Poster Sessions

Respiratory failure and haemodynamics in children and newborns − 499–505

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EARLY PREDICTION OF DISEASE SEVERITY IN RESPIRATORY SYNCYTIAL -INDUCED RESPIRATORY FAILURE

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INTRODUCTION. Respiratory Syncytial Virus (RSV) induced respiratory failure is a condition of low mortality but imposes a high burden on the intensive care unit (ICU) during winter. Early prediction of severely affected infants may be useful for targeting new therapies. The aim of this study was to develop a prediction model for length of ventilation (LOV) based on parameters within the first 24 hours of ICU stay.

METHODS. Prospective data collection on 111 RSV + infants in a regional ICU over two consecutive winter seasons. Eleven were excluded (10 congenital heart disease, 1 neuromuscular disorder) leaving 100 for analysis. Ventilatory strategy has been reported previously. All arterial blood gases and concomitant ventilator settings were recorded over the first 24 hours after admission. The best, worst, mean, and median of 0 hours apart and adjusted mean (beat and worst removed) were calculated for oxygenation index (OI), Alveolar-arterial oxygen gradient and ventilation index. Additional data included birth weight, gestation, chronic lung disease (CLD), age at admission, and bacterial chest infection on admission.

RESULTS. There were no deaths. The median (Q1-Q3) LOV was 106 (72–139) hours. The multiple linear regression model employing the “best” values gave the highest predictive value for LOV. The only independent predictor of LOV from this model was OI (p = 0.002). However, this had little clinical value in predicting LOV for individual patients (r = 0.27, SEE 71 hours. An alternative logistic approach was employed, defining the top quartile for LOV as a “bad” outcome (LOV > 137 hours). Again “bad” OI in the first 24 hours had the only significant association (p = 0.002) with bad outcome, although CLD approached significance (p = 0.09). The maximum predictive value for bad outcome was a bad OI of > 7.9. This gave: spec 99%, sens 32%, PPV 80%, NPV 81%, LR 25. Nosocomial chest infection (> 48 hours after admission) occurred in 10/25 with bad outcome and only 4/75 good outcome (Fisher’s exact p = 0.031, OR 11.8).

CONCLUSION. Prolonged LOV can be predicted from the best OI in the first 24 hours following admission with high specificity. The sensitivity of this model is limited by the occurrence of nosocomial infection.

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INHALED NITRIC OXIDE THERAPY IN PAEDIATRIC ACUTE RESPIRATORY DISTRESS SYNDROME

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INTRODUCTION. The aim of this study was to evaluate the effect of nitric oxide inhalation in pediatric acute respiratory distress syndrome patients with respect to dosage, prolonged inhalation, and weaning.

METHODS. In this prospective study, we evaluated 25 children, aged between 15 and 17 years with acute respiratory distress syndrome who underwent inhaled nitric oxide between 1997 and 2000. The patients inhaled doses between 1 and 100 parts per million of nitric oxide. The oxygenation index > 20 cm H2O. Hemodynamic and blood gas measurements were performed at baseline, at 1 hour after the patients had stabilized, and at 24-48 hours for all period of inhalation.

RESULTS. Results show that there were no secondary effects of nitric oxide inhalation administration. At the same time within 24h of nitric oxide inhalation mean oxygenation index decreased by 53%, mean systemic arterial pressure increased by 13% and abdominal arterial oxygen decreased by 28%. Dose-response tests showed that the optimal concentration of nitric oxide inhalation was 10 parts per million. In our experience prolonged nitric oxide inhalation (to 10 days) in pediatric acute respiratory distress syndrome patients showed improvement of oxygenation without acute secondary effects. An oxygenation index > 5 cm H2O/torr predicted successful withdrawal, with a sensitivity of 72% and a specificity of 84%.

CONCLUSION. Inhaled nitric oxide therapy improves gas exchange and lowers pulmonary vascular resistance with concomitant haemodynamic stabilization in children with acute respiratory distress syndrome. Therapy is not associated with significant clinical toxicity or adverse effects.

REFERENCE. Dose response to inhaled nitric oxide in pediatric patients with pulmonary hypertension and acute respiratory distress syndrome. (Nakagawa TA, J Pediatr, 1997 Jul)

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PROTECTIVE VENTILATOR STRATEGY IMPROVES PULMONARY FUNCTION IN PAEDIATRIC PATIENTS WITH INHALATION INJURY

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INTRODUCTION. Pediatric patients with inhalation injury often develop respiratory failure and require mechanical ventilation. Human and animal studies suggest that Conventional Mechanical Ventilation (CMV) may promote over-distention-induced pulmonary lesions, which could contribute to further lung injury. Protective ventilator strategies are now being used to prevent over-distention and stretching of normal lung units. High Frequency Percussive Ventilation (HFPV) is a form of protective ventilator strategy that has been shown to be effective in the treatment of adults and children with inhalation injury (1,2). The purpose of this study was to investigate if a protective ventilator strategy such as HFPV would result in improved pulmonary function in pediatric patients with inhalation injury when compared to CMV.

METHODS. Twenty-six severely burned children with inhalation injury who were previously ventilated by HFPV (n = 13) or CMV (n = 13) were evaluated for improvements in lung function at 3 months post discharge. Study variables included; Forced Vital Capacity (FVC), Forced Expiratory Volume in One second (FEV1), Maximal Voluntary Ventilation (MVV) and Diffusion studies (DLCO). Pulmonary function studies are presented as mean % of predicted and comparison between groups was performed by an un-paired students t-test.

RESULTS. A total of 26 thermally injured patients with inhalation injury were studied. Demographic data showed no significant difference between the two groups in regards to, age, % TBSA burn, or previous length of ventilation. Patients who were ventilated with HFPV had a significant reduction in the peak inspiratory pressure as compared to CMV. Pulmonary function showed no significant changes in the FVC or FEV1 between groups. However the MVV and the diffusion capacity were significantly increased in patients ventilated with the HFPV.

CONCLUSION. Results indicate that the use of a protective ventilator strategy such as HFPV is effective in significantly improving maximal voluntary ventilation and the diffusion capacity. The results may be relevant when choosing a ventilator strategy for pediatric patients with inhalation injury.

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PRE- AND POST-OPERATIVE RESPIRATORY COMPLIANCE IN SURVIVORS WITH HIGH-RISK CONGENITAL DIAPHRAGMATIC HERNIA

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INTRODUCTION. Timing of corrective surgery in congenital diaphragmatic hernia (CDH) is controversial, and some deterioration in respiratory function has to be anticipated (1). The aim of the present study was to add further evidence of worsening respiratory system compliance (Crs) postoperatively.

METHODS. 9 full-term neonates with high-risk CDH (manifestation within 6 h after birth) who survived surgical repair to discharge from ICU are reported. All patients were on conventional mechanical ventilation. Crs was determined by single breath occlusion method (Semnont-Medec 2000 Pediatric Pulmonary Cart) before and after operation. Simultaneously gas exchange was assessed by using the oxygenation index (OI = mean airway pressure * cmH2O2 * FIO2 (%) / PaO2 (mmHg)).

RESULTS. Median postnatal time for repair was 44 h (range 24–63). Median preoperative Crs was 0.47 ml/cm H2O/kg (0.21–0.83), concomitant Crs 1.25 (0.26–0.78). Postoperative median Crs decreased to 0.34 ml/cm H2O/kg (0.37–0.54) (p < 0.01), whereas median OI remained unchanged 3.9 (2.7–3.8). 6 patients were again investigated before extubation. Crs increased in all but one patient to 0.51 ml/cm H2O/kg (0.42–1.76), and in all OI decreased to 2.54 (1.7–4.6). Median time of mechanical ventilation (pre-and postoperative) was 5.24 (1.35–33.5).

CONCLUSION. Even in this selected group of survivors with repair of CDH, surgical closure / reconstruction of the diaphragm led to a significant deterioration of Crs. Reduced Crs is thought to be due to distortion of mediastinal, diaphragmatic and chest wall structures and increased intrathoracic pressure. Our findings underline the importance of careful preoperative stabilisation and delaying repair, until major adaptation of pulmonary circulation to extrathoracic life has taken place.

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S264
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CLINICAL SCORES OF CROUP SEVERITY AND OBJECTIVE MEASURES OF RESPIRATORY MECHANICS
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INTRODUCTION. Although there are a large number of croup scores used clinically and for research, none have ever been evaluated against objective measures of respiratory function. Clinical criteria included in scores include: cyanosis (or saturation < 92%), respiratory rate, level of consciousness, breath sounds, presence of stridor, presence of pulsus paradoxus, retractions (1 and 2).

METHODS. Ethical approval was obtained and parents consented to and were present during the studies. Studies were performed on 20 patients (aged 3.6 to 23.6 months, median 11.7) with clinically severe croup and 5 normal controls (aged 5 to 33 months, median 13) undergoing EEG as part of investigation of seizures. Children were sedated with chloral hydrate (50-75mg/kg). We recorded tidal intrathoracic pressure changes (DPeO2 cm H2O) with a water-filled oesophageal catheter-manometer and an-flow using a face-mask and Fleisch H1 pneumotachograph. Polygraphic tracings were digitized. We made the following measures of respiratory mechanics: Frequency (f (min-1)), Tidal volume (VT ml/kg), Minute ventilation (VE ml/kg/ min), Peak inspiratory flow rates (VINSPI ml/s), Pressure Time integral (PTTl cm H2O s.min-1) and Pressure Time integral (PTINT cm H2O s.min-1).

RESULTS. No croup patient was clinically cyanosed and on the 14 patients where saturation data was available, median saturation was 95% (range 92-100%). All croup patients had inspiratory and expiratory stridor, chest wall retractions and a croupy cough. Eighteen (90%) of croup patients had palpable pulsus paradoxus and 10 controls.

p = 0.06 < 0.01 NS NS < 0.01 < 0.01 < 0.01

CONCLUSION. Even in severe croup inspiratory flow rates are not significantly different from normal, and although some are unlikely to be useful criteria of severity except in extreme. Intrathoracic pressure swings are very large in severe croup (as are derived parameters) and clinical signs of chest wall rettraction and pulsus paradoxus may be useful. Even in severe croup desaturation and cyanosis are not common. There is a need to evaluate clinical croup scores against objective criteria of severity.

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SEVERE TRAUMATIC BRAIN INJURY AND CEREBRAL PERFUSION PRESSURE IN CHILDREN
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INTRODUCTION. Severe Traumatic Brain Injury (STBI) remains a major cause of death in childhood It is considered good practice, by most neurosurgical units, to monitor intracranial pressure (ICP) in these patients. Goal directed therapy based on maintaining cerebral perfusion pressure (CPP) in order to minimize secondary brain injury, is the main justification for this practice. Doubt remains about the benefits and effects on outcome.

METHODS. Demographic data, hourly ICP and CPP measurements (if monitoring was performed) and outcome were in all patients with a primary diagnosis of STBI admitted to the Paediatric Intensive Care Unit (PICU) at Southampton University Hospital between 1st September 1999 and 1st August 2001. Patients who had ICP monitoring were divided into 3 groups based on their outcome at follow up. Outcome groups were based on those used in similar studies. Intergroup ICP and CPP data were analyzed.

RESULTS. 41 patients were admitted to PICU with a primary diagnosis of STBI, representing just over 6% of all admissions. 31 of these had ICP monitoring on the PICU. Their median age was 9.5 years (27 male, 14 female). The majority of these injuries were sustained as a result of road traffic accidents. The crude mortality rate within these patients was 17%. Results are shown in Table 1. The mean ICP was significantly higher in the disabled survivors than in those who made a full recovery (p < 0.01). The CPP however, was not statistically different (p > 0.2) between these two groups.

Mean ICP Mean CPP

Group 1 (Normal) n = 18 11.73 (95% CI:5.87) 670.0 (95% CI:65-45)
Group 2 (Neurovisability) n = 9 20.65 (95% CI:7.54) 67.05 (95% CI:23.53)
Group 3 (Dead) n = 4 55.70 (95% CI:20.21) 28.67 (95% CI:19.80)

Table 1

CONCLUSION. As would be expected, the patients had higher mean ICPs in the worse outcome groups. However, goal directed therapy to maintain CPP although apparently successful, did not appear to prevent permanent neurological impairment in a significant number of patients. This data supports the view that measurement of ICP with goal directed measures to maintain CPP is a simplistic approach.

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HAEMODYNAMIC EFFECTS OF CAUDAL ANAESTHESIA ASSESSED BY A NON-INVASIVE METHOD
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INTRODUCTION. Pediatric caudal anesthesia is an effective method with a low complication rate. Little is known about its cardiovascular consequences. Transesophageal Doppler, a non-invasive method provided the opportunity for a reappraisal of caudal’s haemodynamic effects.

METHODS. After parental informed consent, Ten children aged two months to five years, scheduled for lower abdominal surgery were studied. General anesthesia was induced using sevoflu- rane. An oesophageal tube was then inserted followed by injection of a transesophageal Doppler probe. Caudal anesthesia was performed using 1 ml/kg of 0.25% bupivacaine with 1/200000 epinephrine. Hemodynamic parameters were collected before (first set) and after caudal anesthesia (second set). The two sets of haemodynamic data were compared using a paired Student t-test. A p value less than 0.05 was considered significant.

RESULTS. Heart rate, systolic, diastolic and mean arterial pressures were not modified by caudal anesthesia. Descending aortic blood flow increased dramatically from 1.14 to 1.72 l/min. (p = 0.0002). In the same time, aortic ejection volume rose from 8.51 to 14.53 ml (p = 0.0002). Simultaneously aortic vascular resistances decreased from 6279 dyn sec.cm-5 to 3901 (p = 0.005).

CONCLUSION. As previously described, caudal anesthesia did not affect heart rate and mean arterial pressure. Surprisingly, a significant increase of descending aortic blood flow was ob- served while systemic vascular resistances decreased. These phenomena were probably in- duced by a caudal sympathetic blockade.

Poster Sessions
Practices in mechanical ventilation – 506–516

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A NEW STRATEGY TO ADMINISTER BRONchodilATING AGENTS IN FLOW LIMITED COPD PATIENTS
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INTRODUCTION. Bronchodilating agents are commonly used in patients with chronic obstructive pulmonary disease (COPD) undergoing mechanical ventilation for acute respiratory failure (ARF). The distribution of the drug in the airways is influenced by several factors, related to the patient, to the ventilator and its circuit, to the drug used and the route of administration. Since the use of an external PEEP (PEEPs) could reduce lung hetero- geneity (1), we reasoned that the administration of subatmospheric in presence of an applied PEEP should improve the efficacy of this therapy.

METHODS. Five flow limited COPD with ARF were studied before and after administration of four puffs of a 0.3% solution of salbutamol by the NPEL test. During the drug administration patients were ran- domly ventilated in humid-ventilated (iv: ZEEP and ZEEP with an applied PEEP equal to 70% of the value of intrinsic PEEP (PEEPi). Then on hour after the same patient was given the drug in the opposite way. Data of respiratory mechanisms were determined on ZEEP by the constant flow rapid occlusion method, which al- lowed to evaluate tidal volume, inhaled and expired volume, (Bt at, Bt, Vm, En), and PEEPi.(2,3). In the same way, the % tidal volume (TV) reduction of an applied PEEP, iv: ZEEP and iv:ZEEP with PEEP (0.3% TV = 60% (b) (0.3) and high: PEEP (6%) (a: NS) (b) and high: PEEP (6%) (a: NS) (b) when compared to the administration on ZEEP table (1).

| Patient | TV (Tid) | TV (Tid) | TV (Tid) | TV (Tid) |
|---------|---------|---------|---------|---------|
| ZEEP    | 25.7%   | 23.6%   | 26.3%   | 26.4%   |
| PEEP    | 18.3%   | 21.2%   | 22.6%   | 23.7%   |

Table 1: Respiratory mechanics data (mean ± SD) obtained before and after bronchodilating agent (b) administration and comparison with ZEEP (a).

