16. Respiratory – Poster Discussions

105

DIRECT OR INDIRECT LUNG INJURY DIFFERENTLY AFFECTS RESPIRATORY MECHANICS DURING ACUTE RESPIRATORY FAILURE.

P Pelosi, M Croci, D Chiumello, A Pedoto, L. Gattinoni.

OBJECTIVES: The aim of this study was to evaluate the possible influence of direct lung injury (primitive pneumonia) or indirect lung injury (secondary pneumonia) on respiratory mechanics during acute respiratory failure (ARF). DESIGN: Patients were studied during sedation and paralysis during volume controlled mechanical ventilation (Servo 900C, Siemens, Sweden) with constant inspiratory flow. SUBJECTS: We studied 8 normal subjects, 8 ARF patients with direct lung injury and 8 ARF patients with indirect lung injury. METHODS: Using the airway occlusion technique and esophageal balloon, we measured lung and chest wall static elastance (Est,L and Est,W, respectively), airway resistance (Rint,L) and additional lung and chest wall resistance (DR,L and DR,W, respectively). Measurements were performed at 0 cmH_2O of positive end expiratory pressure. Intraabdominal pressure (IAP) was measured using a catheter inserted in the bladder, and functional residual capacity (FRC) with Helium dilution technique. RESULTS: Results are presented as mean±SD.

	NORMAL	DIRECT	INDIRECT
Est,L (cmH_2O/L)	9.3±1.7	25.0±3.6°	18.2±5.1°*
Est,W (cmH_2O/L)	5.6±2.1	5.6±3.0	14.2±4.0°*
Rint,L ($cmH_2O/L/s$)	2.1±0.9	4.9±1.3°	7.8±2.4°*
DR,L ($cmH_2O/L/s$)	1.0±0.6	2.5±1.5°	5.1±1.7°*
DR,W ($cmH_2O/L/s$)	1.0±0.4	0.8±0.7	2.5±1.0*
FRC (L)	1.8±0.2	0.9±0.2°	1.0±0.3°
IAP (cmH_2O)	6±2	11±3°	21±6°*
PaO_2/PAO_2	0.75±0.15	0.23±0.06°	0.25±0.05°

° $P<0.05$ Direct and indirect lung injury vs normal
* $P<0.05$ Direct vs indirect lung injury

CONCLUSION: 1) The presence of direct or indirect lung injury seems to differently affect lung and chest wall mechanics (elastance, resistance and intraabdominal pressure). 2) The partitioning of respiratory mechanics is an useful tool to improve our knowledge of ARF physiophatology.

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124

UPPER INFLECTION POINT IN THE ACUTE PHASE OF ACUTE RESPIRATORY DISTRESS SYNDROME (ARDS)

S Nunes, P Valta, J Takala

OBJECTIVES-To determine the presence of an upper inflection point (UIP) in static pressure-volume relationships (PV-curve) during the acute phase of ARDS.

METHODS-25 ARDS patients were studied during the acute phase (first 3 days after diagnosis). PV-curves were obtained by using different positive end expiratory pressure (PEEP) levels combined with several tidal volumes. Static pressures were determined using the occlusion technique. Inspiratory peak pressure values were limited to 35-40 cmH_2O for clinical safety reasons. Compliance values were calculated for each trial. The UIP was defined as the end-inspiratory static pressure corresponding to the point where compliance consistently decreased by 20% from best obtained compliance (1).

RESULTS

	Number of Patients	UIP(Pst-cmH_2O)	Cst(ml/cmH_2O)
UIP	10	29.4(26-34)	37(16-50.6)
NO UIP	15	-	39.9(21.4-75)

VENTILATOR SETTINGS BEFORE MEASUREMENTS

	PEEP(cmH_2O)	Vt(ml)	PaO_2/FiO_2(at PEEP)
UIP	10(6-16)	509(330-810)	107.2(50-217)
NO UIP	10.3(7-15)	507(270-750)	88.1(56-160)

UIP=patients presenting UIP; NO UIP=patients not presenting UIP

CONCLUSIONS-During the acute phase of ARDS some patients present UIP even under a pressure limited approach. Most of the UIP values obtained are in a range of pressures commonly considered safe for mechanical ventilation in these patients. This suggests that PV-curves can provide valuable information also in this phase of the disease, helping to titrate inspiratory pressures, thus avoiding alveolar overdistention..

