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### Basic science

#### P1

#### FAST HUG in an ICU at a private hospital in Brasília: checklist and the eighth evaluation item

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**Introduction** Many authors have written about the need to treat patients closer to their beds, in order to observe them more as distinct people. The FAST HUG mnemonic, which consists of a checklist, was suggested as an idea to be employed everyday, by professionals dealing with patients who are critically ill. Minding these questions and motivated by an idea of follow patients' treatment closer, we have put into practice the instrument developed by Jean-Louis Vincent, evaluating the seven most important procedures in critically ill patients, and performed the FAST HUG. This checklist consists of seven items to be evaluated: Feeding, Analgesia, Sedation, Thromboembolic prophylaxis, Head-of-bed elevation, stress Ulcer prevention, and Glucose control. Knowing that the pressure ulcer is one of the challenges faced by ICU nurses, related to patients' need to stay at rest, to be under rigorous control or more complex therapy, it was decided to create the eighth item on the checklist: S, for skin. It stands for skin treatment, with the techniques used in the unit (Braden Scale), monitoring and evaluating closer skin integrity, and allowing nurses to calculate the scoring average of the Braden Scale, and greater incidence of ulcer in interned patients.

**Objective** To expose the shortcomings found during the FAST HUG application, and to show results obtained with the eighth item of the FAST HUG mnemonic: S – Skin.

**Methods** A descriptive study, based on institutional data, was carried out in the adult ICU of a private hospital. It was performed from 2 to 27 June 2008, except on weekends. Three hundred and twenty-three patients were involved. The checklist was carried out during the afternoons by the head nurse, or the assistant nurse of the unit. In order to do this job, a spreadsheet was elaborated to control data, updated every week. This spreadsheet provided graphics for a more objective control of the results obtained. The idea was exposed to the team, during a training program, and so we started the activities.

**Results and discussion** For 20 days of the checklist, 323 patients were evaluated for the eight items. The real shortcomings most frequently found were related to thromboembolic prophylaxis (85%) and glucose control (90%). These shortcomings were immediately evaluated and, depending on this analysis, this item would go on or not, according to the patient's clinical situation. The shortcomings found were tracked just as they were detected, and their cause would be discussed in a multidisciplinary group, and a solution was found. If the item was not observed, it would be

Figure 1 (abstract P1)

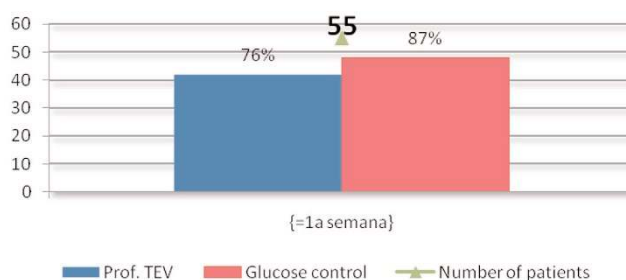
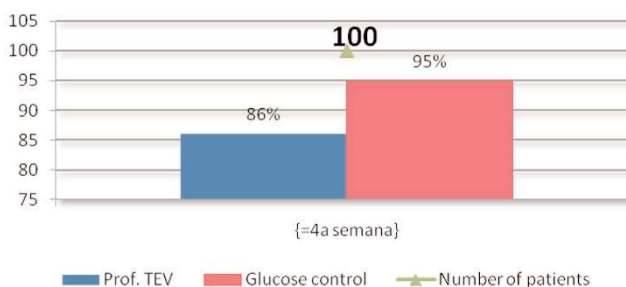


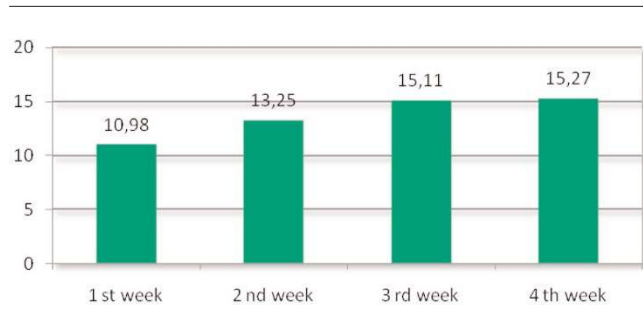
Figure 2 (abstract P1)