CONCLUSION. Although these results are based on a limited number of patients, the use of PEEP, during subatmospheric ventilation seems very promising in reduce respiratory resistance and hence intrinsic PEEP. This could probably explain the fact that the drug reached faster the lung which can be not obtained when the drugs are de- livered on ZEEP.

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SHORT-TERM EFFECTS OF PRONE POSITION IN COPD PATIENTS WITH ACUTE HYPOXEMIC AND HYPERCAPNIC EXACERBATION

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INTRODUCTION. In COPD patients, hypoxemia and hypercapnia are usually easily corrected with invasive mechanical ventilation (IMV). However, some patients require additional therapy because of major hypoxemia despite high FiO2 level. Prone position (PP) is an effective treatment of severe hypoxemia in ARDS. Effects of PP in COPD patients with severe hypoxemic and hypercapnic exacerbation have never been reported.

METHODS. 11 consecutive COPD patients with persistent hypoxemia and hypercapnia (PaCO2 > 45 mmHg) under IMV were studied. Patients with criteria of ARDS or left ventricular failure were excluded. PP was required when PaO2/FiO2 < 200 mmHg with FiO2 > 0.6. Patients characteristics were recorded. Patients were turned every 6 hours. Blood gases and respiratory parameters were measured in PP and in supine position (SP). Study was performed during 36 hours. Thus, six consecutive measurements were performed (SP1, SP2, SP2, SP3, SP3, PP1). A 20% improvement of PaO2/FiO2 was required to consider positive the response to PP. A semi-quantitative assessment of tracheal aspirates was performed: p < 0.05 was considered significant.

RESULTS. Patients characteristics were: age = 73 ± 11 (years); weight = 86 ± 31 (kg); SAPS = 55 ± 10; mortality rate = 40%. 9/11 (82%) patients were responders to PP. No difference was found in platelet pressure, intrapleural PEPE and static compliance according to the patient position. Patients had significant improvement of PaO2/FiO2 in PP as compared to SP (113 ± 18 in SP1 vs 190 ± 26 in PPI; p = 0.0001; 148 ± 17 in SP2 vs 175 ± 22 in PPI; p = 0.02; 151 ± 13 in SP3 vs 199 ± 24 in PPI; p = 0.001). After PP1, PaO2/FiO2 remained improved in PP2 as compared to SP1 (p = 0.034). We determined a linear relationship between improvement in PaO2/FiO2 from SP1 to SP2 and the value of PaO2/FiO2 at PPI (Pearson = 0.986). Volume of tracheal aspirates demonstrated significant improvement from SP1 to PPI (p = 0.007). However, total resistance of the respiratory system and PaCO2 did not vary significantly according to patient position (61.2 ± 3mmHg in SP1 vs 55.7 ± 2.5mmHg in PPI; p = 0.157).

CONCLUSION. PP was effective to treat severe hypoxemia in COPD patients under IMV. We demonstrated that improvement in PaO2/FiO2 between SP1 and SP2 was proportional to improvement between SP1 and DII.

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THE VIRTUAL PATIENT IN THE ICU: FLUID DYNAMICS COMPUTER SIMULATION OF MECHANICAL VENTILATION IN LUNG DISEASE

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INTRODUCTION. The relative inaccessibility of airways and alveoli for measurements and the anatomical complexity of the bronchial tree make assessment of lung disease difficult. Mathematical modeling of gas fluid dynamics of the lung appears promising for improved understanding of pathomechanisms of lung disease and for training in mechanical ventilation.

METHODS. Based on the fundamental constitutive equations of fluid dynamics, a computer simulation model of the lung was created. This allows to model the human tracheobronchial tree, including localized or diffuse, symmetric and asymmetric, homogeneous and focal airway abnormalities, as well as the presence of secretions. Different ventilation settings and a variety of gas mixtures can be chosen, and modelling of turbulent or laminar flow is derived in real-time from actual flow conditions within each airway segment.

RESULTS. Using human morphometric data for simulation of normal lungs with CMV ventilator settings, normal ventilation patterns, pressure, and resistance are observed. Further confirming the applicability of the model. Introducing an orotracheal tube into the model leads to an increase overall airway resistance, as does obstruction at the level of the bronchial tree, with typical prolongation of expiration. With airway obstruction, especially when combined with higher ventilation rates, air trapping is observed. In patients with asymmetric airway obstruction, shifting of air from one lung to the other (‘Pendelluft’), a phenomenon known from respiratory physiology, but usually not directly observable in the ICU patient, can be observed. Furthermore, the effects of helium/oxygen ventilation, a new ventilation strategy, can be directly and quantitatively assessed, and its differential effect in upper versus lower airway obstruction can be studied.

CONCLUSION. Fluid dynamics computer simulation of the ventilated patient is feasible and allows for the simulation of various lung diseases. This simulation model will be useful in the assessment of treatment effects of new ventilatory strategies (like heliox ventilation) and the development of suboptimal ventilation strategies can be directly observed without endangering the patient.

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MECHANICAL VENTILATION PRACTICES IN PORTUGAL: PRELIMINARY RESULTS

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INTRODUCTION. The Portuguese Working Group in Acute Respiratory Failure (www.apcr.org) develop an inquiry to study how conventional mechanical ventilation is employed in Portugal.

METHODS. A 1-d point-prevalence study was performed with the aim of studying the characteristics of ICU patients and methodology of mechanical ventilation. Inquirers were sent to all 50 ICU registered at the Portuguese Society of Intensive Care.

RESULTS. We got responses from 29 ICU, with 194 in-patients at the moment of the study and 169 patients receiving mechanical ventilation, still intubated or with a tracheostomy and ventilated in the previous 24h. The median percentage of patients under mechanical ventilation was 85.5%. The study patients were predominantly male (58.1%), with a median age of 66, a median APACHE II of 2, a median duration of mechanical ventilation at the study day of 9d. The main reasons for mechanical ventilation were acute respiratory failure (68.8%), acute exacerbation of chronic respiratory disease (19.4%), coma (6.9%) and neuromuscular disorders (6.9%). Mechanical ventilation was delivered via an oro-tracheal tube in 69.4%, a naso-tracheal tube in 31.1%, a facial mask in 3.7% and a tracheostomy in 23.8%. Ventilator modes consisted of volume-controlled ventilation in 92%, pressure-controlled ventilation in 20.6%, pressure support in 25.6% and synchronized intermittent mandatory ventilation with or without pressure support in 10%. The median tidal volume setting was 7.9 ml/kg in patients receiving controlled ventilation and the median setting of pressure support was 16 cm H2O. The median positive end-expiratory pressure was 4 cm H2O. The median pH was 7.43. The median PaO2/FiO2 ratio was 232 mmHg < 200 mmHg in 37.7% and < 300 mmHg in 77.5% of the patients. At the study day 45.7% of the patients were in a weaning trial and in almost 2/3 the method employed was ‘pressure support’ > ‘P-11v’ > ‘extubation’.

CONCLUSION. 1. In Portugal indications for initiation of mechanical ventilation are similar to other published series [1]. 2. Half of the patients are ventilated in volume or pressure-controlled modes. 3. By far the preferred weaning method is pressure support. 4. The occupancy and rate of ventilated patients are higher in than other similar series [1].

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RESULTS OF RESPIRATORY MECHANICS ANALYSIS IN THE CRITICALLY ILL: DEPEND ON THE METHOD EMPLOYED
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INTRODUCTION. In critical care ventilated patients we would expect that different methods of respiratory mechanics analysis to yield different results, because the respiratory mechanics of patients with lung injury are characterized by non-linear and heterogeneous behavior. Our objective was to compare the measurements of total resistance and dynamic elastance determined by different techniques of respiratory mechanics analysis based on the time or frequency domains.

METHODS. In 18 sedatedparalyzed patients who needed controlled mechanical ventilation for acute or chronic acute respiratory failure we studied: the total resistance and dynamic elastance. In the time domain were determined by the occlusion technique and by multiple linear regression. The Fourier analysis was used to study the impedance of the respiratory system for elastance and resistance values in the frequency domain. Airflow was measured with a heated pneumotachograph interposed between the endotracheal tube and the Y piece of the ventilator. The flow signal was integrated to obtain the volume. Tracheal pressure was measured using a polyethylene catheter.

RESULTS. The ANOVA analysis of the elastance variable showed no statistical differences (F[4,14] = 3.12, p = 0.05) or of the patients with measured volume (F[4,14] = 3.12, p = 0.05) than Rmx (17.8 ± 19.1 cmH2O·s·L−1) or RF (17.6 ± 19.2 cmH2O·s·L−1). There were no differences between RMx and RF (p = 0.7) and the correlation between resistances was 0.7 ± 0.9. The agreement analysis for variables without statistical differences showed the following limits. EdynLocelic: -17.4 ± 17.3 cmH2O. Edynsoc: mH2O: -12.9 ± 9.9 cmH2O. Edynelic: -18.1 ± 19.1 cmH2O. RFx: -18.1 ± 19.9 cmH2O·s·L−1. This last range was related to the autoPEEP level (r = 0.9).

CONCLUSION. The wide agreement limits show that respiratory mechanics analysis is very dependent on the measurement technique used, particularly for resistance, perhaps due to the higher dependence on frequency.

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RESPIRATORY RATE DURING MECHANICAL VENTILATION ACCORDING TO THE EXPIRATORY TIME CONSTANT
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INTRODUCTION. The analysis of the expiratory time constant (tau) enables calculation of the time required for a complete expiration and therefore appropriate adjustment of the respiratory rate during controlled mechanical ventilation. Our objective was to calculate the respiratory rate at which rate-dependent intrinsic-PEEP starts to appear.

METHODS. Twenty patients were studied, 8 with acute respiratory distress syndrome (ARDS), 8 with moderate acute lung injury (ALI), and 4 with acute-on-chronic respiratory failure (ACRF), all on controlled mechanical ventilation with constant flow. Airflow was measured with a heated pneumotachograph interposed between the endotracheal tube and the Y piece of the ventilator. The flow signal was integrated to calculate the volume. The time constant was measured in the expiratory phase of the volume curve, adjusted to a single-exponential equation plus a constant [Y(t) = Y0 + Y0τ exp(-t/τ)]. We calculated the respiratory rate considering an E/R ratio of 1:2 and an expiratory time of 4-fold the time constant.

RESULTS. The value of τ was very small (0.034 l), being 0.11 in only three patients, and correlated with the tau value (r = 0.65). The tau value was higher (p = 0.006) in patients with ACRF (1.55 ± 0.39 s) than in patients with moderate (0.74 ± 0.20 s) or severe (0.66 ± 0.27 s) ALL. In the patients with ACRF, the respiratory rate set on the respirator (12.7 ± 2.2 breaths per minute [bpm]) was double that calculated with the time constant (6.7 ± 1.6 bpm). These differences were smaller in the other two patient groups (ALL 15.5 ± 1.3 vs. 14 ± 1.9 bpm; ARDS 17.1 ± 2.8 vs. 18.02 ± 2.9 bpm). To maintain the minute volume at this new respiratory rate the tidal volume would have had to be increased from 0.62 ± 0.07 to 1.25 ± 0.421 in the ACRF patients and from 0.61 ± 0.13 ± 0.71 ± 0.351 in the ALL patients; in the latter group the tidal volume would have had to be over 11 times too large.

CONCLUSION. The time constant can be approached without interrupting mechanical ventilation by using a single exponential equation plus a constant. According to our data, this method in low compliance patients with ACRF, in whom, as in some patients with ALL, dynamic hyper-inflation is inevitable.

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LOW STANDARD BASE EXCESS PREDICTS RESPIRATORY FAILURE IN PATIENTS WITH ACUTE SEVERE ASTHMA
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INTRODUCTION. Patients with acute severe asthma present with acute respiratory acidosis due to Ventilation/Perfusion mismatch. Clinical and metabolic predictors of respiratory failure except in obvious extreme cases are sub-optimal. Standard Base Excess obtained from arterial blood gas varies in proportion to metabolic disturbance and if low indicates concomitant metabo- lolic acidosis. We hypothesized that in acute severe asthma, respiratory muscle fatigue will cause lactic acidosis and a change in base excess. This change in base excess in turn may be a predictor of respiratory failure.

METHODS. Retrospective data extracted from medical records of 30 consecutive patients with acute severe asthma requiring intensive care unit admission in urban teaching hospital.

RESULTS. Median age 45 yrs (males = 10, females = 20). 17 cases (57 %) required mechanical ventilation (MV). 28 cases (93 %) survived to hospital discharge. Table below represents initial values in the two groups. Patients requiring mechanical ventilation (MV) and patients not requiring mechanical ventilation (non MV). Lethargy, Wheeze, breath sounds, Blood Pressure and Heart Rate were not significantly different between groups. Change in anion gap negatively correlated with Base Excess (r = −0.622) and not with pH (r = −0.17). Base Excess <−5 had positive predictive value of 87.5% and negative predictive value of 54.5% for mechanical ventilation.

| MV (n = 17) | Non MV (n = 13) | Sig |
|-------------|----------------|-----|
| pH          | 7.21±0.10     | 7.48±0.07 | 0.01 |
| pCO2 mmHg   | 66.8±24.2     | 53.1±15.9 | 0.10 |
| pO2 mmHg    | 325±145.5     | 275±120.7 | 0.10 |
| Respiratory rate/min | 32±5.6 | 30±11.7 | 0.63 |
| Base Excess <−5 | 7 cases (87.5%) | 1 case (12.5%) | 0.04 |

CONCLUSION. Standard Base Excess appears to be low in patients with acute severe asthma requiring mechanical ventilation. Prospective studies are needed to evaluate predictive accuracy of this measure that can be obtained very early from arterial blood gas.

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ELECTROLYTE SHIFT AS PREDICTIVE FACTOR FOR ACUTE RESPIRATORY FAILURE
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INTRODUCTION. We mentioned that patients with low electrolyte status had a higher risk for development of respiratory failure than patients with well balanced electrolytes by same APACHE-II scores. We incubated cultured human lung epithelial cells with different concentrations of K+. Cell cultures with higher concentrations did express more ion channels than those with lower concentrations.

METHODS. We treated 10 Patients with serum K+ lower than 3.5 mmol/L with CIK-Infusion with an predictive balance within 36 hours and 100 patients with a predictive balance within a shortest time. We analysed the evidence of respiratory failure in both groups by monitoring BGA, lactate, blood pressure and electrolytes levels.

RESULTS. The group with low P=0.05 and CIK-Infusion showed no significant differences than the group with lower CIK levels. In the rapid balance group the mortality was significantly higher. 25 patients died on MOF in 18 cases there was an maximum increase and activation of ion channels in lung parenchyma.

CONCLUSION. Ion channels are activated by changes in serum K+ levels. Consecutively all channels have part on cellular water uptake. In clinical practice there was no evidence found for rapid balance of K+ Serum-Lever. Moderate k+ Substitution may lower the incidence of ARF.