REFERENCES

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125

PRESSURE- VS. VOLUME CONTROLED VENTILATION IN A 6-COMPARTMENT LUNG MODEL

R Fretschner*, T Winkler**

OBJECTIVE: The aim of the present study was to compare regional ventilation of a multi-compartment lung model during pressure- (PCV) and volume-controled ventilation (VCV).
DESIGN: Study on a ventilation simulation program.
METHODS: The computerprogram is able to simulate pressure- and volume controled ventilation in a multicompartment electrical lung model. Each of the maximum 9 compartments is characterized by a compliance (C) and resistance (R) which can be set by the operator. For each compartment pressure (Paw), flow (V´) and volume (V) are calculated as a function of time: Paw(t)=V´(t)*R+V(t)/C+PEEPi, (PEEPi - dynamic intrinsic PEEP). In a 6-compartment model time constants (RC) between 0.1 and 120 seconds were simulated. PCV and VCV were simulated with a respiratory rate of 10/min and a tidal volume of 360ml. Endexpiratory pressure was 10 cmH_2O in both simulations; I/E ratio was 1/1.
RESULTS: Application of a tidal volume of 360ml afforded a maximum inspiratory airway pressure of 40 cmH_2O during VCV and 38 cmH_2O during PCV. The distribution of ventilation was different during VCV or PCV, respectively. At the beginning of inspiration VCV caused "Pendelluft" from compartments with long time constants to compartments with short time constants. During PCV compartments with long time constants were better ventilated than during VCV. The tidal volume of compartments with RC 0.1s, 30s and 120s amounted for 266ml, 12,9ml and 3,2ml during PCV and for 273ml, 8,8ml and 2,2ml during VCV. The rapid increase of airway pressure during PCV caused a higher mean airway pressure during PCV and consecutively a larger endexpiratory volume (VLee). VLee of compartments with RC 0.1s, 30s und 120s amounted for 75ml, 195ml and 200ml during PCV, and for 83ml, 161ml and 165ml during CMV.
CONCLUSIONS: Simulations in the lung model propose a more homogeneous distribution of ventilation during PCV. The clinical relevance of this theoretical advantage has to be proven.

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127

A BEDSIDE METHOD TO DETERMINE RESPIRATORY COMPARTMENTS WITH DIFFERENT TIME CONSTANTS.

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OBJECTIVE: To identify respiratory compartments with different time constants in mechanically ventilated patients.
DESIGN: Prospective study in a physical lung model and in mechanically ventilated patients.(Study approved by ethical commitee)
SUBJECTS: 19 patients with and 10 patients without ARDS.
METHODS: Identification of respiratory compartments with different time constants is based on a two-compartment model of the respiratory system. The model consists of a "fast" and a "slow" compartment, each of them characterized by a compliance (C) and resistance (R) (C_{fast}, R_{fast}, C_{slow}, R_{slow}). The total volume change in the lung model (dVL), the volume change of the "slow" compartment (V_{slow}) and the time-constant $R*C_{slow}$ were calculated from the time-dependent volume change of the respiratory system induced by a sudden change of PEEP (PEEP-step). The method was evaluated in a physical lung model and then applied to patients.
RESULTS AND STATISTICAL ANALYSIS: Bias [mean relative error = (measured-expected value)/expected value] and precision (standard deviation of bias) were calculated. V_{slow}/dVL could be measured with a bias of -6% and a precision of ±15%. RC_{slow} was determined with a bias of 8%. Precision was ±43%. "Slowly" distensible compartments were detected after a PEEP-increasing PEEP-step in 3/10 patients without and in 7/19 patients with ARDS (ns.); 1/10 patients without ARDS and 15/19 ARDS-patients revealed "slowly" distensible compartments in PEEP-decreasing PEEP-steps ($p<0.05$,CHI-square-test).
CONCLUSION: Pulmonary compartments with different time constants can be easily identified by PEEP-step analysis. "Slowly" distensible compartments in PEEP-increasing PEEP-steps may reflect expansion of "slowly" ventilated lung spaces or alveolar recruitment, those in PEEP-decreasing PEEP-steps may reflect exspiration from "slowly" ventilated lung spaces, or alveolar derecruitment.

