101

EFFECTS OF DEMAND VALVE CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) AND FLOW-BY CPAP DURING WEANING FROM MECHANICAL VENTILATION.

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CPAP can be delivered by two methods: Demand valve (DV) and continuous flow (CF). It has been shown that the work of breathing (WOB) is greater with DV systems. The objective of this study was to determine the effects on WOB and lung mechanics of DV-CPAP and CPAP flow-by (FB) which is a CF system, in patients weaning from mechanical ventilation. We studied 14 intubated patients through 3 CPAP mode, applied in random order: 1) DV-CPAP, 2) FB using base flow of 10 L/min. (FB10) and 3) FB using base flow of 20L/min (FB20). The ventilator used was the Puritan-Bennett 7200a. Sensitivity of the FB was set at 1L/min., and during DV-CPAP sensitivity of DV was set at 0.5 cmH2O. The level of PEEP set on the ventilator was unchanged. Signals of airflow, airway, esophageal and gastric pressures were adquired and digitized via an A/D converter and were processed by an IBM 55SX computer in order to calculate inspiratory WOB (from Campbell's diagrams), Pdi (Pga-Peso), PEEP and autoPEEP, dynamic lung compliance (Cdyn) and breathing pattern. Differences between CPAP systems were analyzed by a two-way analysis of variance.

Results (mean values ± SEM) were as follows:

	WOB J/min	WOB J/L	Pdi (cmH2O)	Cdyn (ml/cmH2O)	PEEP (cmH2O)
DVCPAP	7.1±.6	.72±.06	9.9±.9	63±6	7.8±.41
FB10	5.7±.4	.59±.03	8.1±.8	63±5	8.1±.4
FB20	6.8±.6	.73±.06	9.8±1	65±6	8.7±.39
P=	0.03	0.02	0.001	0.6	< 0.001

No changes in arterial blood gases, heart rate, blood pressure, respiratory rate, auto-PEEP or tidal volume were observed between 3 CPAP systems.

Conclusion: CPAP FB significantly reduces the inspiratory WOB in comparison with DV-CPAP, although this benefit is only observed with an intermediate base flow level. The high flow during FB20 may be responsible of increasing the PEEP levels.

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102

EVALUATION OF AN EXPERT SYSTEM PROVIDING VENTILATORY MANAGEMENT AND DECISION OF WEANING FROM MECHANICAL VENTILATION (MV).

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Optimisation of the ventilatory assistance with gradual decrease in the level of support and decision for extubation are the two key features of ventilatory management during weaning from MV. We designed a computer-controlled system working with a knowledge-based real time system. It estimates the physiological status of the patient from signals of breathing frequency (main parameter), tidal volume and end tidal CO_2 and adjust the setting of the ventilator in the Pressure Support (PS) mode (Hamilton Veolar). A gradual decrease in the level of support is performed by the system until it indicates to the clinician that the patient should be withdrawn from the machine. We compared this decision of extubation to our standard procedure of weaning in 38 patients. The standard procedure was the following : 1) when usual weaning criteria (respiratory rate, vital capacity, SaO_2, inspiratory force) were present patients underwent a T-piece trial, 2) when patients tolerated a 2 hour trial, extubation was performed, 3) weaning was considered to be successful after 48 hours.

Results :

For 10 patients, weaning criteria were not present and in no one the system proposed to wean them. 28 patients met positive weaning criteria : for 19, the system decision was to withdraw MV, which could be done for 17 of them (good tolerance of a 2 hour trial). 9 patients were not proposed to be weaned by the system, and no one of them were weaned at 48 hours ; however, among the latter, 5 of them had tolerated the 2 hour T piece trial. Therefore, the positive predictive value of our system was 89 % versus 77 % for the conventional approach, while the negative predictive value was similar. In this study, the computer-controlled system, while relieving physician from continuous monitoring of the patient during weaning, improved the prediction of the success of weaning.

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103

PROTECTION OF RENAL FUNCTION DURING PEEP VENTILATION BY FENOLDOPAM

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We investigated the efficacy and safety of intravenous Fenoldopam (F), a selective DA-1 receptor agonist in 33 pat. ventilated with PEEP to improve PEEP-induced impairment of renal function.