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STRESS-ULCER PROPHYLAXIS IN MECHANICALLY VENTILATED PATIENTS: DOES DOSAGE MATTER?
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INTRODUCTION. Mechanical ventilation and coagulation disorders have been identified (1) as the main risk factors of clinically important stress-ulcer bleeding (requiring red-blood-cell transfusion or surgical intervention). A recent large multicenter study (2), including only pa-
tients mechanically ventilated ≥ 48 h observed clinically important bleeding complications in 23 (3.8%) of 608 patients treated with succinyl. These results contrast our own clinical expe-
rience obtained with a different dosage regime and encouraged us to investigate this problem in more detail.
METHODS. Since observational studies have been now acknowledged as similar valid as ran-
domized studies (3), we performed a large prospective observational study with the same inclu-
sion and exclusion criteria and outcome parameters used in the recent Canadian multicenter study (2). The only difference between both studies was the succinate dose. While the Canadi-
an study administered succinate in a dose of 4.4 g day, our patients received a 3.5 g day regime. Preliminary endpoint was the occurrence of clinically important bleeding. The predicted bleeding incidence was calculated based on the results of the Canadian study and was compared to the actual bleeding incidence.
RESULTS. After approval of our ethics committee 620 mechanically ventilated patients were included in the study. Coagulation disorders were present in 95 (15.5%) patients. Apache II Score was 26.47 ± 7.49 and duration of mechanical ventilation was 6.8 ± 10.43 days. The pre-
dicted incidence of clinically important bleeding in our study was 24 (95% confidence interval 15–36), while the actual incidence was 1 (95% confidence interval 0–4, p = 0.001).
CONCLUSION. The results of the Canadian study group are not valid for ICU’s with a differ-
et dosage regime of stress ulcer prophylaxis. Since there are no hints, that the efficacy of ICU therapy in Canada and Germany is principally different, the reason for the difference of bleed-
ing incidence may most probably be explained by the divergent succinate dosage.
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COULD ALL THE TECHNIQUES OF CHEST PHYSOTHERAPY BE USED WITH SAFETY IN PATIENTS WITH GLASSOW COMA SCALE < 8?
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INTRODUCTION. To evaluate the effects of the technique of chest physiotherapy for flow de-
viation (through the unilateral continuous thoracic compression of one hemi thorax with the ob-
jective of expanding the other lung) in ICU.
METHODS. We evaluated 30 patients with Glasgow Coma Scale < 8 (22 with Traumatic Brain Injury and 8 with Stroke) ranging from 19 to 81 years of age (mean 45.3 ± 15.33). APACHE II ranged between 8 to 36 (mean 21). All ICU monitoring was by subdural catheter. The patients were monitored with volume control ventilation and the technique was achieved between the first and the third day after the brain injury. The sedation was enough to maintain the Ramoney scale in six. All of the patients were submitted to continuous unilateral thoracic compression during 90 seconds, whereas ICP was monitored.
RESULTS. All of the patients showed increase in ICP after 60 to 90 seconds of continuous uni-
lateral thoracic compression. Before the technique be accomplished, ICP ranging from 5 to 32 mmHg (mean: 15.33 ± 9.1). After the technique, ICP ranged from 8 to 36 mm Hg (mean: 20.5 ± 9.4). The increase of ICP ranged from 2 to 8 mm Hg (mean: 4.7 mmHg). According to Wicckson Test, there was a significant increase of ICP after the technique (P = 0.0000075). The decrease of the CVP (Cerebral Pressure Perfusion) ranged from 2 to 8 mmHg (mean: 4.7 ± 2.9). The ICP in mechanical ventilation ranged from 5 to 33 days (mean 11.0). Four patients died.
CONCLUSION. The technique for flow deviation, showed as it should not be used in pa-
tients with severe brain injury. We suggested that this technique should be contraindicated in patients with Glasgow coma scale < 8, once it showed significant increase in ICP, with decrease of the CVP and possible clinical deterioration.
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PARTITIONING OF WORK OF BREATHING IN MECHANICALLY VENTILATED COPD PATIENTS: EFFECTS OF BODY POSITION
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INTRODUCTION. The purpose of this study was to thoroughly elucidate the effects of body positioning on the partitioned inspiratory work done on the respiratory system (RS), chest wall (CW), and lung (L) in chronic obstructive pulmonary disease (COPD).
METHODS. COPD and control (with no respiratory pathology), anesthetized, paralyzed, and mechanically ventilated patients were positioned supine (S), semirecumbent (SR), and prone (P) in random order. Tracheal (RS) and esophageal (CW) pressures were determined while tidal volume (VT) was varied from 0.2 to 1.2 L by 0.2 L increments at constant flow (0.9 L/ s). RS and CW intrapleural positive end-expiratory pressures (PEEP), peak pressures, resistive pres-
sure drops, viscoelastic pressure dissipations, and static (plateau) pressures were determined with the end expiratory/inspiratory occlusion technique (1). RS and CW pressure volume curves were constructed for each body position, and the dynamic and static components of the RS, CW, and L work per breath were determined (at VT = 0.6 and 1.2 L) as previously described (1). Statistical analysis was performed with two way analysis of variance. The Sheffe test was used for post hoc comparisons. Significance level was set at P < 0.0034 (Bonferroni correction).
RESULTS. A) COPD group. At 0.6 L, the total RS (WTotRS) increased from S to P due to si-
multaneous increases in the RS elastic work (WeiRS), and static PEEP L, and CW work (WPEEL and WPEEP CW respectively) from S to SR, an increase in the resistive CW work was counterbalanced by a simultaneous decrease in WPEEP CW from S to P. WTotRS increased due to simultaneous increases in WeiRS, WPEEL, and WPEEP CW. At 1.2 L, however, P induced a decrease in dynamic L work was counterbalanced by simultaneous increases in WPEEL and WPEEP CW from S to SR, only WPEEP CW decreased, from S to P, a de-
crease in the viscoelastic L work was counterbalanced by simultaneous increases in WPEEL and WPEEP CW. B) Control group. At 0.6 as well as 1.2 L, neither WTotRS nor any of the L,
CONCLUSION. In COPD, at a VT of 0.6 L, SR position seems to be an effective alternative position to S; P positioning seems disadvantageous, because it aigments air trapping, at VT = 1.2 L, although WTotRS is not affected by body position change. P positioning is still asso-
ciated with increased air trapping. In control patients, the effects of S, SR, and P positioning on breathing work are similar at both 0.6 L and 1.2 L.
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RESPIRATORY FUNCTION AND CONTROL OF BREATHING IN PATIENTS WITH GENERALIZED MYASTHENIA GRAVIS
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INTRODUCTION. Central ventilatory drive has studied in several different neuromuscular dis-
cases. Myasthenia Gravis has been implicated with increased neuromuscular drive. The aim of this study was to identify the respiratory centre response in generalized Myasthenia Gravis.
METHODS. 15 patients with moderate generalized Myasthenia Gravis, 9 males and 6 females aged 18-69, were included in the study. 15 healthy persons with similar age and sex were used as control group. Spirometry, ventilation muscle strength as reflected from maximum inspirato-
y and expiratory respiratory pressure (MIP, MEP); inspiratory rate (RI), tidal volume (TV), mean inspiratory flow (V(1/T)), Ti/Tot, mouth occlusion pressure (PO1) were recorded in all the patients. Statistical analysis was performed by using student t-test.
RESULTS. In patients with Myasthenia, forced vital capacity was decreased in 4 subjects. Mean value of forced vital capacity (FVC) was 85 ± 14% of predicted. Muscle strength was markedly reduced, maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP) was 52.5 ± 48.22% of predicted value respectively. There was no significant difference for para-
eters of control of breathing (VT, RR, Vti, Vt/Ti, Ti/Tot, PO1) between myasthenic patients and the control group. Data is summarized in the following table (all values are expressed as mean ± SD).

| Parameter     | Control Group | Myasthenia     | p     |
|---------------|---------------|----------------|-------|
| Vt (l/min)    | 22.1±4.44     | 21.4±3.48      | 0.96  |
| V ti (l/min)  | 0.41±0.15     | 0.39±0.01      | 0.22  |
| Ti/Tot        | 0.64±0.12     | 0.64±0.10      | 0.33  |

CONCLUSION. Muscle strength was reduced significantly in all myasthenic patients. A nor-
mal breathing pattern with a slight increase in mouth occlusion pressure (PO1) was also present in patients with generalized Myasthenia Gravis.
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A COMPARATIVE STUDY OF FOUR PREDICTIVE PARAMETERS FOR WEANING
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INTRODUCTION. To evaluate four predictive parameters for weaning, observing: (a) The generated pressure in the airway at 0.6 sec after the inspiratory effort (P<0.4 < 2 cmH2O); (b) Rapid Shallow Breathing Index (FIV ratio > 103); (c) PaO₂/FiO₂ ratio > 300; and (d) A new integrative index, the Index of Nemer (IN) = Quasi estatic lung compliance x SaO₂/FIV ratio > 25.

METHODS. Two hundred and ten patients with several etiologies in weaning process were evaluated all of them with FiO₂ < 0.4 and PEEP < 8 cmH2O. The age ranged between 17 and 94 years. APACHE II ranged between 2 and 40 (mean 17.7). Success in weaning was obtained in 142 patients (those who were not reintubated in the following 48 hours after the definitive disconnection from the mechanical ventilator). The ventilators used were Evia I and 2 (Drager – Germany). The four predictive parameters were measured before the definitive disconnection from the mechanical ventilation. Clinical and neurological stability were indispensable for the admission of the patients in the study.

RESULTS. Of the four predictive parameters for weaning, the Index of Nemer showed the best accuracy, with sensitivity 0.99; specificity 0.96, positive predictive value 0.99, negative predictive value 0.96. The value of c2 (Quin-Square) found was significant with 25.33 (P < 0.01). Following, the P2.1 showed sensitivity 0.94, specificity 0.46, positive predictive value 0.92, negative predictive value 0.56. Next, the Rapid Shallow Breathing Index showed sensitivity 0.64, specificity 0.64, positive predictive value 0.94, negative predictive value 0.39. Finally, the PaO₂/FiO₂ ratios showed sensitivity 0.92, specificity 0.17, positive predictive value 0.88, negative predictive value 0.27.

CONCLUSION. The Index of Nemer showed to be more accurate in the weaning outcome. We conclude that the Index of Nemer in an index that integrates several parameters, like the Index of Nemer, may evaluate with greater accuracy the prognosis of patients in weaning.

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THE USE OF END-POSITIVE AIRWAY PRESSURE (EPAP) IN PATIENTS WEANING FROM MECHANICAL VENTILATION
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INTRODUCTION. The use of spontaneous EPAP in weaning from mechanical ventilation has been widely explored. In theory EPAP can prevent airway collapse during expiration. The purpose of our study is to compare EPAP with support pressure ventilation (PSV) and T-piece in patients undergoing weaning.

METHODS. Twenty one patients who needed mechanical ventilation for more than 48 hours in a general intensive care unit were prospectively evaluated in a randomized cross-over study. All patients were submitted to the three methods (EPAP, PSV and T-piece) during 30 minutes. Each method was followed by a rest time (at least 30 minutes). They were monitored by Vent- Track (Novametrix, USA) Parameters, measured at 1 and 30 minutes, were: work of breathing (WOB), minute ventilation (MV), arterial oxygenation (SatO₂), end-tidal CO₂ (ETCO₂), heart and respiratory rate (HR and RR), mean arterial pressure (MAP). Comparisons were done by a one way analysis of variance and t test. The level of significance was p < 0.05.

RESULTS. The preliminary results obtained with the three methods were: no differences in the median values among the treatments groups are greater than would be expected by chance in WOB (p value = 0.01) MV (p value = 0.002)** and SatO₂(p value = 0.004)**. (EPAP different from PSV, PSV different from T-piece and EPAP different from T-piece; **EPAP different from PSV and PSV different from T-piece; ***EPAP different from T-piece and PSV different from T-piece). Comparison between ETCO₂, HR, RR and MAP obtained at 1 and 30 min were not different.

CONCLUSION. Those preliminary results showed that EPAP offered greater WOB than PSV or T-piece, smaller MV than PSV but similar to T-piece and similar SaO₂ to PSV but greater than T-piece. In general, EPAP offered no advantage over the other methods in patients weaning from mechanical ventilation.

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THE INDEX OF NEMER AND FREQUENCY/TIDAL VOLUME RATIO IN WEANING OF PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE
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INTRODUCTION. To compare the accuracy of the Index of Nemer (IN) with the Rapid Shallow Breathing Index (FIV)/Tidal volume ratio in weaning of patients with Chronic Obstructive Pulmonary Disease (COPD).

METHODS. We evaluated 68 patients with COPD in weaning process (all of them with FiO₂ < 0.4 and PEEP < 8 cmH2O). The ages ranged between 43 and 94 years. APACHE II ranged between 10 and 25 (mean 15.14). Success in weaning was considered when the return to mechanical ventilation wasn’t necessary in the following 48 hours after definitive disconnection from the mechanical ventilator. The ventilators used was the Eviol and 2 (Drager – Germa- ny). Clinical and neurological stability were indispensable for admission the patients in this study. Index of Nemer = Quasi-estatic Lung compliance x SaO₂/FIV ratio > 105 > Prognosis in weaning. < 105 > Poor prognosis in weaning. Rapid Shallow Breathing Index = FIV ratio > 105 > Prognosis in weaning. < 105 > Poor prognosis in weaning.

RESULTS. Of the 68 patients evaluated, 57 were successful in weaning while 11 were unsuccessful. 5 of each died. The FIV ratio indicated with accuracy the prognosis of weaning in 48 of the 68 patients, whereas the Index of Nemer was accurate in 66 of the 68 patients. The value of c2 (Quin-Square) found for the Index of Nemer was significant with 53.1 (P < 0.02). The FIV ratio showed sensitivity 0.79, specificity 0.54, positive predictive value 0.90 and negative predictive value: 0.33. The Index of Nemer showed sensitivity 0.98, specificity 0.54, positive predictive value: 0.80 and negative predictive value: 0.90.

CONCLUSION. Once the patients with COPD generally present high respiratory frequency with lower tidal volume, we believe that it is less accurate in predicting the weaning outcome in these patients. The Index of Nemer, that integrates several parameters in only one equation, showed great accuracy in predicting the weaning outcome in patients with COPD.

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THE VALUE OF RESPIRATORY RATE/TIDAL VOLUME RATIO AS A WEANING PARAMETER FOR MECHANICALLY VENTILATED COPD PATIENTS
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INTRODUCTION. The aim of this study was to determine the value of the respiratory rate to tidal volume ratio (FIV) as a weaning parameter in mechanically ventilated COPD patients.

METHODS. We studied 32 COPD patients on the day that their primary physician decided a T-piece weaning trial. Minute ventilation (VE), respiratory rate (I), rapid shallow breathing index (FIV), heart rate (HR), and arterial blood pressure (BP), were measured just before and at 5, 30, and 60 minutes after the patients were disconnected from the ventilator. Arterial blood gas- es were measured before disconnection and at 5 and 30 minutes of the trial. Patient character- istics included age, days on mechanical ventilation, and endotracheal tube size, while laboratory data of the trial day included temperature, complete blood count, serum albumin, magnesium, phosphorus, and electrolytes.

RESULTS. Group A consisted of 21 patients (mean age 70 ± 9.2 years, ventilator days 5.2 ± 2.0) who were able to remain in spontaneous breathing and were successfully extubated. Group B (mean age: 71.9 ± 4.7 years, ventilator days 5 ± 2.3) consisted of 3 patients who were extubated and reintubated during the next 48 hours and 6 patients who returned to ventilatory support because of clinical deterioration during the T-piece trial. Statistical analysis (S2-test) between the two groups for all measured parameters at the 4 time-points of the trial showed no differences. Mean FIV was high for both groups, without a rising trend on subsequent mea- surements during the trial for both groups. To evaluate the predictive accuracy of FIV ratio we used six threshold values (30, 105, 110, 115, 120, and 225). The highest sensitivity and specific- ity was achieved with a threshold value of 125 at 60 minutes of the T-piece trial (81.3 and 45.5, respectively).