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160

OPEN UP THE LUNG: CAN HIGH AIRWAY PRESSURES BE BENEFICIAL?

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OBJECTIVES: The "Open Lung" concept has been proposed for several years. It should be investigated whether a strictly controlled protocol employing high airway pressures for an aggressive recruitment of alveoli can be beneficial in ARDS patients.

DESIGN: Open prospective clinical study in a 16 bed surgical ICU.

SUBJECTS: 13 consecutive patients with severe ARDS (Murray-Score > 2,75; $p_aO_2/f_iO_2 < 140$ mmHg (63-140, mean 102), mean f_iO_2 0.72; 8 male, 5 female, mean age 54 years) and conventional ventilation (PCV, PEEP 6-16 mbar, I:E=1:1, $p_{peak} < 30$ mbar) after major visceral surgery.

METHODS: If after 3 hours of conventional pressure controlled ventilation pulmonary function did not improve, PEEP was increased to 20-25 mbar, p_{peak} to a maximum of 50 mbar, TV was maintained at 8-10 ml/kg. Hemodynamic stability was achieved with increased preload (HES) and β_1-adrenergic drugs to a CI > 4.5 l/min/m^2 and a $DelO_2$ > 600 ml/min/m^2. High airway pressures were limited to a maximum of 24 hours. p_{peak} was immediately reduced to below 30 mbar, if ventilatory dead space (V_{dead}) increased by more than 50% or hemodynamic stability could not be maintained.

RESULTS AND STATISTICAL ANALYSES: 11 patients showed an immediate improvement in oxygenation. In these patients an f_iO_2 below 0.35 could be reached within 3 hours (1-6) maintaining a p_aO_2 over 70 mmHg. Airway pressures could then gradually be reduced to reach PEEP below 12 mbar and p_{peak} below 30 mbar after 25 hours (6-48). V_{dead} remained constant or slightly decreased. From these responders three patients died (2 MOF, 1 MI, 1 LE). 8 patients could be extubated after 207 hours (24-500) and finally leave the hospital. 2 patients did not respond within 30 minutes and airway pressures were reduced to initial levels. Both patients were treated with prone position and showed an improvement in pulmonary function. One non-responder died from myocardial infarction, the other could leave the hospital. In all patients, responders and non-responders, hemodynamic stability during increased airway pressures could easily be maintained. Renal function was not changed. Clinical or radiological signs of barotrauma or volotrauma could not be found.

CONCLUSION: Applying high PEEP and high airway pressures over short time periods while maintaining controlled tidal volume could dramatically improve pulmonary function in 11 out of 13 patients with severe ARDS. In the early stages of severe ARDS the "Open Lung" approach appears to be a promising concept in addition to other established treatment modalities. In any case high airway pressures must be limited to very short time periods in order to reduce the risk of barotrauma and extra-pulmonary side-effects. Continuous and comprehensive monitoring is an utmost necessity.

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177

EFFECTS ON GAS EXCHANGE AND RESPIRATORY MECHANICS OF PERIODIC LUNG INFLATION IN ARDS PATIENTS

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Periodic lung inflations (PLI) have been shown to improve lung function and CT scan morphology in anesthetized mechanical ventilated normal subjects (1). Clinical relevance of PLI is rather controversial in the ventilatory management of acute respiratory failure patients. Aim of this study was to compare the effects on gas exchange and pulmonary mechanics of three different mechanical ventilation (MV) modes: MV at low PEEP level, MV at high PEEP level, and MV at low PEEP including periodic lung inflations.

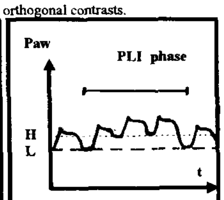
METHODS AND MATERIAL : In 15 sedated paralyzed ARDS patients (Lung Injury Score >2.5) under MV two levels of PEEP were chosen according to oxygenation. PEEP Low (L) corresponded to a value in which arterial saturation , determined by pulse oximeter , was comprised between 85% and 93%. Then , PEEP was increased to a High (H) value in order to satisfy the following formula : PaO_2 (H) - PaO2 (L) / PaO_2 (H) > 0.3 . Three randomized 30 minute steps were applied : MV (H) , MV (L) , MV (PLI). During the MV (PLI) a modified EVA ventilator (Drager, Lubeck - Germany) every 30 seconds increases PEEP from L to H for 2 consecutive breaths, maintaining inspired Tidal Volume (TV) unchanged. (Figure)

Each patient had an EKG, an arterial line and a pulmonary arthery catheter for intrapulmonary shunt (QS/QT) measurement. Each step airway pressure and flow were continuously recorded, while TV and End Expiratory Lung Volume (EELV) were measured by integration of the airflow signal. Functional Residual Capacity (FRC) was measured through the Helium dilution technique.