PEEP ventilation was chosen as a standard and reproducible model for renal dysfunction. PEEP was progressively increased every 2 h in steps of 4 cm H_2O up to a max. of 12 cm H_2O. Pat. were included in the study if PEEP decreased urine output of > = 25%. The overall treatment period of F was 4 h, with measurements of renal function (urinary flow rate, creatinine clearance, sodium excretion, potassium excretion) and hemodynamics at baseline, 2 h after inducing renal dysfunction with PEEP as well as 2 and 4 h after commencing F - infusion and 2 h after termination of the F. - administration. The median F.- dose during the first 2 h of infusion was 0.1 mcg/kg/min. during the following 2 h 0.2 mcg/kg/min. After institution of F.- infusion mean creatinine clearance improved significantly by 34.6% and 52.0% after 2 and 4 h of F. - infusion compared to values during PEEP alone. Mean diuresis increased by 24.1% and 102.1% after 2 and 4 h. In addition, F. tended to increase both sodium and potassium excretion, especially with the higher dose. During F. - administration blood pressure dropped slightly and heart rate increased slightly, which was clinically irrelevant. F. was well tolerated by all pat. in this trial.

The present study suggests that the selective DA-1 agonist F. in a dose of 0.2 mcg/kg/min. may improve PEEP - induced renal impairement without inducing hemodynamic changes unfavorable for the critically ill pat.

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104

PROGNOSIS OF CRITICALLY-ILL PATIENTS WITH ACUTE RENAL FAILURE AND AT LEAST 3 ORGAN SYSTEM FAILURES TREATED WITH CONTINUOUS HEMOFILTRATION. R Robert, J Rouffineau*, K Dhoste*, F Malin, O Pourrat, JM Péchier*.

The aim of this study was to look for prognostic indices in patients with acute renal failure and at least 3 OSFs (Knaus) treated with continuous hemofiltration (CHF).

Methods :70 patients were retrospectively studied: mean age = 58.6 years (14-84); 78.6% were septic, 94.3 % mechanically ventilated and 99% required inotropic support. CHF was arterio-venous (n=23) or veno-venous (n=47); the mean ultrafiltration rate was 1000 ml/h; the hemofilters were Amicon D30,Hospal AN69, Gambro 77H. The mean duration of CHF was 95.9 hours (1-456).The following data were recorded: SAPS (a = admission; b = before starting CHF) and urea,creatinin, pH, Na, K, PaO2/FiO2, leukocytes, platelets, hematocrit before starting CHF. We compared these variables in survivors and non-survivors at 24, 48 h after starting CHF and on discharge from hospital. We used Student t test and multivariate analysis

Results: At 24 h, in non-survivors (n=15) SAPS b was higher (21.7±3.8 vs 19.1±4.1, p=0.03) and pH lower (7.24±0.12 vs 7.33±0.09, p=0.001) . At 48 h, only pH was significantly different in non-survivors (n=24) (7.27±0.11 vs 7.33±0.09). The only prognostic factor for outcome on discharge was SAPS b : non-survivors (n=54) 20.4±3.8 , survivors (n=16) 17.5±4.4. Multivariate analysis showed discriminant value for pH at 24 and 48 h and SAPS b at 24h

Comments: Despite extra-renal epuration, allowed by CHF in critically-ill patients with hemodynamic disorders,.the final mortality remains high (77.1%) and correlated to the severity of the illness as assessed by SAPS b. The influence of pH on the prognosis at 24 and 48h probably reflects the severity of hemodynamic disorders in non-survivors.

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105

EFFECTS OF PUMPED CONTINUOUS VENO-VENOUS HEMOFILTRATION (CVVH) IN PATIENTS WITH CARDIOGENIC SHOCK AND MULTIPLE ORGAN FAILURE AFTER CARDIAC SURGERY.