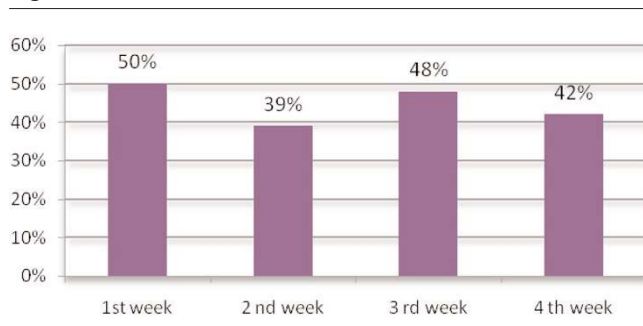
written down but not treated as a real shortcoming. The changes in medial prescription were done immediately. In cases where the patient did not show a favorable situation for the utilization of thromboembolic prophylaxis (bleeding, presurgical, among others), it would be treated as a nonreal shortcoming. The same was done for glucose control. We realized that after 4 weeks using this instrument there was a small reduction of shortcomings in glucose control (Figure 1), and a discrete raise in thromboembolic prophylaxis (Figure 2). From this point we reviewed the checklist, in order to provide a field to write down real shortcomings, so that they are given more relevance and treatment, since the patients' clinical situation deserves different treatments that do not interfere in the unit's quality of service. The inclusion of skin evaluation through the Braden Scale was an opportunity to follow patients' skin, by means of risk evaluation to develop wounds, providing data on the daily scoring average of the Braden Scale and the spot where these wounds were more frequent. An average Braden score of 13.65 (Figure 3) was verified, and it was also seen that the greater incidence of pressure ulcer was in the sacral region (44.75%) (Figure 4).

**Conclusions** It can be concluded that FAST HUG, in addition to being a tool to evaluate assisting quality and to assure patients that their needs will be fulfilled while they remain in the ICU, may be considered a boost to overcome new challenges. Along with the

**Figure 3 (abstract P1)**



**Figure 4 (abstract P1)**



checklist, a reduction of shortcomings found in glucose control was observed and a rigorous multidisciplinary evaluation of patients with contraindications to the use of prophylaxis of TEV. Also, we could see a greater attention of the multidisciplinary team to the results provided by the evaluation of skin wound risk, since they offer a significant prognostic value.

**References**

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**P2**

**Feasibility of stored red blood cell transfusion in pigs**

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*Critical Care* 2009, **13(Suppl 3)**:P2 (doi: 10.1186/cc7804)

**Introduction** The mechanisms associated with immunomodulation after red blood cell transfusion are not completely understood, possibly due to methodological biases in the clinical studies and presence of comorbidities such as sepsis. Therefore, a controlled

animal model of blood cell transfusion may be a more appropriate approach to minimize these issues. We designed this pilot study in order to validate *in vitro* and *in vivo* the survival of swine erythrocytes stored for 13 days.

**Methods** Blood was collected from one Agroceres® swine and stored in 2 units of red blood cells (RBC). The following measurements were performed at baseline and after 13 days of storage: volume, hemoglobin and hematocrit, hemolysis index, potassium, sodium, glucose and pH. *In vivo* validation and hemolysis evaluation were performed by labeling the cells with Na<sub>2</sub><sup>51</sup>CrO<sub>4</sub> and recovering viable erythrocytes up to 24 hours after transfusion in one autologous material and four homologous animals. A splenectomy was performed after death to evaluate splenic sequestration of RBC.

**Results** *In vitro* validation of the samples is demonstrated in Table 1. The mean RBC recovery value after 24 hours of injection of labeled RBC was 97.5 ± 19%, demonstrating a good viability of the samples. The evaluation of splenic hemolysis was negative.