CONCLUSION. Rapid shallow breathing index is not an accurate predictor of weaning out- come in COPD patients. Clinical judgement seems to predict successful extubation better than any of the threshold values of the FIV ratio that were tested. Unless more sophisticated weaning parameters are used, measuring only the FIV ratio in COPD patients during a T-piece trial does not seem to help in predicting weaning outcome.
INCIDENCE OF UNPLANNED EXTUBATION IN A SURGICAL INTENSIVE CARE UNIT

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INTRODUCTION. Unplanned endotracheal extubation (UEE) is a common problem in mechanically ventilated patients in the intensive care units (ICUs). Both, accidental and self-extubation are considered unplanned extubations[1,2]. The aim of the study was to investigate the incidence and the management of unplanned extubation in a surgical ICU.

METHODS. We studied prospectively all mechanical ventilated patients admitted to our surgical ICU during a two years period. We registered, gender, type of patients, type of UEE, time of UEE, modality of ventilatory support, level of sedation, need for reintubation and outcome.

RESULTS. During the study period between January 1999 and December 2000 a total of 924 patients were admitted and 666 (72.1%) of them were under mechanical ventilation. UEE occurred in 31 patients (4.7%). 22 were male and 9 female with a mean age of 48±20(1–103) years. In 20 patients UEE was delivered or self-extubation and in 5 patients was accidental. The type of patients under mechanical ventilation were: 15 neurosurgical patients, 11 general surgical patients and 5 polytransplant patients. A 65% of the UEE occurred during night time. UEE occurred during the weaning period in a 84% of patients and during full ventilatory support in a 16% of patients. Twelve of 31 patients (38.7%) need reintubation after UEE. The length of ICU stay of the mechanically ventilated patients was 7.5 days and 9.9 days of the UEE patients. The mortality rate of UEE patients was (9.7%).

CONCLUSION. The incidence of UEE in our surgical ICU (4.7%) was similar to those reported in the literature (3 to 16%). The majority of UEE were self-extubations, during weaning period and at night time. The UEE was higher in neurocritical patients. UEE did not prolong the ICU length of stay, neither increased the mortality rate.

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RISK FACTORS AND THE IMPACT ON THE OUTCOME OF ACUTE CORTICOSTEROID MYOPATHY

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INTRODUCTION. We set out to determine the incidence, risk factors and the impact on the outcome of acute myopathy in a group of patients admitted to the ICU by acute exacerbation of chronic respiratory failure that received high doses of corticosteroids.

METHODS. Twenty-six patients with respiratory failure that received corticosteroids intravenously were studied prospectively. All these patients required mechanical ventilation but only seven were treated with muscle relaxants. At the admission/arrival of illness was evaluated by APACHE II score. Daily, laboratory tests included: glucose, sodium, potassium, phosphorus, creatinine, and creatine phosphokinase. Serum magnesium levels were measured twice a week. Other factors analysed were: demographic data, previous corticosteroid therapy, type of medication employed and total doses, the presence of sepsis, and bacteremia. An electrophysiological study (EPS) was performed in all cases at the onset of weaning. Acute myopathy was diagnosed if small, brief and polyphasic motor unit action potentials characteristic of a myopathic process were present. Muscle biopsy was done when EPS was consistent with myopathy. Univariate and multivariate analysis were carried out with SPSS 9.0.

RESULTS. Nine patients (34.6%) developed acute myopathy that was confirmed by histology in four cases (permission was denied in the rest). In the multivariate analysis, risk factors for myopathy were APACHE II score at admission (OR 2.05, 95% CI 1.13–3.78, p < 0.001) and the development of sepsis (OR 32.05, 95% CI 2.76–370.18; p < 0.001). Myopathy prolonged significantly mechanical ventilation and increased the length of ICU and hospital stays. Three patients with myopathy (33.3%) and three without myopathy (17.6%) died and in the multivariate analysis, myopathy was not an independent predictor of in-hospital mortality.

CONCLUSION. Severity of illness at the admission and the development of sepsis are risk factors associated with myopathy in critically ill patients after the administration of high doses of corticosteroids. Myopathy increases length of mechanical ventilation and in-hospital stay although mortality was unaffected.

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NORTH OF ENGLAND REGIONAL VENTILATOR DEPENDENCY STUDY: DOES THE NORTHERN REGION NEED A REGIONAL WEANING CENTRE?

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INTRODUCTION. A number of regional weaning centres have been set up in Europe and North America for assessment and treatment of patients who remain ventilator dependent after critical illness1. These centres provide successful weaning for 55–70% of such patients1, in a less intensive and cheaper environment, and free scarce intensive care beds. This study examines the need for such a weaning centre in the Northern Region of England.

METHODS. A telephone survey of all the 38 intensive care units within the Northern Region of England was carried out at one-week intervals to identify patients who had ventilated for more than two weeks. A series of questions about each patient was asked in order to exclude any patient who had required the services of an intensive care unit, other than for ventilatory support, during the preceding week, or who was receiving terminal care.

RESULTS. During the study period of six months, 71 patients who had only received respiratory support in the preceding week were considered appropriate for a weaning facility. 26 patients (36.5%) were female and 45 (63.5%) were male. Their median age was 66 years (range 22 to 89 years). All but one had a tracheostomy created. During the study period, 52 (73%) of these patients were successfully weaned, 12 (17%) died and 7 remained ventilated in intensive care beds at the end of the study period. If transferred to a weaning facility, eight patients (11%) would have required readmission to an intensive care unit for further organ support. These ventilator-dependent patients occupied intensive care beds for a median duration of eight days (range 1 to 184 days) after being identified as suitable for a weaning unit. These 71 patients occupied 1040 intensive care bed-days at hospitals in the North of England, an average of 5.7 beds per day being occupied by patients suitable for a weaning unit (5.1% of available intensive care beds in the region). One patient identified as being suitable for a weaning unit at the beginning of the study was still ventilator-dependent at the end of the study 184 days later.

CONCLUSION. Intensive care beds are an expensive and scarce resource. This study has identified a group of patients who currently occupy intensive care beds while needing only ventilatory support, and who could be cared for in a lower-intensity regional weaning unit. The median length of time in the weaning unit would have been 6 days, a small sub-group would have had a much longer stay. Other studies have demonstrated the success of such units for carefully selected patients2,3. By opening such a unit the Northern Region of England could release an average of 5.7 intensive care bed per day.

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THE VALUE OF RAPID SHALLOW BREATHING INDEX IN PREDICTING WEANING OUTCOME IN MECHANICALLY VENTILATED CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS

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INTRODUCTION. Rapid shallow breathing index was used to predict weaning outcome in mechanically ventilated patients. This index was validated in general intensive care (1), but not well evaluated in the specific setting of chronic obstructive pulmonary disease (COPD) patients.

METHODS. This prospective clinical study was conducted between January 1996 and January 2001 and included 112 consecutive COPD patients requiring weaning from mechanical ventilation. During weaning procedure patients were ventilated with pressure support mode (Siemens Servo 900C at 8 cm/H2O. TV (ventilatory rate/tidal volume) ratio was calculated at one and at 60 minutes. Success of extubation was defined as the absence of reintubation or need for non-invasive ventilation within the first 48 hours. Sensitivity, specificity, positive predictive and negative predictive values were calculated and then analyzed withReceiver Operating Characteris tic (ROC) curves. The area under the curve (AUC) at one and at 60 minutes was calculated.

RESULTS. The area under ROC curves were respectively 0.53 and 0.60 at one and at 60 minutes.

CONCLUSION. The TV ratio, in this group of COPD ventilated patients, was not valid in predicting weaning outcome.

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HOME MADE COMPUTER-BASED SYSTEM TO IMPROVE ICU ADMINISTRATION AND CLINICAL EFFECTIVENESS
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INTRODUCTION. The amount of data to integrate in an ICU is considerable. Managing daily information of different sources has become a challenge. We present a computer system that reliably acquires, stores and displays basic information necessary for clinical effectiveness and to report activity and performance of an ICU.

METHODS. The system is made of five modules: a patient database (for administrative, medical and nursing data), an information module (to facilitate transmission of useful information), a radiological module (for easy consultation of X-ray), a laboratory module (for consultation of lab results) and an archive module (for consultation of former records).

RESULTS. The database was created with Filemaker pro. It allows gathering and analysis of data to report the activity of the unit (nurse workload score, medical procedures...) and patient characteristics (origin and destination, physiologic scores, diagnosis, mortality...). Every item has been chosen with care. The information system has been created with HTML language with allows easy sharing of documents through the Intranet of the hospital. This module contains useful informations for medical and nurse staff which are updated regularly: policies, procedures, clinical guidelines, care plans, teaching program with slides when available, monthly electronic newspaper, virtual library with selection of useful articles, report of cases of interest.

CONCLUSION. The coordinated system has been elaborated during the last four years. The database is easily modified according to the new exigencies of the hospital administration or medical society. Guidelines are regularly updated. This computer based tool was immediately well accepted and is a cohesion tool. We present this work to show that with the limited resources of a non university hospital a motivated team may create a customized tool which meet the special needs of an ICU.

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POLYSOMNOGRAPHY. A DIAGNOSTIC TOOL FOR EVALUATING SLEEP DISORDERS IN INTENSIVE CARE MEDICINE
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INTRODUCTION. Sleep disorders occur in intensive care therapy. Until now, monitoring and assessment of the level of sleep and the quality of sedation are only performed either by clinical aspects or by sedation scores, such as RAMSAY score [3]. More than 20 other scores have been developed [3] which shows that the best suitable evaluation tool is still missing. Polysomnography [4] is the golden standard for evaluation of sleep which, however, was possible up to now only in special sleep laboratories. The development of a computer based miniaturized sleep laboratory now enables studies in the intensive care unit (ICU). The aim of this study was to establish such a sleep laboratory in the ICU environment.

METHODS. Six postoperative extubated patients (55 yrs, SD ± 11.5) were examined at night (09.30am, SD ± 2.03am). Polysomnography and sleep analysis was performed according to international criteria [2, 4]. A digital 32-channel polysomnograph (MEPAL, MAP, Martini+) was used for data recording.

RESULTS. Application of the electrodes and the transition-resistances of the skin raised no problem. Electromag, produced by other ICU equipment (e.g. monitors, respirators etc.), did not produce artifacts. During the measurement interferences occurred in the following situation: (a) patients with qualitative disturbances of consciousness, (b) actions performed by doctors or nurses. (c) considerable perspiration. All interferences were caused by loosening or re-Removing of the electrodes. Hydropumps were prepared. Based on these, the following variables were calculated: TST (total sleep time) 297 min (+ 115 min), TIB (time in bed) 462 min (± 123 min), proportion of sleep stage: stage 1 37.9% (+ 15.9%), stage 4 91.0% (+ 9.7%), stage SW5 (slow-wave-sleep) 5.8% (+ 1.13%) and proportion of REM-sleep 2.6% ± 3.0%.

CONCLUSION. Based on our results, it is possible to establish polysomnography in the ICU and to achieve a valid diagnosis of sleep disorders. Polysomnography is not yet an instrument for routine diagnostics, but it can become a valuable sophisticated method of examination. Especially educated staff is needed for its use. It could be shown that sleep disorders in intensive care are not uncommon.

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OUTSOURCING AN ICU: A SUCCESSFUL EXPERIENCE
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INTRODUCTION. Outsourcing an ICU is an extremely new option of management, considering the costs involved set up and management of own ICU plus the need of expertise. It could be a choice if the hospital owner don't have enough money or experience in the critical care area. There is a lot of potential benefits, but they still are not clear. We wish to show a model of outsourcing and the results of a successful practical experience of seven years and around 4.000 admissions.

METHODS. The period of the study was from December 1994 to March 2001 in the Hospital Espalho do Rio de Janeiro, a 64 bed-hospital oriented to high level surgical surgery, basically oncologic. We adopted the model of complete outsourcing, including all the process in the ICU. Then, it was included purchase or rent of medical equipment, all the salaries and taxes, acquisition and sell of medical mattered and drugs, to make the bill and all other activities involved in the ICU process.

RESULTS. We have started 5 years ago, beginning with 4 beds, followed by 8 and then 12 beds. The results have been very good. This complete model, with all process, including pharmacy and nursing, seem to us the best, although they have more complexity and need a high cost management, compared to other outsourcing models. The set up costs are also higher. During this 7 years, we have paid to the hospital 17% of our bill and we have had a liquid profit of 6%.

CONCLUSION. Outsourcing is a good option to hospitals which don't know or don't want to manage the risks of an ICU. The complete model is the best, considering major flexibility against high costs, giving better profits and pay known better services. Although the risks of bad management and bankrupt are bigger. The liquid profit for ICU managerial group are around 6% and the hospital receive 17% of the bill without any risk or cost.

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TREATMENT OF STEROID-INDUCED CHELOSTASIS WITH ALBUMIN DIALYSIS: CASE REPORT
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INTRODUCTION. Hepatoscellular cholestasis caused by anabolic steroids is well known and difficult to treat [1]. Albumin dialysis has been shown to improve the outcome in patients with cholestatic liver failure caused by chronic liver disease [2]. We report a 22 year old man who was admitted with pruritus and jaundice in December 2000 for the first time. The patient was known to suffer from chronic hepatitis C for years, which had been treated unsuccessfully with interferon A and ribavirin. Two weeks before the first admission he had taken anabolic steroids (sustanon and nandrolone) by I.m. injection for body building. The clinical examination revealed an impressive asterixis and numerous scratch marks. Total serum bilirubin was 30.8 mg/dL at this time, the direct bilirubin 9.71 mg/dL. There was a slight increase of transaminases and alkali-phosphate. Blood cell count and prothrombin time were normal. Liver biopsy showed a periportal cholestasis with mild portal cell infiltration. Treatment with corticosteroids, a histamine (H2) blocker and metronex, an opioid antagonist, was not effective. Administration of phe- nobarbital for enzyme induction failed to reduce hyperbilirubinemia and to ameliorate allergic clinical symptoms. Since itching and jaundice worsened and the bilirubin level rose to 30 mg/dL, the pa- tient was re-admitted to hospital in January 2001.

METHODS. The molecular adsorbent recirculating system (MARS) was connected with a hemofiltration device (Baxter BM 14 + BM 11). MARS contains a synthetic hydrophilic hydrophobic domain presenting non permanent membrane (pore size smaller than albumin size: 100- nm thick). The opposite side of this membrane is rinsed with ligandin-like proteins (albumin) as molecular adsorbents that are regenerated online using a chromatographic-recycling system [2]. Anticoagulation was performed by continuous infusion of heparin. Three MARS sessions were run: 9 hours at day 1, 18 hours at day 2 and 24 hours at day 5. Laboratory values were control- led before, 6 hours after start and at the end of albumin dialysis.

RESULTS. The procedure was well tolerated by the patient. There were no haemodynamic reactions and no bleeding events. The patient’s condition significantly improved from the first session. The pruritus had nearly vanished after the third therapy. Total bilirubin declined from 31 mg/dL (before MARS therapy) to 17.3 mg/dL after the third albumin dialysis). Bile acid (choleylucin) concentration decreased from 2.814 mcg/dL to 828 mg/dL. Six weeks later the pa- tient presented in a satisfying condition. The bilirubin level was 3.6 mg/dl at this time.

CONCLUSION. Symptoms of steroid-induced cholestasis can efficiently be treated by albumin dialysis with the molecular adsorbent recirculating system (MARS). The therapy results in a markedly reduction of bilirubin and bile acids. In our patient the MARS treatment was well tolerated. Whether it has contributed to the recovery of excretory liver function is unknown.