The absolute lung volume at an elastic recoil pressure (Pel,rs) of 20 cmH2O was computed as: LV20=FRC+EELV+(Cpl,rs*ΔP). Cpl,rs is the respiratory system compliance computed as TV/(Pel,rs-PEEP). ΔP=20-PEEP level. LV 20 was utilized as an indicator of differences in alveolar recruitment between the three ventilatory modalities.

RESULTS : data were analyzed on multivariate analysis of variance with orthogonal contrasts.

MV (PEEP)	L (9.4±3cmH2O)	H (16±2cmH2O)	PLI
PaO2 (mmhg)	79.4±14	139.3±32.5	117.9±40.6 #
QS/QT (%)	47.1±7.1	38±7.9	40.2±8 #
PawM (cmH2O)	17.4±4.2	24.3±3.2	19.2±3.9 #$
Cpl,rs (ml/cmH2O)	36.3±15.3	31.1±11.4	38.2±15.8 #$
LV 20 (ml)	1691.5±633.9	2111.1±859.2	1983.3±791.2 #



\# p<0.01 of (L) vs (H) and (PLI) $ p<0.01 of (H) vs (PLI)

Airway pressure during MV with PLI

PawM is the mean airway pressure over 30 seconds

CONCLUSION : MV (PLI) improves gas exchange , alveolar recruitment and respiratory system compliance compared to MV(L). In spite of lower mean airway pressure MV(PLI) improves gas exchange and alveolar recruitment, as much as MV(H). We observed during MV(H) lower Cpl,rs compared to MV(PLI) suggesting lung overdistension and higher risk of pulmonary barotrauma.

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200

CONTINUOUS AUTOMATIC MEASUREMENTS OF COMPLIANCE AND AIRWAYS RESISTANCE IN AN "IN VITRO" PULMONARY MODEL, DURING CONTROLLED MECHANICAL VENTILATION.

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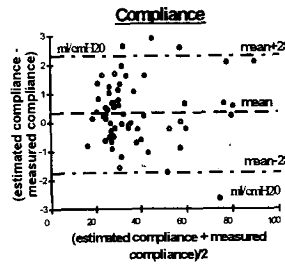
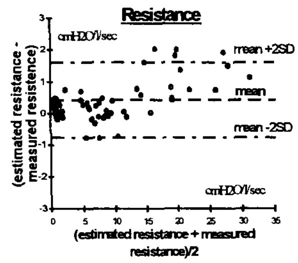
Objectives : We tested a ventilator-linked software which estimates in continuous respiratory system Compliance (Cpl) and airway Resistance (Raw) during controlled ventilation with no need for flow interruption.

Materials and methods : Using the equation of motion of the relaxed respiratory system: Paw = (1/Cpl)V + RawV̇, the software calculates the values of Cpl and Raw as follows: starting from Paw, V̇, and derived V , the software continuously compares Paw calculated from estimated Cpl and Raw with Paw measured from the ventilator. The differences between the calculated and measured values are continuously minimized through a recoursive technique adjusting the estimated value of Raw and Cpl (Extended Kalman Filter). This method was tested with a Servo 900C ventilator (Siemens) connected to an "in vitro" pulmonary model composed of Endotracheal Tubes (ETT) and 2 litres anaesthesia bags. In order to modify Cpl and Raw,1 to 4 anaesthesia bags, different flow patterns of ventilation (volume and pressure control mode), ETT diameter ranging from 4.5 to 9 I.D. and different Tidal Volume and Respiratory Rate were used. The "Von Neergard-Wirtz elastic subtraction technique" was the "gold standard" method used to calculate Cpl and Raw. To evaluate the accuracy of the estimated Cpl and Raw the Bland-Altman test was applied.