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Sequential hemodialysis in critically ill patients is often accompanied by circulatory instability and hypotension. The aim of the study was to assess the hemodynamic tolerance of CVVH in sixteen patients with cardiac failure (cardiac index < 2 $l.min^{-1}.m^{-2}$) after cardiac surgery. They presented an acute renal failure (ARF) due to a cardiogenic shock and multiple organ failure. CVVH was performed with an hemofilter Gambro AV60 and a Gambro BMM 10-1 system. Systolic arterial pressure, heart rate and cardiac index remainded unchanged. After 48 h of CVVH, serum creatinine and serum urea decreased from 337±32 [SEM] and 32±8 to 252±27 $mmol.l^{-1}$ and 25±7 $mmol.l^{-1}$ respectivly ($p<0,001$). After 24 h of CVVH, pH increased from 7,13±0,1 to 7,30±0,04 ($p<0,001$). The all patients tolerated well the treatment without any hemodynamic problem. However, the mortality remainded high (14/16) and only two patients could be withdrawn from CVVH. The beneficial effect on mortality seems to be directly dependant on severity and reversibility of cardiac failure. The set-up of CVVH is easy and rapid in the intensive care unit and it is well hemodynamically tolerated. We conclued that CVVH can be proposed as an efficient treatment of ARF in post bypass low cardiac outpout.

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106

COMPARISON OF SAPS, APACHE II AND OSF IN THE EVALUATION OF SEVERE ACUTE RENAL FAILURE (ARF). French Multicenter Group, and

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In a prospective study all the patients admitted into 20 ICUs for ARF (plasma creatinine (P.Cr) > 310 µmol/l) or who developped an ARF during the ICU stay had serial measurements of variables permitting the calculation of SAPS, APACHE II, OSF at ICU admission, enrollment (P. Cr > 310 µmol/l = day 1), day 2, 4 and 7. The end-point of the study was hospital outcome. Comparison of the efficacy of the scores was made using ROC curves and calculation of sensitivity (Se), specificity (Sp) at the best Youden test.

Results : 360 patients were studied, 217 enrolled at admission (primary ARF (PARF) death rate 49.7%), 143 after admission (secondary ARF (SARF) death rate 71.3%). At admission the 3 scores have similar but rather poor performances (Se 0.49-0.64, Sp 0.54-0.71). This may be due to a misleading classification of SARF patients whose scores are lower ($p<0.001$) than those of PARF pts. whereas their death rate is higher. Indeed the scores fare better and similarly at enrollment in all ARF patients, (table 1), but neither SAPS nor APACHE II have been validated in the literature after the first day of ICU stay.

TABLE 1 : Area under the curves (ROC)

	SAPS	APACHE II	OSF
Admission	0.6104	0.6062	0.5557
Day 1	0.6929	0.6989	0.6746
Day 7	0.7643	0.7491	0.6789

TABLE 2 : Average value of the scores

	SAPS		APACHE II		OSF	
	Living	Dead	Living	Dead	Living	Dead
Admission	15.4	17.7	22.4	25.8	1.35	1.56
Day 1	15.1	19.3	23.2	29.2	1.39	2.02
Day 7	11.8	17.4	16.6	24.1	0.87	1.51

In each scoring system, the average value decreases from enrollment to day 7 but average scores remain always lower in survivors than in patients who will die (table 2). SAPS and APACHE II have similar and better performances than OSF, which is less efficient after day 1 (table 1). SAPS and Apache II remain closely correlated throughout the ICU stay ($y = 0.58 x + 2.64$ $R = 0.83$)

Conclusion : for a proper classification of ARF patients, measurement of scoring systems at admission is not sufficient : measurement at enrollment provides a better classification. SAPS and APACHE II have similar performances and are closely correlated. The scores decrease along time during the ICU stay and thus an average value for a group cannot be interpreted without the knowledge of the day where it is measured. This could be true in other diseases, which can lead to admission in the ICU or develop during the ICU stay, where scoring systems should be validated along time during the ICU stay in prospective studies.

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107

ACUTE RENAL FAILURE POST IMMUNOTHERAPY : EFFECT OF NOREPINEPHRINE INFUSION

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Interleukin 2 (IL2) and alpha interferon (IFN) are shown to mediate the regression of some metastatic tumors. However severe side effects involving multiple organ systems are associated with these treatments. Patients have to be admitted to ICU. One of the major side effects is acute renal failure (ARF), which has been regarded as functional in its mechanism. Renal hemodynamic modification has been previously reported : drop in renal vascular resistances (RVR) primarily on postglomerular vessels leading to a preservation of renal plasma flow (RPF) and a solitary fall in glomerular filtration rate (GFR) (Kidney International 40:309-314, 1991). In this situation, it was rational to the use of vasoactive agents such as norepinephrine in the treatment IL2-induced ARF.