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METABOLIC EFFECTS OF VACCINATION WITH MONOPHOSPHORYL LIPID A UNDER ENDOTOXEMIA OBLIGITIZED BY MICRODIALYSIS
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INTRODUCTION. Endotoxemia with subsequent cellular and organ failure currently still is a serious and important complication in intensive care treatment. Monophosphoryl lipid A (MPL) is a non-toxic hydrolyzed derivative of lipid A, which has been suggested to have positive immunomodulatory influences with induction of endotoxin tolerance as a prophylactic and therapeutic intervention. The aim of the study was to observe the effect of pretreatment with MPL to cellular metabolism after induction of endotoxemia using in vivo microdialysis.

METHODS. After approval by the local ethics committee 10 female pigs (25 ± 8 kg b.w.) were challenged with endotoxin infusion (S. frdiz. H909). 5 animals received low dose treatment with MPL for 5 days before start of the experiment, while a sham group (n = 5) served as control. Haemodynamic parameters (MAP, HR, CO, SV0) and blood gas analysis inclusive Lactate (ABL, Radiometer/Copenhagen) were determined in intervals of 30 min during an observation period of 5 hours. Additionally microdialysis catheters (CMA 66, Microdialysis/Sweden) were inserted into the intramuscular and intratissue compartment to determine the interstitial concentrations of Lactate and Glyceral.

RESULTS. No significant differences regarding the haemodynamic and blood lactate parameters were observed between both groups. After preconditioning with MPL, interstitial lactate concentration of the muscle and hepatic tissue showed significantly lower values after 5 hours of endotoxemia (3.6 ± 1.1 vs. 7.4 ± 1.9, resp. 2.7 ± 1.1 vs. 7.2 ± 1.6). MPL vaccination further resulted in significantly lower tissue glyceral values for intramuscular (55.4 ± 13 vs. 357 ± 75μM) and intrathropic tissue (44.5 ± 23 vs. 234 ± 39μM) (p < 0.05).

CONCLUSION. Pretreatment with the lipid A derivative MPL before Endotoxemia as prophylactic therapeutic intervention has been described before. Using microdialysis we were able to objectively the metabolic changes in different tissues and the favorable effect of this vaccination, although no significant differences were observed regarding the clinical parameters. Microdialysis may serve as an additional guide for objectivation of potential success of therapies in critical ill patients in intensive care units.

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METABOLIC MONITORING IN ACUTE CARDIAC FAILURE USING MICRODIALYSIS: A CASE REPORT
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INTRODUCTION. Measurement of certain metabolites (e.g. lactate, pyruvate, adenosine, hypoxanthine) have been suggested to be useful for estimation of the severity of illness in intensive care patients. Using the well established method of Microdialysis it is now possible to have an access to measure cellular metabolism directly in the tissue of the critical ill patient.

METHODS. We present the case of a 72 year old patient at ICU suffering from left ventricular failure and acute renal failure after cardiovascular surgery with the complication of acute myocardial infarction. A microdialysis probe (CMA 66, A. Semma/Spredkholv/Germany) was inserted in the abdominal subcutaneous space and perfused with Ringer's solution (2 ml/min) using a particular perfusion pump (CMA 107). Lactate, pyruvate, glyceral and glucose were determined in the microdialysis samples hourly over a period of 8 days (CMA 600/CMA Microdialysis/Solna/Sweden). Blood lactate was measured in intervals of 3-4 hours (ABL/Radiometer/Copenhagen).

RESULTS. Concomitant to acute left ventricular decompensation-intestinal glycerol was elevated 3 fold from 410 ± to 1290 μmol/L. Intestinal lactate/pyruvate-ratio increased from 16 to 32 during this period. After cardiac recompensation by therapy with catecholamines and implantation of a intraaortal counter pulsation both parameter decreased to normal values. Under continuous veno-venous hemofiltration (CVVH) interstitial lactate (5.5 mmol/L) was approximately 2.5 fold higher than blood lactate during whole observation time.

CONCLUSION. Interstitial glycerol as a parameter for lipolysis due to adrennergic stimulation and cell membrane degradation, as well as lactate/pyruvate ratio seem to be useful parameter for "metabolic stress" in seriously ill patients. Blood lactate does not seem to be a valuable parameter during CVVH. Microdialysis might be a promising additional tool in the concept of multimodal monitoring for bedside-observation of patients in the ICU.

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INTERSTITIAL MICRODIALYSIS AS A CLINICAL TOOL FOR METABOLIC MONITORING IN CRITICALLY ILL PATIENTS
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INTRODUCTION. Microdialysis is a minimal invasive method for continuous monitoring of interstitial metabolic changes. The aim of the study was to perform microdialysis of sceletal muscles in order to assess early changes in interstitial metabolism and to compare selected blood-chemical parameters in skeletal muscles and blood in trauma patients.

METHODS. After institutional approval 12 critically ill patients with trauma requiring ventilatory support were studied immediately after admission. Microdialysis probe CMA 60 with cut-off 20 000 Da (CMA Microdialysis Solna Sweden) was inserted under ultrasound control into the left m. quadriceps femoris. After 30 minutes recovery period microdialysis procedure with Ringer lactate solution using flow rate 35 ul/h was started. Microdialysis samples in 60 minutes intervals were collected during 72 hours.Venous blood samples were collected every 4 hours. Lactate, glucose and urea concentrations in microdialysates and venous blood were evaluated.

RESULTS. Relationships between concentrations in microdialysis sample and venous blood at selected time intervals (HR) are presented in the table:

| Parameter       | Lactate (mmol/L) | Glucose (mmol/L) | Urea (mmol/L) |
|-----------------|------------------|-----------------|--------------|
| Microdialysis/Blood (HR 1-3) | 1.35±0.18 | 7.37±0.02 | 4.28±0.28 |
| Microdialysis/Blood (HR 7-9) | 6.36±0.10 | 7.48±0.14 | 4.17±0.26 |
| Microdialysis/Blood (HR 13-15) | 4.52±0.13 | 7.04±0.25 | 3.95±0.22 |

CONCLUSION. Microdialysis probe insertion is a simple and easy procedure without any complication. Under low microdialysis perfusion rate similar interstitial and microdialysate concentrations of low molecular weight analytes (urea, glucose, lactate, amino acids) can be assessed.

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MONITORING REGIONAL VERSUS GLOBAL HAEMODYNAMIC PARAMETERS IN CRITICALLY ILL HYPOVENTILATING PATIENTS: WHAT IS BETTER?
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INTRODUCTION. Regional parameters of organ dysfunction have been claimed to be better than global haemodynamic parameters. Whether there is a difference between the use of regional or global parameters during resuscitation in critically ill patients with or without hypotension is not known.

METHODS. Haemodynamic optimisation was targeted using standardised resuscitation with the mean arterial pressure (MAP), heart rate (HR), wedge pressure (PCWP), cardiac output (CO), and systemic vascular resistance as parameters. After stabilisation was achieved rapid in-fusion bolus was initiated to evaluate whether occult haemodynamic abnormalities could be detected and corrected. During resuscitation global haemodynamic parameters were measured is-multiparametrically with regional somatic flow (PnicoseaCO2 and pH) and indocyanine green (ICG) derived parameters (CBL clearance of ICG from blood and PDR, plasma disappearance rate of ICG) and were compared between patients with and without hypotension at admission. Data presented as mean ± SD.

RESULTS. Resuscitation increased MAP (72.5 ± 15 vs 80 ± 2, p = 0.01), CVP (11 ± 0.8 vs 11.5 ± 0.7, p = 0.04), and oxygen delivery index (597 ± 30 vs 645 ± 49, p = 0.08) significantly. After stabilisation significant differences persisted between the patients with and without hypotension with respect to intrapulmonary P nicoseaCO2 (73.2 ± 0.7 vs 73.1 ± 0.02, p = 0.055), CBI (401 ± 54 vs 795 ± 65, p = 0.0001), and PDR 11.8 ± 15 vs 20.2 ± 1.5, p = 0.0001. Patients who subsequently died had a significant lower Ph2CO (72.4 ± 0.3 vs 73.1 ± 0.02, p = 0.03), higher P nicoseaCO2 (71.6 ± 0.5 vs 67.0 ± 0.2, p = 0.02), and lower CBI (411 ± 56 vs 587 ± 60, p = 0.02), PDR (p = 0.01), and RVEEDV1 (p = 0.05), of which the pH, P nicoseaCO2, and CBI were the most important predictors of outcome. Rapid bolus infusion after stabilisation improved gastric pH (7.2 ± 0.02 vs 7.27 ± 0.03, p = 0.01) and CBI (402 ± 25 vs 575 ± 28, p = 0.006) significantly in patients who were hypotensive at admission.

CONCLUSION. Resuscitation at admission of critically ill patients with shock does not require monitoring of regional parameters. However, after stabilisation regional parameters were the best predictors of outcome. Further resuscitation efforts in this phase should be aimed at influencing these regional parameters.
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INACCURACY AND FAILURE OF INTRACRANIAL PRESSURE DEVICES FOR MONITORING AND TREATMENT IN INTENSIVE CARE PATIENTS
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INTRODUCTION. Intracranial pressure monitoring (ICP) is an important technique in the management of patients at risk for secondary brain damage. However, the rate of inaccuracy or failure of ICP devices in the intensive care unit (ICU) was rarely reported (1,2).

Aim. To investigate the rate of inaccuracy or failure of ICP devices in patients with ICP monitoring during their ICU stay.

METHODS. Prospective, observational study in a surgical ICU of an university hospital including consecutive patients with ICP devices. Institutional recommendations defined that every ICP device with implanted ICP devices and with a GCS <13 require ICP monitoring. Inaccuracy of ICP device was defined as high variability of the ICP values (differences >2 mmHg) in calm patients. The patients were divided with unchangeable neurological status and/or CT scans. Failure was defined as constant values (i.e. without variation) during coughing.

RESULTS. Over a 6-month period 36 patients (mean age 48±4 years, 23% to 75%, with a CP devices were admitted on ICU. Fourteen patients (39%) had head injuries, 10 (22%) spontaneous subarachnoid hemorrhages, 3 (8%) tumors, 1 (3%) subdural hemorrhage. ICP devices consisted of 19 ventricular catheters (53%) connected with a transducer, amplifier and recorder, and 17 parenchymal catheters (47%; Camino system). ICP devices were used in 23 patients for monitoring (64%), and in 15 patients for cerebral perfusion (56%). Two of the five ICP devices were ventricular drainages (obstruction, malpositioning) and three were intraparenchymal catheters.

CONCLUSION. Failure or inaccuracy of ICP devices was high in our institution and improvement in reliability of ICP devices is urgently needed to avoid unnecessary supplementary investigations (CT scans, neurological consultations).

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EARLY COIL EMBOLIZATION IN THE TREATMENT OF POOR-GRADE PATIENTS WITH ANEURYSMAL SUBARACHNOID HEMORRHAGE
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INTRODUCTION. Controversy persists regarding the optimal management of patients with Hunt and Hess (H-H) grades IV and V after aneurysmal subarachnoid hemorrhage (SAH). Although more than 90% of these patients die if untreated, many physicians remain reluctant to aggressively treat them. Moreover, a more aggressive management, including the early aneurysm obliteration, could decrease this high mortality (1). We show our experience with the use of early endovascular aneurysm coil embolization in this patients.

METHODS. Prospective study over a 5-year period, from 1996 to 2000. All patients admitted in poor clinical grade, defined as H-H IV or V, after aneurysmal rupture were evaluated. The aim of study was to evaluate the morbidity and mortality in the early (<72 h) embolized patients. Outcome was assessed, at discharge from ICU and nowadays (by telephone interview), using the Glasgow Outcome Scale (GOS).

RESULTS. One hundred and ninety one patients with SAH were admitted in this period (61 (32%), were categorized as poor clinical grade: 29/8 (48%) were excluded according to different reasons: 1) iatrogenic factors (21/8 patients) not coils set out in 14 patients (6 of them met brain criteria at admission and 8 were excluded by age, cancer and severe chronic cardiac or respiratory illness) and only one survived. 2) 15 patients could not be evaluated by technical impossibility in 12 (8%) of them by aneurysm morphology or difficulty access; one by severe vasospasm and another one by minority cerebral blood flow and negative angiography in other 3 patients. The remaining 55/1 patients (72%) underwent early embolization. Of them 11 died during their ICU stay (2 by multiorgan failure; 1 by vasospasm; 1 by brain oedema and 1 by aneurysmal rupture during the endovascular treatment). 27 left ICU after a mean of 212±170 hours of mechanical ventilation and a mean ICU stay of 21±8 days. At discharge from ICU, their GOS was 4-5 (48%), GOS 3 (14%) and GOS 2 (9; one of them died during hospital stay). However, follow-up review, after hospital discharge, showed a favorable outcome (GOS 4-5) in 18/26 patients (69%), whereas 6 patients had a GOS 3 and only 2 patients had died (none of these cases caused by the SAH). Overall mortality after follow-up was 25% (8/32). To the contrary, 11/15 (73%) not embolized patients had an unfavorable outcome, being noteworthy that 9 died during this period.

CONCLUSION. In our experience an aggressive management, including an early (<72 h) coil embolization, modifies favorably the morbidity and mortality of poor grade patients with aneurysmal SAH. We suggest that an active management, including early embolization, should be considered independently of the neurological state at admission.

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THE CARDIAC COMPLICATIONS IN PATIENTS WITH INTRACEREBRAL HAEMORRHAGE IN INTENSIVE CARE UNIT
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INTRODUCTION. The typical electrocardiographic pattern associated with central nervous system diseases is characterized by deeply inverted or tall T waves, prolongation of the QT interval, and prominent U waves (1,2). The aim of this study is to examine the kind of ECG changes in patients with intracerebral hemorrhage in ICU.

METHODS. The study group was consisted of 34 patients (14 male and 20 female) of average age 65 years. The youngest was 42 and the eldest 77. There were 20 patients with haemorrhage in regio capsularis (11 cases and 9), and 9 with haemorrhage intraependymarum temporoparietalis (6 cases and 3) and 5 with haemorrhage subarachnoidalis. ECG changes were evaluated during the 24 hr hours from receiving in the ICU and shortly before discharge.

RESULTS. The most common ECG abnormalities associated with central lesions that we found were: elevated, peaked, or notched T waves in 20 patients (58.8%), prolongation of the QT interval in 19 patients (55.9%), ST segment depression in 11 patients (32.3%), increased T wave amplitude in 6 patients (17.6%), flattening or inversion of the T wave, and U waves in 5 patients (14.6%), increased QRS voltage in 5 patients (14.6%) and ST segment elevation in 4 patients (11.7%). We didn’t register increased Q waves. The most frequent ECG changes that we registered among rhythm and conduction disturbances were: narrow-QRS tachycardia with regular rhythm, 14 patients (41.4%) with sinus tachycardia and 1 patients (2.9%) with paroxysmal reentrant tachycardia; narrow-QRS tachycardia with irregular rhythm, 2 patients (5.8%) with atrial fibrillation, 6 patients (17.6%) with incomplete/ partial/ left bundle branch block (LBBB) and 3 patients (8.8%) with sinus bradycardia, 3 patients (8.8%) with left anterior fascicular block, 2 patients (5.8%) with premature atrial beats and 2 patients (5.8%) with prematu- rous ventricular beats.

CONCLUSION. The majority of ECG abnormalities that we registered were transient and lost during recovery. Only patients with haemorrhage subarachnoidalis had sinus bradycardia. The malignant ventricular arrhythmias and sudden death which are associated with prolongation of the QT interval are warning that all patient received in neurologic ICU I would have ECG monitoring.

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LOCAL THROMBOLYTIC THERAPY IN DURAL SINUS THROMBOSIS
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INTRODUCTION. Purpose: to report our experience in two cases of coma due to dural sinus thrombosis (DST), treated with local thrombolysis.