Results:





Mean differences between estimated and measured Cpl and Raw were respectively 0.34 ± 1.10 ml/cmH2O and 0.35 ± 0.62 cmH2O/L/sec.

Conclusion: The system tested provided very accurate measurements of Cpl and Raw in a simplified model of the respiratory system during controlled mechanical ventilation.

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201

CLOSED AIRWAY SUCTIONING SYSTEM : EFFECTS OF THE MODE OF VENTILATION UPON THE AIRWAY PRESSURE IN AN IN-VITRO MODEL

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Aim of this study was to measure the pressures recorded in a lung simulator during suctioning trials performed using a closed system suction catheter (CSS), (Ballard Trach Care-Ballard Med. Pr od. Inc-Midvale, Utah) under Volume Control (VC) and Pressure Control (PC) ventilation. (Trigger was set at -2cmH2O).The CSS system is claimed to prevent losses of PEEP, suctioning related hypoxemia , and to maintain positive pressure ventilation (1). **Methods and Materials** : Servo 300 and Servo 900C were tested (Siemens, Elema SW), both in VC and PC mode. The ventilator was connected to 30 L-bottle used as a lung simulator , and the ventilatory circuit included an endotracheal tube (ETT) with a CSS. With adult ETT (I.D. 9-7mm) an adult (14F) CSS was used, PEEP was 10 cmH20, respiratory rate 12/min. and TV 600 ml.;with pediatric ETT (I.D. 6 to 5mm) a pediatric (12F) CSS was used PEEP level was 5 cmH20, resp.rate 22/min and TV 150 ml. A suctioning trial was performed with each ETTsize, both in VC and PC. The trial lasted 20 seconds. Pressure was measured inside the bottle, as an indicator of distal airway pressure. During the suctioning the pressure decayed, reached in most instances a steady state and average value was then computed (steadyP). The minimum pressure reached inside the bottle was also recorded (MinP). **Results**: Steady and MinP are reported in cmH2O.

		SERVO 300				SERVO 900			
ETT		VC		PC		VC		PC	
size	PEEP	SteadyP	MinP	SteadyP	MinP	SteadyP	MinP	SteadyP	MinP
9	10	-3.4	-12	15.4	8.5	/	-135	12.3	5
8	10	-6.04	-16	15.5	7.5	/	-84	11.33	6
7	10	-34.25	-38	-9.73	-15	/	-90	-7.67	-9
6	5	-4.38	-9	3.94	1.75	/	-140	18.21	17.5
5.5	5	-9.27	-12.5	-2.49	- 4.5	/	-112	-35	-37
5	5	-17.16	-19.5	-10.09	-12.25	/	-144	-40	-45

During VC steps very high level of negative pressures were measured. During the VC trials with the S900C the pressure never reached a steady state, and the minimum values at 20th sec are reported . During PC the SteadyP was closer to PEEP level and decayed below 0 cmH2O only during trials with ETTn7, n5.5 and n.5, because the suction catheter substantially reduced the ET tubes section area. **Conclusion**: These data suggest that CSS should only be used with selected ventilatory setting. Comparing VC with PC we can conclude that PC seems to minimize the decrease in pressure due to suctioning, and that the Servo300 protects the patients from negative airway pressure better than the S900C.

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212

DETERMINANTS OF VENTILATION DURING BREATHING WITH BI-LEVEL CONTINUOUS POSITIVE AIRWAY PRESSURE (BIPAP)

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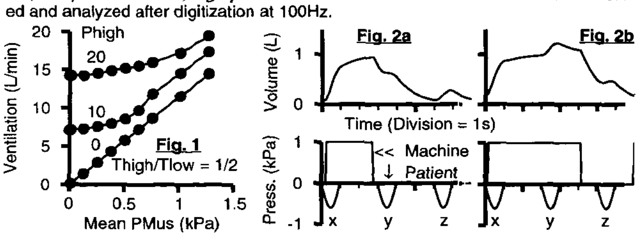
OBJECTIVES: In BIPAP mode even small patient efforts normally only effecting deadspace ventilation have been found to increase alveolar ventilation [Putensen, Anesthesiology 81:921 (1994)]. This study was to elucidate the translation of patient inspiratory efforts and independently cycling machine pressures to ventilation.