**Conclusions** Erythrocytes from pigs stored under human standardized conditions for up to 13 days may be used for experimental transfusion studies. This controlled animal model may be useful to study pathogenetic mechanisms related to adverse effects of RBC transfusion.

**Acknowledgement** Supported by Research and Education Institute, Hospital Sírio-Libanês.

**Hemodynamic/shock**

**P3**

**Validation of an echocardiography training program for intensivists**

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*Critical Care* 2009, **13(Suppl 3)**:P3 (doi: 10.1186/cc7805)

**Introduction** The use of echocardiogram performed by intensivists, as a modality of hemodynamic monitoring, is becoming increasingly frequent in ICUs worldwide. Several training programs and curriculums have been proposed to avoid the misuse and misinterpretation of this tool. However, until now, there have been few reports validating this type of training. The aim of the present study is to compare these measurements in order to evaluate the efficacy of our institutional training program.

**Methods** In our institution, we have performed a 140-hour bedside echocardiography training (plus 10-hour theoretical classes) for seven intensivists. At the end of the training period, the intensivists and the teachers (experienced level III echocardiographers) registered echocardiography-derived hemodynamic variables of the same patient a few minutes apart.

**Results** We have obtained 46 paired measurements. The velocity–time integral of ventricular outflow tract showed a Pearson correlation coefficient = 0.860 (*P* < 0.01), a bias of 1.19 cm and a

**Table 1 (abstract P2)**

Unit	Period	Volume (ml)	HT (%)	Hb (g/dl)	Hemolysis index (%)	K <sup>+</sup> (mEq/l)	Na <sup>+</sup> (mEq/l)	pH	Glucose (mg/dl)
Unit 1	Baseline	196.3	68.8	22.5	0.07	3.5	144	7.09	333
	13-day storage	187.1	67.9	22.3	0.09	32.8	118	6.90	362
Unit 2	Baseline	163	67.9	22.3	0.02	3.2	145	6.96	362
	13-day storage	144.7	67.2	22	0.1	31.3	120	6.90	370

mean error of 29% between paired measurements. The systolic volume classification (between low or normal and high) resulted in a kappa coefficient of 0.696 ( $\pm 0.105$ ). Myocardial contractility resulted in a kappa coefficient of 0.823 ( $\pm 0.121$ ).

**Conclusions** Our study demonstrates that our training program was efficient. Hemodynamic-focused echocardiography can be accurately performed by intensivists after attendance of this training program.

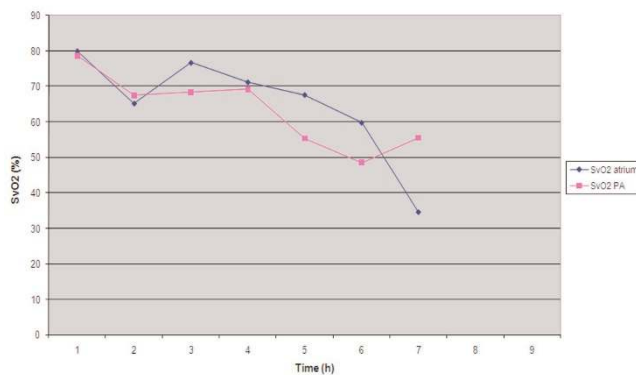
**P4**

**Do right atrium to mixed venous oxygen saturation gradients mirror heart oxygen uptake?**

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*Critical Care* 2009, **13(Suppl 3)**:P4 (doi: 10.1186/cc7806)

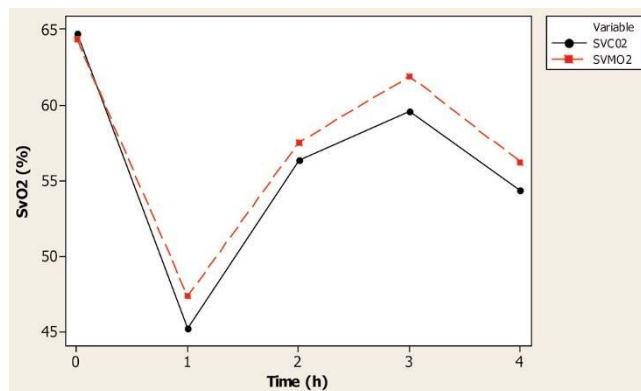
**Objective** To analyze behavior of venous oxygen saturation (SvO<sub>2</sub>) measured in the coronary sinus and to correlate it with central to mixed venous SvO<sub>2</sub> gradients.