Twelve patients (10 males, 2 females) aged 58±7 years with metastatic renal cell carcinoma were treated by IL2 (72 MU/m2/day) and IFN (15MU/m2/day) as a 30 min infusion at 8 hour interval for 6 consecutive days. Patients received concomitant medications in attempt to minimize side effects. Central venous pressure was maintained from 1 to 5 cm H2O by administration of albumin solution (mean amount of albumin per patient 32±17g). Renal function was measured before the treatment (C), after 3 injection of IL2 +IFN (IL2-IFN) and after under norepinephrine infusion (0.25 µg/kg/min) (NE). Following parameters were measured or calculated : mean blood pressure (mBP), heart rate (HR), inulin clearance (GFR) and PAH clearance (RPF), filtration fraction (FF), RVR and microalbuminuria (µAlb).

Results are shown in the following table (mean±SD). Wilcoxon test was used : a if $p<0.05$ versus C; b if $p<0.05$ versus IL2-IFN.

	mBP mmHg	GFR ml/min/1,73m2	RPF	FF	RVR mmHg/ml/min	µAlb/créatinin mg/100mg
C	95±14	76±14	377±72	0.20±0.35	0.18±0.05	8±2
IL2-IFN	78±15(a)	52±19(a)	399±104	0.13±0.03(a)	0.13±0.04(a)	17±22(a)
NE	99±17(b)	59±23	372±111	0.16±0.05(a.b)	0.18±0.07(b)	31±40(a.b)

Treatment by IL2 and IFN induces a "glomerular" functional ARF : decrease in FF [-35%] because of a drop in GFR [18%] with a conservation of RPF and an increase in µAlb [112%]. NE infusion lead to a normalization of mBP and RVR. The increased RVR are probably due to an increase in postglomerular resistances (increase in FF and in µAlb), but also an increase in preglomerular resistances (decrease in RPF). This later mechanism explains that GFR did not increase significantly [19%].

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108

PROGNOSIS OF ACUTE RENAL FAILURE (ARF) IN INTENSIVE CARE UNITS (ICU). A PROSPECTIVE MULTICENTER STUDY

The French Study Group on ARF, M.M. Agostini*, Ph. Mezzarobba**. Coordinators : D. Kleinknecht*, Ph. Loirat**, F. Brivet***, P Landais.

In order to assess the prognosis of patients (pts) hospitalized with severe ARF, a prospective study was conducted during a 6-month period in 20 multi-disciplinary ICUs. Inclusion criteria were : 1) blood urea > 36 mmol/l and/or serum creatinine level (SCr) > 310 umol/l (Knaus et al, Ann Surg, 202 : 685, 1985) ; 2) an increase in blood urea and/or SCr of 100 % above baseline values in pts with previous chronic renal failure (SCr > 150 umol/l), excluding those with SCr > 300 umol/l.

360 pts, 240 M, 120 F, aged 60.3 ± 18.0 yrs, were included on admission (217) or secondarily (143). Only 41.6 % of pts had a normal health status 3 months before admission. Mean SAPS was 16.0 ± 5.5, mean APACHE II score was 24.3 ± 8.3, and mean OSF was 1.75 ± 0.95. Reason for admission was medical in 78 % of cases. 187 pts (52.0 %) were oliguric. ARF was prerenal (61), renal (282) or post-renal (15). The mechanism of ARF was toxic (71), septic (176), hemodynamic (246) or other (105). 174 pts (48.3 %) were dialyzed, but 36 were not because of treatment limitation. Mean length of stay was 16.3 ± 15.9 days. 41.7 % of pts were alive at discharge. The survival rate was lower in men ($p = 0.023$), in oliguric ($p = 0.0001$), dialyzed ($p = 0.03$), and ventilated pts ($p = 0.0001$), in those with sepsis ($p = 0.0001$), circulatory failure ($p = 0.0001$), cirrhosis ($p = 0.04$), and in those included after admission in ICU ($p = 0.0001$).

Conclusions : These results show, in the studied population : 1) the high incidence of medical ARF ; 2) the bad prognosis linked to a poor previous health status, to the presence of oliguria, sepsis, circulatory failure, and to a delayed appearance of ARF.

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