential time block design. All patients admitted consecutively to the surgical ICU were allocated to either receive protocol care (n=96) or usual care (n=97) based on date of unit admission. Protocol care was provided by dedicated unit therapists guided by a validated evidence based protocol. Usual care was provided by hospital therapists as part of a clinical rotation that includes other rotations.

**RESULTS.** The evidence based protocol management of 5 patients admitted to an ICU would prevent one intubation (RR 0.16 95% CI 0.07–0.71; RRR 0.84 NNT 5.02; p=0.005). The risk of failing an extubation was 77% less when admitted during the protocol care intervention period (RR 0.23 95% CI 0.05–0.98; RRR =0.77 NNT 6.95; p=0.04). The mean difference in the ventilation time was 5.10 h 95% CI 9.65–19.84; p=0.50. The mean difference in the daily unit TISS-28 score during the two intervention periods was 1.99 (95% CI 0.65–3.35) points (p=0.04). There was no difference in hospital length of stay (p=0.20) or ICU length of stay (0.98). The difference in the time from unit discharge to hospital discharge was 3.97 95% CI 0.35–6.5 days (p=0.05). There was no difference in unit (p=0.28) or hospital mortality (p=0.25). The risk rate of an adverse event occurring in the protocol intervention period was 6:1000 treatment sessions (p=0.34).

**CONCLUSIONS.** The use of an evidence based physiotherapy protocol for the comprehensive physiotherapeutic management of patients in a surgical ICU was feasible and safe. The preliminary results of this study suggest that a physiotherapy service which is guided by an evidence based protocol and offered by a dedicated unit therapist has the potential to lower the cost of ICU care and facilitate the functional recovery of patients after unit discharge. These results must now be confirmed in a multi centre randomised controlled trial.

## 0953

### CONSULTANT WORKING PATTERNS COULD IMPACT SIGNIFICANTLY ON ICU LENGTH OF STAY: EVALUATION OF DAILY VS WEEKLY COVER

S. Kalman[1], T. Szakmany[1,2]

[1]Prince Charles Hospital/Cwm Taf LHB, Anaesthetics, Theatres and Critical Care, Merthyr Tydfil, UK, [2]Royal Glamorgan Hospital/Cwm Taf LHB, Anaesthetics, Theatres and Critical Care, Llantrisant, UK

**INTRODUCTION.** Providing more continuity of senior medical cover on the ICU has been advocated by various intensive care organizations and lately also been mandated by the Welsh Assembly Government in the UK [1]. Weekly cover as opposed to sessional practice got logical advantages, however published evidence to prove the benefits is sparse (2).

**OBJECTIVES.** To evaluate the impact of change from sessional to weekly daytime consultant cover on ICU length of stay (LOS) and turnover on a six-bedded closed ICU in a district general hospital.

**METHODS.** Retrospective comparative analysis of the critical care minimum dataset database. We compared a 6 months period (January to July 2008) before weekly working was implemented and a corresponding 6 months period (January to July 2009) after the change of working pattern. We have specifically looked at LOS, number of admissions, advanced respiratory, advanced circulatory and renal support days and non-clinical transfers per month for the two periods. Data presented as mean $\pm$ SD. For statistical analysis paired t test was used.

**RESULTS.** In the pre-implementation period 134 patients were admitted, compared to 170 patients when weekly consultant cover was embedded. Unit mortality was similar, 29% vs. 26%, respectively. LOS decreased from $143 \pm 72$ to $80 \pm 13$ h ($p < 0.05$). Although acuity of the patients showed a downward trend this was not statistically significant: the number of advanced respiratory days reduced from $108 \pm 64$ to $83 \pm 52$ (NS), advanced circulatory days increased from $57 \pm 8$ to $71 \pm 8$ (NS) and renal support days reduced from $133 \pm 14$ to $85 \pm 10$ (NS). There were 8 non-clinical transfers due to lack of critical care beds in the pre-implementation period and it was reduced to 3 in post-implementation phase.

**CONCLUSIONS.** Our results provide further evidence that more continuous senior medical cover on the ICU can significantly reduce LOS and increase turnover with similar patient acuity and mortality. The weekly consultant cover helped to eliminate risks associated with inadequate handover and resulted in more thorough evaluation of the patients over their course of stay. More consistent daily treatment plans were implemented which could have impacted on the LOS. This relatively simple organizational change helped to increase the availability of a critical care bed for elective surgical activity and also reduced risk of a non-clinical transfer from our hospital.

**REFERENCE(S).** 1. Audit Commission. Critical to success: the place of efficient and effective critical care services within the acute hospital. Abingdon, UK: Audit Commission Publications, 1999.
2. P. Royle, J. Bramall and A. Norrington, The effect of introducing a consultant weekly working pattern on mortality in a critical care unit. J Int Care Soc. 2008; **9:**26–9.

## 0954

### IMPACT OF THE PANDEMIC 2009 INFLUENZA A(H1N1) VIRUS IN FRENCH ADULT ICUS: PRELIMINARY RESULTS OF THE REVA-GRIPPE-SRLF SCREENING REGISTRY

J.-C.M. Richard[1], T. Pham[2], W. Yaba[2], A. Mercat[3], C. Brun-Buisson[2], L. Brochard[2], for the REVA-GRIPPE-SRLF Registry

[1]CHU Charles Nicolle, Rouen, France, [2]AP-HP CHU Henri Mondor, Créteil, France, [3]CHU Hôtel-Dieu, Angers, France

**INTRODUCTION.** The worldwide 2009–2010 H1N1 flu epidemic has imposed an important burden for ICUs, though this has not been clearly described yet. In France, some ICUs participating to the prospective registry REVA-GRIPPE-SRLF performed on a voluntary basis a daily screening of their specific activity and the occupation rate (OR) due to H1N1, all along the epidemic period.

**OBJECTIVES.** To evaluate the proportion of ICU beds occupied by mechanically ventilated (MV) patients with H1N1, according to the time period and in the different French regions.

**METHODS.** We conducted a prospective observational survey using a specifically dedicated web-based registry. Screening of non infected (Nin-MV) and infected MV patients (In-MV) was performed prospectively weekly during the pandemic period in each ICU. To calculate the occupation rate of available days-beds by In-MV patients (OR-In-MV), we compared per week the number of day-beds available in each ICU and the number of day-beds occupied by In-MV patients. For each ICU and French region we computed the OR-In-MV for every week of the pandemic period (week 44, 2009 to week 5, 2010), reported the maximal OR-In-MV and the corresponding week. For each region, we also reported the regional maximal OR-In-MV (calculated by averaging OR-In-MV of the different ICUs of the region) and the corresponding week.

**RESULTS.** Data were collected during at least 3 consecutives weeks around the pandemic peak in 72 ICUs from 22 French regions. The median number of ICU beds per units was 12 (min 12-max 30). The median value of maximal OR-In-MV for each ICU was 10 (min 2-max 32). The median value of the maximal regional OR-In-MV was 8 (min 5- max18). A maximal OR-In-MV above 20% observed in 12 ICU and 8 regions

**CONCLUSIONS.** The maximal OR-In-MV observed during the pandemic flu period varied markedly from one ICU to the other (2–32%). It also largely differed within the different regions. A maximal OR-In-MV above 20% observed in 17% of the ICUs participating to the study reflects the important burden on ICU beds of the French pandemic.

**GRANT ACKNOWLEDGMENT.** The registry was made possible thanks to grants from Société de Réanimation de Langue Française (SRLF), the French Agency ANRS and the French Minister of Health.