METHODS. We present two cases of young women, with subacute cephalic resistance to con- ventional analgesia, that were admitted to our Intensive Care Unit (ICU), due to an acute mental dis- toration. Both had risk factors for DST intake of oral contraceptive and habit of smoking (1). Pregnancy and thromboembolism (second case). The diagnosis of DST ( superior sagittal sinus and transverse sinuses) was made with magnetic resonance (MR) angiography and confirmed afterward with angiography. In both cases, the computed tomography (CT) scan showed diffuse brain swelling. The first patient also had a cerebellar hematoma. Intracra- nial pressure (ICP) monitoring was started, demonstrating maintained high pressures (range 35–45 mmHg) in the 2 patients. This finding contrasted with just a moderate brain swelling in the CT scan, and with a favourable neurological exploration. The patients received anticoagula- tion and local thrombolysis with urorosys (UUK).

RESULTS. In both cases, the transfemoral infusion of UUK into the thrombosed sinus, achieved a total sinus patency. The patients received UK doses ranging from 4.5 to 5.5 ml UU, with a mean infusion time of 110 hours. No major bleeding complications were associated with the treatment (including absence of growth of preinfusion cerebellar hematoma). Symptoms of intracranial hypertension ceased. On discharge from th ICU, the patients had no neurologic sequelae. In both patients, the transcranial Doppler ultrasound found no residual thrombus, achieved a total sinus patency. The patients received UK doses ranging from 4.5 to 5.5 ml UU, with a mean infusion time of 110 hours. No major bleeding complications were associated with the treatment (including absence of growth of preinfusion cerebellar hematoma). Symptoms of intracranial hypertension ceased. On discharge from th ICU, the patients had no neurologic sequelae.

CONCLUSION. Local fibrinolysis with UUK associated with anticoagulation, is an effective ther- apy to improve the neurologic status in DST. The maintained hyperPIC in these two cases of DST, does not correlate with severe brain injury.

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INTRODUCTION
Diffuse axial injury (DAI) has been recognized as a common cause of unfavourable outcome in patients with severe head injury (SHI). Cerebral magnetic resonance (MR) has been shown sensitive for detection and characterization of these lesions. Gentry (1) had previously defined three major anatomic areas of DAI: Larot DAI lesions (type 1), DAI of the corpus callosum (type 2) and brain stem DAI (type 3).

METHODS
We performed a prospective study between Jan 1, 1999 and Aug 31, 2000 with seventeen patients with SHI and discrepancy between the normal CT and the neurological status defined as no intracranial hypertension and abnormal awake when withdrawing sedatives. MR was performed at medium of 10 days after injury to detect DAI-type lesions. Patients with DAI were divided into the three groups previously defined. We compared the MR findings with the Glasgow Outcome Scale (GOS) at 6 months.

RESULTS
In fifteen patients (88%) MR demonstrated DAI-type lesions. The GCS was lower in patients with DAI-type 2 and 3 (4,75 and 5 respectively) than in patients with DAI-type 1 (Glasgow 7). The correlation between DAI groups and the GOS scale is shown in the following table:

| DAI-type 1 | DAI-type 2 | DAI-type 3 | Total |
|-----------|-----------|-----------|-------|
| 2          | 3          | 4          | 4     |
| 4          | 4          | 4          | 4     |
| 8          | 8          | 8          | 8     |

CONCLUSION, RM is a sensitive method in detection of DAI-type lesions. The abnormal neurological status might be probably due to the DAI lesions. There is a good correlation between the GCS, DAI type lesions and GOS at 6 months. More than 50% of patients with DAI due to SHI had a good recovery at 6 months. Despite the little number of patients with DAI-type 1 lesions (without corpus callosum or brain stem involvement) it seems that they have a better prognosis.

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541 S-100 B AS A MARKER OF BRAIN DAMAGE IN ISOLATED TRAUMATIC BRAIN INJURY AND IN POLYTRAUMA

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INTRODUCTION
Critically ill patients suffering from traumatic brain injury are often difficult to monitor and treat effectively. Though far more reliable than clinical assessment or intracerebral pressure, computer tomography is always associated with considerable stress for the severely injured patient. Thus, a serum marker which is highly specific for brain trauma would be very useful to the intensivist monitoring and treating these patients. Our goal was to determine whether S-100 B could be such a marker.

METHODS
This prospective study has been underway since 1999. Presently, it includes 70 patients. Depending upon their pattern of injury, patients are assigned to one of 3 groups: Group 1: isolated traumatic brain injury – Group 2: traumatic brain injury in combination with polytrauma – Group 3 (controls): polytrauma without traumatic brain injury. All patients are examined by computer tomography on admittance. S-100 B is determined by venous blood drawn within the first hours after trauma and daily for a maximum of 4 weeks. S-100 B values and courses are compared to clinical and neurological findings, laboratory controls and computer tomography.

RESULTS
All patients, including those suffering from polytrauma without traumatic brain injury, show a significant increase in S-100 B during the first hours after trauma. However, survivors differ from in their further course of S-100 B. In all survivors, S-100 B decreases after the initial peak within the first 48 hours after trauma and remains normal. In all non-survivors, however, S-100 B remains elevated and/or shows a second increase at least 48 hours before death. This pattern is the most clearly visible in patients with isolated traumatic brain injury.

CONCLUSION
In our opinion, S-100 B is a very useful marker for the intensivist managing traumatic brain injury. S-100 B measurement can be repeated regularly without any stress to the patient, supplying valuable information regarding the evaluation of ongoing therapy in traumatic brain injury on the one hand and outcome on the other.

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NON-INVASIVE AORTIC BLOOD FLOW MEASUREMENTS IN TRAUMA PATIENTS USING A TRANSESOPHAGEAL ECHO-DOPPLER PROBE
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INTRODUCTION. A new, noninvasive technique for the determination of central hemodynamic parameters like myocardial contractility, peripheral resistance and volume status, is the measurement of blood flow in the descending aorta using an intrasophageal echo-doppler probe. A good correlation with cardiac output has already been demonstrated. 1,2
We currently evaluate the practicability and value of this system in the setting of early inhospital trauma management.

METHODS. Registration of aortic blood flow ABF and systolic time intervals like Left Ventricular Ejection Time LVET using a transesophageal echo-doppler probe (DYNEMO 3000, Fa. SOMETEC, France) in 36 intubated, severely injured patients (NACA > 3) over the first four hours of stabilisation and operation. Study period 4 1/2 years (7.96–31.12.00), permitted by the ethics committee of the university of Ulm.
Evaluation of problems and artefacts.

RESULTS. Meanwhile 36 severely injured patients have been monitored during 59 sessions (ave: 3 samples recorded). The medium age was 32 years (17 – 93), the injury severity ISS 25 (9–66), 33% multi-system-trauma, 86% head injury. The proper placement of the esophageal echo-doppler-probe took a medium time of 5 sec (29 sec. – 15 min). Contradictions for the esophageal probe like pharyngeal tamponade after severe maxillofacial injury occurred in two cases. The medium artefact rate per session was 22% [1 – 100%], which was mainly caused by diagnostic and therapeutic manipulations in the patients face. Five of six patients with an ABF < 2 m/min at hospital admission died because of severe haemodynamic complications. One of them was not detected by conventional haemodynamic monitoring (RR-pulse). None of the patients with an initial ABF > 2 m/min developed lethal haemodynamic conditions.

CONCLUSION. The echo-doppler-sonographic measurement of aortic blood flow rapidly provides a noninvasive continuous monitoring of central haemodynamic parameters, which are not registered by means of “conventional” monitoring. The predictive and therapeutic value of this new haemodynamic profile has to be shown in a larger collective of trauma patients.

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DETECTION OF TRACHEAL INJURY BY HELICAL CT AND 3D-CT (ID- TRACHEOGRAPHY)
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INTRODUCTION. It is important but difficult to detect tracheal injury exactly in the patients with subcutaneous cervical emphysema. We can easily suspect respiratory tract injury from subcutaneous emphysema or deep cervical (prevertrbral) emphysema in plane neck x-ray exami- nation. Both the tracheal injury and the pulmonary injury with a tear of the parietal pleura near apex could make subcutaneous and deep cervical emphysema. However, it is difficult to detect the site of injury, traches or peripheral lung. Bronchoscopy often miss the existence of the upper tracheal injury, especially in intubated patients. The aim of this study is to clarify the usefulness of the helical CT and 3 dimensional spiral CT (ID-CT, “arteriography” or “3D-tracheo- graphy”) for diagnosis of the existence or neglect of the tracheal injury.

METHODS. Patients with blunt neck or chest trauma and having cervical emphysema (subcu- taneous emphysema, deep cervical emphysema) are examined by ordial neck and chest CT imag- ages. If we can point out any irregular low density area around the trachea or any irregularity of tracheal ring, we performed thin slice helical CT and 3D-tracheography in the next day.

RESULTS. Six cases were examined. Irregular low density area around trachea was pointed out in two cases and irregularity of tracheal ring in one of them . For these 2 cases, we performed 3D-tracheography and we were able to detect the existence and the site of tracheal injury as the defect of continuity of tracheal lumen (air). Although other 4 cases showed prominent sub- cutaneous or deep cervical emphysema at emergency room, they did not show any other sign of the tracheal injury, did not need any treatment for tracheal injury, and showed prompt improve- ment of subcutaneous and deep emphysema.

CONCLUSION. Our strategy using ordinal CT and 3D-CT (3D-tracheography) is thought to be useful for the detect the injured site of tracheal injury in the patients with blunt neck and chest trauma.

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CONTINUOUS SVO2-MONITORING IN THE EARLY PHASE OF ACUTE RESPIRATORY FAILURE AFTER TRAUMA. WE OBSERVED THAT A SVO2 IS POSSIBLE TO DECREASE OR AVOID AGGRESSIVE TREATMENT BY 30% OR MORE BY EARLY MONITORING OF SVO2 AND CCI.
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INTRODUCTION. SVO2 monitoring is a sensitive marker for predictive septic patients to in- dicate a beginning respiratory failure. Patients with minor chest trauma (OIS/Chest II or OR- Slange I and ISS < 15) develop in 20% a respiratory failure within 3 days after trauma. We monitored patients with minor chest trauma on SVO2, in spite to recognize the earliest possible time for assisted ventilation in order to avoid fulminant respiratory distress and unnecessary ven- tilator treatment.

METHODS. We monitored patients (n = 46) with clinical finding of minor chest trauma and necessity of intensive care with an SVO2 catheter. We recorded data on BGA, Lactate, SVO2, and CICO. The patients who had an average of 63,5 years and an aver. APACHE-II-Score of 19,34 on admission to the ICU. Within the first 36 hours after admission there was a need to ventilate 22 patients after unsuccessful conservative treatment. 13 patients were treated directly with assisted ventilation (CPAP/ASB) 11 patients got treatment with higher degrees of ventila- tion.

RESULTS. First. SVO2 was decreasing in the middle 6 hours earlier then peripheral BGA. Far- ther on cardiac parameters did show septic values 3 hours in advance of clinical findings and ventilation. There was no decrease of both values on patients without need of ventilator treat- ment. Second. Both groups of ventilated patients showed the same time of recovery in recorded parameters. Nevertheless the assisted group was ventilated for an significant longer time (- 29,34 hours). Duration of treatment in the assisted group was 42,32 – 12,3h. Third. In cases it was possible to avoid mechanical ventilation even if clinical findings did implicate it. There was a good cardiac function with good oxygenation.

CONCLUSION. Although there is a clinical need for ventilation after minor chest trauma, there is no need for aggressive treatment. The starting point for ventilation is clearly marked by a simultaneously decrease of SVO2 higher than 5% of starting value and Increasing CO. It was shown that aggressive treatment may supports an pulmonary organ failure. With monitor- ing of SVO2, it is possible to optimize ventilation treatment by the use of early assistive and secondly of aggressive ventilator treatment. We investigate that a possible to decrease or avoid aggressive treatment by 30% or more by early monitoring of SVO2 and CCI.

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WINDSURFING AND SEVERE ACCIDENTS: THE GREEK EXPERIENCE
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INTRODUCTION. Windsurfing is a popular water sport, which may be prone to accidents when certain basic rules or procedures are violated. The bibliographic data on the issue are rather limited (1). Local conditions in the Aegean sea (hundreds of islands, kilometers of isolat- ed coasts, millions of tourists, extended summer period and rapidly changing weather condi- tions) exacerbate the problem and quite often test the efficacy of emergency medical service.

METHODS. A study of severe windsurfing accidents in Aegean Sea was performed during the period 1998–1999. As severe windsurfing accident was defined any accident that happened dur- ing windsurfing and required the transportation of the patient to a tertiary hospital. Any trans- portation to tertiary hospitals from the Greek islands and mainland is reported, and in vast ma- jority of cases arranged, through the Greek National Centre of Emergency Care. A question- naire with regard to the conditions of the accident was filled in an effort to elucidate mecha- nisms and conditions leading to accidents.

RESULTS. Our study revealed 22 cases of severe accidents due to windsurfing with a wide range of injuries including head injuries, spinal cord injuries including tetraplegia and severe ex- tremities fractures. The hypothermic water environment represented an additional aggravating factor. For 19 of these cases air-transportation was required. Prolonged hospitalization, severe disabilities, even deaths, were the consequences of these accidents. This study examined the characteristics of these patients and the possible risk factors and conditions associated with the accidents. Accidents were not associated with previous experience and proficiency of the surfer or type of surf, but were associated with poor physical condition, difficult environmental condi- tions, unknown venue, sailing alone, life jacket and wetsuit absence and foot fixation to foot- stalks.

CONCLUSION. Windsurfing accidents represent a constant challenge for the emergency med- (– 28,34). Appropriately trained staff at all levels must develop suitable plans to enhance the risk awareness and the safety precautions for popular to surfers, such as advanced life support on the spot, easy access to special transportation facilities via boats or helicopters, and timely admission to appropriate hospital for better management of their injuries could limit the health cost of this recreational activity.

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VENTRICULAR SEPTAL DEFECT COMBINED WITH RUPTURES OF TRICUSPID AND MITRAL VALVES AND PERICARDIUM OF A POLYTRAUMA PATIENT: CASE REPORT
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INTRODUCTION. Blunt thoracic trauma that leads to intracardiac defect is uncommon, and usually connected with a high-speed traffic accident. We report a case of a ventricular septal defect combined with a laceration of tricuspid valve and a rupture of pericardium in a polytrauma patient after falling from height.

METHODS. A 54-year-old healthy man fell down from the height of approximately 15 m. He had a short time loss of consciousness with his Glasgow Coma Scale being 15 thereafter. Fractures of rib, bilateral pubic rami, sacrum and ribs with paraxial segment on the left side were diagnosed. Besides rib fractures his chest radiograph was normal on hospital admission. G-clamp was placed on pelvis and external fixator on thorax. Anaesthesia and recovery period were uneventful and the patient was sent to the general ward. Next morning the patient had an episode of rapid desaturation down to SpO2 70%, 'Aspiration revealed a newly appeared harsh systolic murmur and his neck veins were distended. On transoesophageal echocardiography (TEE) he showed grade 3 insufficiency of tricuspid valve with pulmonary hypertension and dilatation of the right heart. A left to right shunt was detected on the interventricular septum. As his clinical condition was deteriorating rapidly a decision of saturation of the ventricular septal defect was made. At the operation the inspection the heart revealed no signs of myocardial contusion, but a pericardial rupture was found. After right ventriculotomy a midlinevalve ventricular septal defect measuring 1.5 cm in diameter with contused/injured surrounding was found. Additional findings included an avulsion of the anterior tricuspid papillary muscle, valve leaflets themselves were not injured. Despite of reversal of Heparin effect and normalisation of the coagulation profile with 4 units of fresh frozen plasma (FFP) and 4 units of platelets, improved bleeding from mediastinal drains was detected, and on immediate reesternomy diffuse bleeding was seen. Total amount of postoperative mediastinal bleed was 2000 ml. He needed inotropic support with dopamine and noradrenaline for the first 3 postoperative days.