DESIGN and METHODS:— *Digital simulation*: Data resembling digitized measurements of flow, volume, and pressures were generated by repeatedly solving the equation of motion of a one compartment linear respiratory system (RS). Settings: Elastance (E) 1 or 2kPa/L, resistance (R) 1.1 or 2.2kPa/L/s, including 0.6 for ETT, patient muscular effort (PMus, simulated as sine half-wave) 0 to -2kPa peak negative pressure lasting 0.5 or 1.0s, frequency of efforts (respiratory rate, RR) 20/min, machine rate 8/min with high/low phase time (Thigh/Tlow) 1/2 or 2/1, low pressure 0kPa, high pressure (Phigh) 0 to 2kPa. — *Mechanical model*: The two bellows of a VentAid Training/Test Lung (Michigan Instruments, Inc.) were coupled to move together. One, the "muscle", was driven by a ventilator (EVITA, Drägerwerk AG) in pressure control mode to simulate breathing efforts (0.2 to 2 kPa for 0.5 or 1.0s, RR20/min). The other one, the "lung", was connected to another EVITA providing BIPAP via one or both lumina of a 41Ch double lumen ETT (R 0.92 or 0.55kPa/L/s at 1L/s, respectively), a model trachea, and a variable orifice pneumotachygraph (Hamilton Medical). Settings: E 2 or 4 kPa/L, machine rate 8/min with Thigh/Tlow 1/2, low pressure 0kPa, high pressure 0 to 2kPa. Pressures and flow were recorded and analyzed after digitization at 100Hz.



RESULTS / CONCLUSION: Fig. 1 shows that increases in patient effort translate to smaller increases in ventilation with higher support levels. Fig. 2a and 2b elucidate the reasons: Efforts x only accelerate inspirations without deepening them. The effects of efforts y and z depend on Thigh/Tlow ratio: With short Thigh (Fig. 2a) effort y is ineffective: It cannot match elastic recoil. In contrast, with longer Thigh (Fig. 2b) effort y is well translated to alveolar ventilation as there is no preceding expiration and thus no deadspace ventilation. This might be one reason for the effects described in the reference above. (Examples: digital simulation, low E and R, effort 1.0s)

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579

LUNG DISTENSION WITH CPAP CAN IMPAIR WEANING FROM VENTILATION. K Crowley, M Geoghegan, F Colreavy, D McMahon, M Doyle.

OBJECTIVES: To describe the response of patients receiving mechanical ventilation (MV) to different levels of CPAP; to test the hypothesis that in some patients CPAP can impair weaning from mechanical ventilation (MV) by causing rapid shallow breathing (RSB).

DESIGN: Prospective study of 30 patients receiving MV in pressure support mode (PSV), cardiovascularly stable and needing $FiO_2 < 0.6$.

METHODS: Breathing frequency (f), tidal volume (V_t), were measured at CPAP levels of 0, 3, 6, 9, and 12 cmH_2O. Other ventilator settings were left unchanged. For each patient the level of CPAP with the lowest f/V_t was identified ("Best CPAP"). Time to extubation of survivors was noted.

RESULTS & STATISTICAL ANALYSIS: Patients for whom "Best CPAP" was zero were weaned soonest from MV.

"Best CPAP" cmH_2O	0	3	6	9	12
No. patients	11	7	2	5	5
Days to weaned	1.6	5.3	10	3.0	5.8
mean (sd)	(2.2)	(3.8)	-	(2.8)	(4.2)

* P<0.05 compared to CPAP 3 and 12 cmH_2O, ANOVA.

CONCLUSION

Patients closest to successful weaning from mechanical ventilation breathe most comfortably with zero CPAP. In such patients addition of CPAP causes RSB and may delay weaning.

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614

RESPIRATORY SYSTEM MECHANICS IN THE EARLY PHASE OF ACUTE RESPIRATORY FAILURE IN PATIENTS AFFECTED BY SEVERE KIPHOSCOLIOSIS.