RESULTS. Postoperative TEE showed intack function of tricuspid valve and no residual ventricular septal defect. The pelvic hematoma were not enlarged in comparison with preoperative finding. The main postoperative problems were associated with his lung function – both diffuse contusion and aspiration pneumonitis in the right lower lobe. After several attempts he was finally extubated on the 12th postoperative day and in his further course he had no cardiopulmonary problems. His ICU stay was 13 days.

CONCLUSION. In the first stages of making the diagnosis of intracardiac injury after blunt thoracic trauma a high degree of suspicion is needed, and a close cooperation between intensivists, cardiac and trauma surgeons should follow, to achieve maximally aggressive treatment of the injuries. Prompt clinical diagnosis aided by echocardiography, and aggressive surgical inter-vention for repairing the lesions resulted in complete recovery of our patient.

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INFLUENCE OF BLOOD PRODUCTS TRANSFUSION ON THE DEVELOPMENT OF NASOCOMIAL PNEUMONIA IN SEVERE HEAD INJURY PATIENTS
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INTRODUCTION. To evaluate if the initial transfusion of the different blood products is associated with the appearance of mechanical ventilation acquired nosocomial pneumonia (MVAPN) in severe head injury (SIH) patients.

METHODS. A prospective case-control study matched 1:1 in a Neurotraumatological Intensive Care Unit (NIUA) during a 3 years period (1999–2002). Only SIH patients/Glasgow Coma Scale <8/9with at least 48-hour stay in the NIUA were included in the study. Case description MVAPN patient according to the CDC criteria. Control description. Patient admitted during the study period who didn’t developed MVAPN. The matched variables were: a) age < 5 years, b) APACHE II < 45, c) Injury Severity Score(ISS) < 45, d) cerebrovascular lesions according to the Trauma Coma Data Bank (TCDB) and e) length of mechanical ventilation period at least equal to the period previous to the MVAPN diagnose in cases. The following variables were included Presence or not of naso-intubation, lowest haemoglobin value in the first 48 hours, blood transfusions, being analysed global and separately taking into account the different blood products transfused within the first 48 hours after admission and performing a univari-ant study with a p < 0.05 being considered significant.

RESULTS. 72 patients (cases) with MVAPN (25.5%), out of 282 patients admitted during the study period, and 72 matched controls were included in the study. No significant differences were observed in any of the analysed variables between cases and controls: presence of anemia(38.9 vs 41.7%), haemoglobin value(4.3 ± 1.3 vs 11.6 ± 2.4), red cells transfusion(47.5 ± 61.1%), plasma transfusion(3.5 ± 19.4%) and platelet transfusion(9.5 ± 6.3%).

CONCLUSION. The different blood products transfusions in the initial stage of Severe Head Injury (SHI) is not associated with the posterior development of Mechanical Ventilation Acquired Nosocomial Pneumonia (MVAPN).

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A REMIFENTANIL-BASED TECHNIQUE FOR ANALGESIA AND SEDATION IN ICU PATIENTS WITH NEUROTRAUMA. PRELIMINARY DATA
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INTRODUCTION. Remifentanil hydrochloride (R) is a potent mu-opioid agonist with fast on-set (0.1 min) of action. It is metabolized rapidly by non-specific tissue and blood esterases with a biological half-life of < 10 min (1). R, as the major metabolite has ca. 1/4000 of R’s potency. R can therefore be titrated to optimal analgesia with predictable, rapid dissipation of effects even after prolonged infusions. R supplemented with propofol (P) or midazolam (MID) was compared with fentanyl (F) or morphine (M) (also supplemented with P or MID) for up to 5 days in mechanically ventilated neurotrauma patients requiring daily scheduled assessments of neurofunctional function.

METHODS. Open treatment with R, F or MID was randomised 2:1:1. R infusion was started at 9 mcg/kg/h (and titrated to 18 mcg/kg/h) with or without supplemental P (Days 1–3) or MID (Days 4–5) to pre-defined optimal sedation (Sedation Agitation Scale 1 – 3) and analgesia (None or Mild pain). For P were administered with P or MID according to routine practice. The primary end-point comprised the interval from start of down-titration or stopping of study drug(s) to completion of daily neurological assessment. Safety was assessed throughout.

RESULTS. The mean ± SD durations of administration of R, F and M in the first 34 (24 M; 10 F) patients were 70 ± (6), 63 ± (42) and 42 ± (24), respectively. Seven patients received R for 5 days. Preliminary data are tabulated below:

|               | Mean ± SD | Neurological Assessment | Time (mins) |
|---------------|-----------|-------------------------|-------------|
| Age (yr)      | Day 1     | Day 2                   | Day 3       |
| Remifentanil  | 49.6 ± 18.8 | 32 ± 16                 | 38 ± 26     | 56 ± 26 | 62 ± 38 |
| Fentanyl      | 45.1 ± 17.3 | 75 ± 82                 | 79 ± 45     | 82 ± 50 | 113 ± 46 | 146 ± 32 |
| Morphine      | 52.4 ± 19 | 53 ± 24                 | 190 ± 183   | 155     | —        | —        |

CONCLUSION. R supplemented with P or MID was well tolerated. The time intervals from down-titration to successful neurological assessments were shorter for R-based sedation compared to F or P-based treatments. These preliminary observations support the lack of accumulation and predictable offset of effects of R which may make it a potentially useful agent in this setting.

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HYPONATREMIA WITH NATHRIURESIS IN NEUROSURGICAL PATIENTS
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INTRODUCTION. Hyponatremia with natriuresis is common in patients with intracranial diseases including head injury, tumours, intracranial infection, subarachnoid haemorrhage and stroke. Two major hypotheses have been proposed to explain hyponatremia in acute brain disease: the syndrome of inappropriate secretion of antidiuretic hormone (SIADH), and the cerebrospinal fluid (CSF) leak. SIADH is characterized by high normal blood volume, and CSW by a low blood volume.

METHODS. We investigated the incidence of these syndromes in neurological patients admitted to the Intensive Care Unit, who fulfilled inclusion criteria: 1) serum sodium < 130 mEq/L, 2) serum osmolality < 280 mOsm/kg, 3) urine sodium < 20 mEq/L, 4) urine osmolality > 200 mOsm/kg, and 5) absence of renal, adrenal, thyroid, liver and cardiac failure. Control group included normonatremic neurological patients. Blood volume was measured with the CYSI-labelled autologous erythrocyte technique.

RESULTS. Hyponatremia occurred 2–19 days (median 5 days) after ICU admission. Results are shown in Table (mean ± SE, *p < 0.05). Hyponatremic patients had a blood volume simi- lar to control normonatremic patients, indicating SIADH and not CSW.

|               | Normal | Hyponatremia (n = 9) |
|---------------|--------|---------------------|
| Plasma sodium, mEq/L | 135–145 | 139±2             |
| Plasma urea, mg/100 ml | 15–40 | 30±5            |
| Hematocrit, % | 36–50 | 32±4             |
| Blood volume, ml/kg | 65–70 | 50±4             |

CONCLUSION. We conclude that CSW has a low incidence in hyponatremic neurological patients.
Poster Sessions

Diagnosis in sepsis/MODS – 550–563

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IS THE DEGREE OF MULTIPLE ORGAN DYSFUNCTION RELATED TO SEVERITY OF MICROCIRCULATORY FAILURE?

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INTRODUCTION. Multiple organ dysfunction syndrome (MODS) is believed to result from microcirculatory failure in surgical intensive care patients. We hypothesized that degree of MODS is mirrored by simple tests of microcirculatory function. Therefore, we compared reactive hyperemia response in the forearm using transcutaneous PO2/PCO2 electrodes and laser doppler velocimetry, microvascular permeability (strain-gauge plethysmography) in legs and gastric tonometrically derived variables in patients with moderate and severe MODS.

METHODS. Twenty-two patients with MODS (1, moderate MODS group: less and equal 8 points; n=13; severe MODS group: greater and equal 9 points; n=9) were studied. All patients were monitored including a pulmonary artery catheter and a gastric tonometer during the study. Reactive hyperemia in the forearm skin after an arachidonic acid occlusion of 5 min was investigated using a transcutaneous PO2/PCO2-electrode heated to 37 °C and a laser doppler flowmeter (Periflux 4001, Perimed, Jarfalla, Sweden). Fluid filtration capacity and isovolumetric venous pressure were assessed using a electrophoretical sensor with automated calibration for strain-gauge plethysmography (Filibras 2001, Dongen GmbH, Germany). In addition, arterial lactate concentrations, arterial, mixed venous blood gas analysis and systemic haemodynamic variables were measured and systemic oxygen transport variables calculated. For statistical analysis paired Student’s t-test and in cases of non-normal distribution the Wilcoxon signed-rank test was performed. P-values < 0.05 were considered significant. Data are given as mean ± SD.

RESULTS. There were no differences in age, systemic oxygen delivery, consumption and oxygen extraction ratio between groups. Mortality in patients with moderate MODS was 15.4%, in patients with severe MODS 55.6% (p = 0.049). Patients with high MODS demonstrated significantly higher arterial lactate concentrations (4.5 ± 3.5 mmol/l) when compared with moderate MODS (1.7 ± 0.9 mmol/l; p = 0.04). We observed no significant differences in gastric pH, gastric regional to arterial PCO2 difference, capillary filtration coefficient and isovolumetric venous pressure measured in legs and the magnitude of skin reactive hyperemia response in the forearm between patients with moderate and severe MODS.

CONCLUSION. Once MODS has established microcirculatory parameters do not reflect severity of organ dysfunction and are not associated with mortality in surgical intensive care patients.

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DIAGNOSIS OF CAPILLARY LEAKAGE SYNDROME BY MEASUREMENT OF INTRA THORACIC BLOOD VOLUME

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INTRODUCTION. Capillary leakage syndrome (CLS) is a frequent complication in sepsis. Extravascular fluid results in generalized oedema and haemodynamic instability despite massive fluid therapy [1]. Until today there are no standardized criteria available for diagnosis of CLS. Aim of this study was to evaluate dynamic changes of intrathoracic blood volume index (ITBVI) as a diagnostic determinant for CLS.

METHODS. In a prospective clinical study 6 patients with septic shock (SAPS II-Score: 48 ± 10), multiple organ failure and CLS were compared to 6 control patients. CLS was judged clinically by generalized oedema, positive fluid balance and weight gain. Dynamic changes of following parameters were measured before (T1 = 0min) and after (T2 = 90min) administration of 30ml of albumin 20%. ITBVI calculation was done by the mean transit time approach (thrombolytic dilution technique) using a computer system (COLD-ZDOI, Pulsion Medical Systems, Munich, Germany), central venous pressure (CVP) and plasma volume by photometrically determined of indocyanine green concentration (PVIGC). Data are presented as mean and standard. Statistical intergroup comparison was performed using unpaired t-test. (*) *p < 0.05 was considered significant.

RESULTS. Changes of ITBVI at T2 in CLS patients were significantly smaller compared to controls (-53 ± 126 ml/m² vs. 103 ± 148 ml/m²; p < 0.05). CVP averaged 18 ± 2 mmHg in CLS patients and in controls 9 ± 2 mmHg at T1. Change of CVP at T2 was not different in CLS patients compared to controls (0 ± 2 mmHg vs. 2 ± 2 mmHg; p = 0.13). At T1 PVIGC was measured in CLS patients with 451 ± 7.5 ml/kg/total body weight (BW) and in controls with 57.6 ± 10.2 ml/kg/BW (p = 0.05). Change of PVIGC at T2 was not different in CLS patients compared to controls (4.3 ± 8.7 ml/kg/BW vs. 2.5 ± 4.2 ml/kg/BW; p = 0.65).

CONCLUSION. These results suggest that measurement of dynamic changes in Intrathoracic blood volume index of hyperoncotic solution may serve as a useful approach to diagnosis of CLS in critically ill patients.

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CALCULATION OF CARDIORESPIRATORY INTERPLAY IN MODS PATIENTS: WHICH METHOD IS THE BEST?

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INTRODUCTION. To date there are two methods for calculation of the cardiac chemoreflex sensitivity (CCRS, a marker of cardiorespiratory interplay). We have recently shown that the arterial CCRS (aCCR S) is the more blunted the more MODS is pronounced (1). On the other hand the venous CCRS (vCCR S) is used for risk stratification in chronic heart failure (CHF) and sudden cardiac death (2). In the current study we aimed to apply both methods to MODS patients and we asked which method is most suitable for calculation of autonomic function in MODS.

METHODS. 47 consecutive patients with MODS (APACHE II Score [AP II] > 18) were enrolled in this study. The aCCR S was calculated as regression slope of heart interval (HI) and PaO2, HI and PaO2 were assessed at baseline, after 1/3 increase of FIO2, and after returning to baseline (1). This regression slope was also used to calculate regression slope of HI and venous PO2, and subsequently, both CCRSs. The vCCR S according to (2) was calculated as the ratio of HI alteration to that in venous PO2 after 5 minutes of increase in FIO2. We also calculated this ratio for arterial PO2 (aCCR Sratio).

RESULTS. 47 patients: 85 ± 12.8; 81 ± 2 kg. AP II 30 ± 7 (mean ± SD). The table summaries the correlation of the parameters vs. the AP II.

| aCCR S (1) (mmHg/min/m²) | vCCR S (2) (mmHg/min/m²) | CCRSratio (3) (mmHg/min/m²) |
|--------------------------|--------------------------|-----------------------------|
| -0.6 ± 0.01              | -0.1 ± 0.08              | -0.1/0.7                    |

CONCLUSION. The aCCR S or CCRSratio appear to reflect most accurately the cardiorespiratory interplay in MODS patients. We believe that the impairment of autonomic function in MODS should be calculated by a method using alterations in arterial PO2, because this approach uses the physiological stimulus of the chemoreceptors. The application of vCCR S for risk stratification may be suitable in CHF but does not seem to be transferable to MODS.

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EARLY AND LATE CHANGES IN PLATELET COUNT ARE CORRELATED WITH OUTCOME IN PAEDIATRIC ICU PATIENTS

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INTRODUCTION. Both in adults and in children low platelet counts in the first days after ICU-admission are associated with poor outcome. We have found that in adults a blunted rise in platelet count from day 3 to day 10 after ICU-admission is associated with adverse outcome (1). In children admitted to the ICU the relation between time dependent changes in platelet count and outcome has not been investigated. In this study we analyzed the platelet count in children admitted for 4 days or more to our pediatric ICU.

METHODS. All children admitted to the PICU from 1995 to 1999 were analyzed. All platelet counts were corrected and CRP determinations performed directly before and up to 10 days after ICU-admission were analyzed. Mortality was determined at 30 days.

RESULTS. A total of 555 admissions of 454 patients (Male/Female:287/167 ) with a mean age ± SD (range) of 3.0 ± 4.4 (0–19) years were included. 48 patients died within 30 days. At day 3 the platelet count ± SD was 214 ± 164 versus 102 ± 135 (p < 0.01). At day 10 the difference in platelet count were even higher: 326 ± 210 versus 172 ± 202 (p < 0.01). CRP levels at day 3 were 77 ± 90 and 124 ± 183 mg/l respectively (p < 0.001). Remarkably, leukocyte counts were similar in both in groups at day 3 ± 12 ± 7.5 and 13 ± 12 ± 10.8 (NS). At day 10 leukocyte count was 13 ± 7.2 and 17.0 ± 9.2 (p < 0.001) in survivors and non-survivors respectively. When patients with high or low platelet count before ICU-admission were analyzed separately, a difference between survivors and non-survivors was still observed, in both subgroups survivors had a significantly higher rise in platelet count.