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OBJECTIVES : to evaluate the respiratory system mechanics in the early phase of decompensation in a group of 7 severe KS patients (Cobb angle> 90°),requiring mechanical ventilatory support.
DESIGN : prospective clinical study with control group (6 ASA 1 pts. mechanically ventilated during minor surgery)
METHODS : respiratory system mechanics was evaluated during constant flow controlled mechanical ventilation at zeep with the end inspiratory and end expiratory occlusion technique.
In the six patients who showed increased R_{RS} min we evaluated the possibility to reverse this increase with a charge dose of 6mg/Kg of doxophylline i.v.In four KS patients,in which a reliable oesophageal pressure was confirmed by a positive occlusion test,we partitioned respiratory system data in the lung and chest-wall subcomponent.
RESULTS : all KS patients showed reduced values of Crs and Rrs: in details, the basal average values of Crs was 36± 10 vs 58± 8.5 ml/cmH2O in control patients; Rrs max was 20 ± 3.1 vs 4.5 ± 1.2 cm H2O/l/sec;Rrsmin 6.2± 1.2 vs. 2± 0.5 cmH2O /l/sec: Δ Rrs 14 ± 2.6 vs2.4 ± 0.7 cmH20/l/sec. All KS patients showed low values of PEEPi (1.8± 1.5 cmH_2O). The partitioning of respiratory system mechanics showed both a reduction of C_L (66.7± 7.2 ml/cmH_2O) and C_{CW} (84 ± 8.2 ml/ cmH_2O) while both R MAX_L and R MAX_{CW} were increased (16.6 ± 2 and 2.8± 0.4 cmH_2O /l/ sec, respectively). The infusion of doxophylline did not significantly change respiratory mechanics evaluated 15, 30, 45 min after the infusion.
CONCLUSION: during acute decompensation both lung and chest-wall viscoelastic components are severely reduced in KS patients: conversely, and contrary to COPD patients, airway resistances and PEEPi increase seem to play only a secondary role.

615

SIGNIFICANCE OF THE CHESTWALL COMPLIANCE AND WORK OF BREATHING IN PATIENTS WITH THE RESPIRATORY FAILURE AFTER UPPER ABDOMINAL SURGERY.

T. Kubota and K. Murata

OBJECTIVES : Upper abdominal surgery induces the chestwall and diaphragmatic dysfunction, and often causes the difficulty of weaning from ventilator. We conducted this study to evaluate the chestwall compliance and respiratory work in patients undergoing upper abdominal surgery. We also compared these parameters in patients between the successful weaning and the failure of weaning.
SUBJECTS and METHODS : 20 patients undergoing upper abdominal surgery were subjected. They were divided into two groups consisting of the successful weaning (G-S) and the failure of weaning (G-F). In addition to this, the respiratory failure without operation was studied as control (G-C). Immediately before weaning trial we measured the total, lung and chestwall compliances (CT, CL, Ccw) under controlled ventilation respectively. During the weaning, the total respiratory work (WT=WL+Cw) was directly measured on the basis of Campbell's formula. Similtaneous measurements of the respiratory works on lung and chestwall (WL, Wcw) were done from the changes in intrapleural pressure using respiratory monitor (RM-300, Minato Ika, Japan). Oxygen cost of breathing (OCB) and pressure time product (PTP) were also assessed.
RESULT : Results are as follows ;

	G-C n=7	G-S n=10	G-F n=10
CT (ml/cmH20)	73±26	89±48	60±37
CL (〃)	71±24	123±58 §	83±28
Ccw(〃)	216±84	122±53	66±29 # *
WT(Jul/min)		7.0±2.6	10.4±5.2 #
WL (〃)		4.7±1.5	6.2±4.0
Wcw (〃)		2.3±1.4	4.6±3.5 #
OCB (%)		5.0±8.2	14.1±12.1 #
PTP(cmH2O/min)		161±50	217±52 #

\# : P<0.05 G-S vs G-F *: P<0.05 G-C vs G-F
§ : P<0.05 G-C vs G-S

DISCUSSION and CONCLUSION : Patients with respiratory failure after upper abdominal surgery indicate the significant low compliance on chestwall and diaphragm. They also showed the significant increases in the total respiratory work and the chestwall work of breathing. From these sesults, we concluded that one of the causes of the postoperative respiratory failure is contributed to the low compliance on chestwall and diaghragm. Decreased compliance on chestwall are an important factor on the diaghragmatic dysfunction.

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