CONCLUSION. Alike to adults, in children a low platelet count is associated with mortality. Both a low platelet count during the first days after ICU-admission, and independently, a subsequent failure of the platelet count to rise are associated with increased mortality. The initial leukocyte count is not associated with mortality, with only limited differences later on. Presumably persisting systemic inflammation – as reflected by CRP – is associated with persisting platelet consumption in non-survivors.

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BRONCHIAL AND PLASMA LEVELS OF INFLAMMATORY CYTOKINES IN BRONCHOPNEUMONIA ASSOCIATED WITH SEVERE HAEMATOGENOUS CANDIDAL OR BACTERIAL SEPSIS
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INTRODUCTION. Candidal infection is associated with high morbidity and mortality. Some Authors have
studied several antigens and candidal metabolites in the blood of patients with suspected or con-
firmed candidemia or hematogenously disseminated candidal infection. Our aims is to correlate the cy-
tokines/bronchialwashing/cytokinelevels of patients with confirmed candidiasis and bronchopneu-
monia with severe bacterial sepsis in critical ill patients and to register changes after antifungal treat-
ment.

METHODS. Patients included in the study are those admitted (more than 48 hours) in ICU. We have
considered 18 patients subdivided into two groups: A) patients admitted with severe sep-
sis plus candidemia or B) patients admitted with sepsis and confirmed candidaemia with bron-
chopneumonia. We have registered inflammatory cytokine levels in bronchial washing and plasma (IL
6, TNF alpha, IL-1alpha, IL-8) at admission and then 2, 3 and 7 days after antifungal treatment. We have mea-
sured cytokines by an ELISA assay.

RESULTS. Results are shown in table 1 and 2. Also the plasma levels registered in the groups confirm the different response in cytokines levels and are correlated with bronchial levels in the two groups of patients

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LIPOPOLYSACCHARIDE-BINDING PROTEIN IS A USEFUL MARKER FOR SYSTEMIC INFECTION ON THE ICU
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many

INTRODUCTION. Lipopolysaccharide-binding protein (LBP) is an acute phase protein facilitat-
ing the recognition of low concentrations of lipopolysaccharide (LPS) by monocytes, thus both pro-
viding a sensitive marker during the onset of infection. The aim of the present study was to
examine the time course of LBP serum levels in critically ill patients and of other inflammatory
markers.

METHODS. The study included 34 patients fulfilling 3 or more of the SIRS criteria. LBP (nor-
mal <10 ng/ml), PCT (normal <0.5 μg/ml), IL-6, CRP and WBC were determined daily over a period
of 10 days. Sepsis was included if APACHE II and SAPS on admission and MAP and SOFA and
were improved before and 24 h after EICO.

RESULTS. Mortality was 18% (6 in the ICU and 0% in the ECC group). LBP levels never differed between survivors and non-survivors, whereas PCT levels were significantly dif-
ferent on day 4, 5 and 6 in 7. However, the course of LBP levels over the ICU stay showed con-
stantly decreasing values in survivors compared to elevated LBP levels in the non-survivor group.
LBP was elevated in the control group after EICO (Mean: 27.5 pg/ml) which was a five-
fold increase compared to normal values, whereas LBP levels were 19.5 pg/ml. In patients with infection (29/34, 88.2% CDC criteria), LBP levels were increased compared to those with non-in-
fected SIRS (41/45, 15.4% vs. 35 μg/ml) as p < 0.05. PCT levels never differed between infection and non-infection. In six patients with infection there was pathological PCT value whereas only one of those patients had no elevation in LBP

CONCLUSION. In this study LBP levels were consistently elevated in those patients suffering from proven infection, whereas PCT levels were not. Furthermore PCT showed a more pronounced increase than LBP in patients with non-infectious SIRS after EICO. Despite the fact that LBP did not differ significantly between survivors and non-survivors it seems to be an adequate and early marker for an ongoing infection in surgical ICU patients.

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IMPLICATION OF PLASMA MEDIATORS ON BLOOD INNATE IMMUNITY IN SEVERE IMMUNE DISTURBANCES AND SEPTIC SHOCK
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INTRODUCTION. Blood innate immunity is inhibited after head trauma and brain surgery with in-
creased incidence of infections (1). Neuroendocrine mediators (hypothalamo-pituitary-adrenal (HPA) axis and sympathetic nervous system (SNS)) released in blood in cytokines may participate in this inhibi-
tion. This hypothesis has been tested in sepsis (2) and surgery and malignant glioblastomas (MGB) sur-
geries.

METHODS. With Ethics approval, patients (n=5, MGB n=3) were compared with healthy volun-
teers (n=4). Protocol: prospective (preop), 2hrs after surgery (postop), day 1 (D1), day 2 (D2), female
immunity study. HLA-DR expression on monocytes (MO) (flow cytometry). Mean Fluorescence Intensi-
ty (MFI), plasma IL-10 and IL-12p40 normalised by producing cells (ELISA); neuroendocrine media-
tors: ACTH, cortisol; coagulation (Fg), noradrenaline (Norad), dopamine (Dopa), prolactin (PL), serum vasopressin (AVP) (Radio Immuno Assay). The impact of these mediators has been tested in 6.6 plasma stimulated whole blood culture (p) and with plasma replaced by culture medium (Med). RMP (100+100+100+100) %: LPS effect on MO HLA-DR. IL-10 and IL-12p40 in each condition was ex-
pressed as a % of preop levels. Healthy volunteers: No MGB with LPS and IL-10 IL-12p40.

RESULTS. Preop MGB HLA-DR did not differ from healthy and was depressed in postop (p < 0.01), with an altered response to LPS (table 1). Postop inhibition was attenuated in culture medium, suggest-
ing an impact of plasma factors. This inhibition was not related to plasma IL-10 and IL-12p40-modifica-
tions. After LPS-stimulation in plasma as is medium, SZ had an anti-inflammatory profile (increase in IL-10/low IL-12p40 at D3) and MGB did not respond for both IL-10 and IL-12p40. Endocrine response: AVP and PL peaked in postop (p < 0.02) while only partly tended to peak. ACTH, cortisol, Norad, and Dopa did not change.

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PROTEINASE-INHIBITOR BALANCE IN POSTPARTUM SEPSIS AND SEPTIC SHOCK
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INTRODUCTION. Proteinase plays significant role in the development of cascade phase of se-
psis and septic shock, the proteinases activity is controlled by the range of inhibitor’s activity. That’s why the study of proteinase-inhibitor balance (PIB) in sepsis and septic shock is worth while.

METHODS. We checked 30 healthy and 20 purperous with postpartum sepsis and septic shock. We evaluated the following parameters of PIB: concentration of Plasminogen (%), activity of Chymotripsin Proteases (Emil), activity of Antichymotripsin (Emil), activity of Acid-stable Inhibitor (Emil), activity of Emil. saline of anti-2-Macroglobulin (Emil).

RESULTS: We registered considerable increase of the Plasminogen concentration (74%, p < 0.001) and of Acid-stable Inhibitor (110% p < 0.004) in normal purp-
erous in comparison with donors. 20 purperous with postpartum sepsis and septic shock received complex infusion-therablasion therapy and plasmapheresis. The plasmapheresis was carried out before and after satiation of the septic locums the plasma-exchange regime, in volume 50%, and 70% of Circulating Plasma Volume (CPV) accordingly. Retrospectively we subdivided the purperous with sepsis and septic shock in two groups: 1 group – 12 women, who received plasmapheresis on the 2nd day of the disease – all of them recovered. 2 group – 8 purperous the procedure was started on the 5th day of sepsis course and with the Polysolign’s Insufficien-
cy with the involvement of 2 and more systems, these women died on the 10-12-th day of the disease. In the 1-st group we registered gradual normalization of the PIB parameters: the mean Plasminogen concentration in the beginning was 73% + 13.6%, and at the 5-th day after Plasmapheresis increased by 61.8% from the starting level (p = 0.007); the activity of Chymotripsin Protines decreased on 40.6% (p = 0.08); activity of Chymotripsin had the tendency to decrease. In the 2-nd group we did not observe any changes in PIB: the starting mean Plasmino-
gen concentration did not exceed 50% and afterwards remained monotonously low; the activity of Chymotripsine Protines and Antichymotripsine did not reliably change; the activity of Acid-stable Inhibitor had a tendency to decrease immediately after plasmapheresis, but on the 5th day after plasmapheresis it again gradually increased up to the starting level, the activity of anti-2-Macroglobulin remained persistently low during all the period of the disease and did not exceed 3.5 Emil.

CONCLUSION. Correction of the PIB is possible in the first 2 days after obstetric sepsis man-
agement formation the plasminogen does not effect efficient and, to our opinion, is reliably connected with the increase of lethality (up to 80%–100%).

REFERENCE. Correction of the PIB is possible in the first 2 days after obstetric sepsis man-
ifestations.
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ROLE OF LEUKOCYTES IN THE HYPERLACTATEMIA FOLLOWING CARDIOPULMONARY BYPASS
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INTRODUCTION. Blood lactate concentrations are commonly increased in patients recovering from cardiopulmonary bypass (CPB) after cardiac surgery. Although this hyperlactatemia may be due to tissue hypoxia, many patients with hyperlactatemia have adequate haemodynamic parameters and normoventilation, suggesting that the increase is not due to inadequate tissue oxygenation. The aim of this study was to evaluate if leukocytes could contribute to the increase in lactate metabolism.

METHODS. In 10 adult patients undergoing CPB for cardiac surgery, 15 mL of heparinized blood sample was obtained before induction of anesthesia and 3 hours after the end of the surgical procedure. Blood samples were immediately frozen and maintained at -80°C until processing. Lactate concentration was measured by a lactate analyzer and corrected for pH by the lactate-pH equation. The lactate production of each sample was calculated in mmol/L/L/min using linear regression. The relative contribution of WBC to whole blood lactate production (%WBC) was also calculated.

RESULTS. No correlation was found between lactate production and leukocyte count. Lactate production was significantly lower in the group of patients with lactate concentrations <2 mmol/L/L/min compared to the group with lactate concentrations ≥2 mmol/L/L/min.

CONCLUSION. Hyperlactatemia is more common after CPB in patients with leukocytopenia, and this may be due to increased lactate metabolism by leukocytes.
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**SEVERITY STRATIFICATION OF SEPTIC SHOCK ACCORDING TO NORADRENALINE REQUIREMENT**

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**INTRODUCTION.** Septic Shock (SS) severity is usually estimated from indexes of multiorgan dysfunction, but haemodynamic dysfunction, despite its main role, has traditionally been under-scored. The aim of this study was to test a severity classification for SS according to Noradrenaline (NA) requirements.

**METHODS.** An algorithm for haemodynamic treatment in SS, which established NA as the first drug (followed by dobutamine or adrenaline as required), was followed prospectively in all SS patients from December 1999 to August 2000. We evaluated Apache II and SOFA scores, and minimum values for C-reactive protein (CRP) and lactate. Patients were classified in three groups according to NA requirement: Mild shock, NA ≤ 0.1 mg/kg/min; Moderate shock, NA from 0.1 to 0.3 mg/kg/min; and, Severe shock, NA > 0.3 mg/kg/min.

**RESULTS.** 56 SS patients were enrolled. The three groups were comparable in age and sex, but severe SS patients had higher APACHE and SOFA scores, lactate levels and mortality (Table). No differences were observed between the mild and moderate groups in any variable.

|          | Mild (n = 15) | Moderate (n = 17) | Severe (n = 24) | p    |
|----------|--------------|------------------|----------------|------|
| Age (years) | 64±10       | 62±1.14         | 58±145         | NS   |
| Sex (M/F)  | 5/10         | 9/0              | 14/10          | NS   |
| Apache II  | 15±1±6       | 13±7±0          | 20±8±6         | 0.05 |
| Max. SOFA  | 6.8±3.3      | 7.5±3.3         | 11±3.0         | 0.05 |
| Max. Lactate (mg/dL) | 3±2       | 2.6±1.7         | 7.5±3.9        | 0.05 |
| Max. CRP (mg/dL) | 27.7±15.5  | 29.1±8.1        | 26.7±12.5      | NS   |
| Max. Creat (mg/dL) | 1.7±0.6     | 2.9±3.2         | 2.3±1.4        | NS   |
| Mortality (%) | 3(20.0%)    | 4(23.5%)        | 17(70.8%)      | 0.05 |

**CONCLUSION.** We found that NA requirement > 0.3 mg/kg/min strongly predicts mortality in SS patients. In contrast, doses above 0.1 but less than 0.3 mg/kg/min, which SOFA score assigns 4 points, is not useful as a severity marker. Based on these results, a new and strong criterion for Severe Septic Shock is proposed. This new concept may be useful to assist in decisions about more invasive or alternative monitoring techniques, especially when used in association to a pre-defined algorithm.

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**PROINFLAMMATORY CYTOKINES IN ACUTE MYOCARDIAL INFARCTION WITH AND WITHOUT CARDIACgenic SHOCK**

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**INTRODUCTION.** Little is known about cytokine levels in patients with acute myocardial infarction (MI) complicated by cardiogenic shock (CS). In some of these patients a severe systemic inflammatory response syndrome (SIRS) is observed, which is associated with a particularly poor outcome. Serum levels of tumor necrosis factor alpha (TNF-alpha), interleukin 1-receptor antagonist (IL-1Ra) and interleukin 6 (IL-6) were measured in this setting in a prospective study. The following three groups of patients were compared: 1) acute uncomplicated MI 2) acute MI complicated by cardiogenic shock 3) acute MI with cardiogenic shock and SIRS.

**METHODS.** Twenty-eight patients admitted to our hospital with the diagnosis of acute MI were included in the study (24 men; mean age 59 ± 10 yrs). 16 patients had an uncomplicated acute MI, 6 MI complicated by cardiogenic shock and 6 MI with CS and SIRS. All patients were subjected to acute angioplasty with angiographic success. Cytokines were measured two-hours until creatine kinase (CK) reached its peak level (starting prior to PTCA). All parameters were measured using standard laboratory techniques. Patients with concomitant conditions which potentially could elevate cytokines (e.g. infection) were excluded from the analysis.

**RESULTS.** See Table 1. None of the patients with uncomplicated MI and none with CS and SIRS died during the primary hospitalisation. Of the patients with CS and SIRS the in-hospital mortality was 67%.

|          | 1) MI without SIRS | 2) CS without SIRS | 3) CS with SIRS* |
|----------|-------------------|--------------------|-----------------|
|          | n = 16            | n = 6              | n = 6           |
| CK-MB IU/L | 292              | 373                | 945             | NS  |
| Troponin I | 35.9             | 35.2               | 58.6            | NS  |
| TNF-alpha pg/ml | 2.9       | 4.9                | 9.9             | NS  |
| IL-6 pg/ml | 56.1             | 83.1               | 27.5            | NS  |
| IL-1Ra pg/ml | 1144            | 19988              | 15053           | 0.02 |

*p-values 1) vs 2) 0.06 NS* 2) vs 3) 0.004 NS

**CONCLUSION.** The inflammatory-associated cytokines IL-1Ra and IL-6 are significantly elevated in patients with MI complicated by cardiogenic shock and SIRS when compared with patients with uncomplicated MI. TNF-alpha levels did not differ significantly between these two groups. Among shock patients the group with SIRS showed dramatically higher levels of IL-1Ra, heralding a particularly poor outcome.

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