**Figure 1 (abstract P4)**



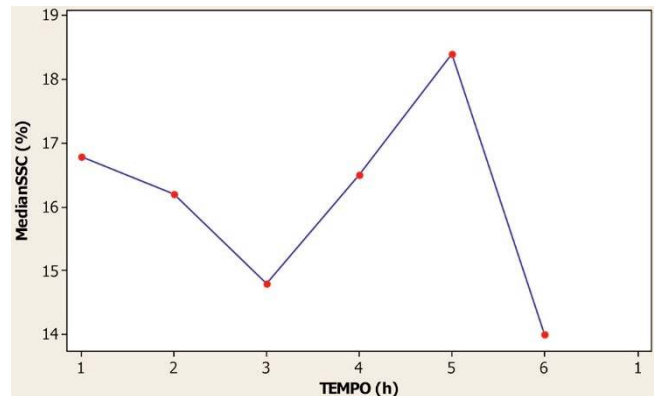
Central venous to pulmonary artery SvO<sub>2</sub> gradients.

**Figure 2 (abstract P4)**



Time series plot of SVC O<sub>2</sub>; SVM O<sub>2</sub> – sham.

**Figure 3 (abstract P4)**



Time series plot of median SSC.

**Methods** Sixteen large white pigs, weight 35 kg, in general anesthesia (isoflurane, fentanyl, pancuronium), fully monitored (electrocardiography, etCO<sub>2</sub>, invasive pressure, pulmonary artery catheter, portal vein Doppler ultrasound flow, small bowel tonometry), were studied. Fifteen pigs were submitted to fecal peritonitis sepsis (1 g/kg feces plus 150 ml warm saline) after fluoroscopy-guided coronary sinus catheterization and the last one was the sham. Laboratory data (blood samples collected from the coronary sinus, right atrium, pulmonary artery) and hemodynamic data were registered hourly. After the experiments, pigs were sacrificed with a sedative overdose and KCl 19.1% injection.

**Results** Central to mixed venous SvO<sub>2</sub> curve distances vary along time (hours) (Figure 1) more in septic pigs than in the sham (Figure 2). Measurements of SvO<sub>2</sub> from the coronary sinus reach extremely low values (Figure 3).

**Conclusions** Absolute SvO<sub>2</sub> gradient variations along time, in sepsis, may be the consequence of coronary sinus contribution, considering the extremely low values observed. Further studies should explore whether these gradient variations may be an indicator of myocardial oxygenation status.

**P5**

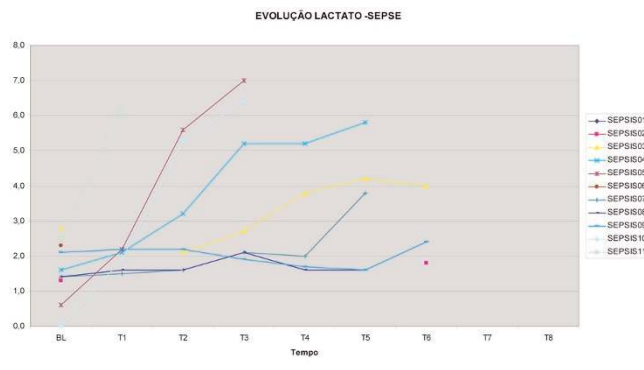
**Lactate generation is not related to tissue partial pressure of oxygen levels in sepsis**

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*Critical Care* 2009, **13(Suppl 3)**:P5 (doi: 10.1186/cc7807)

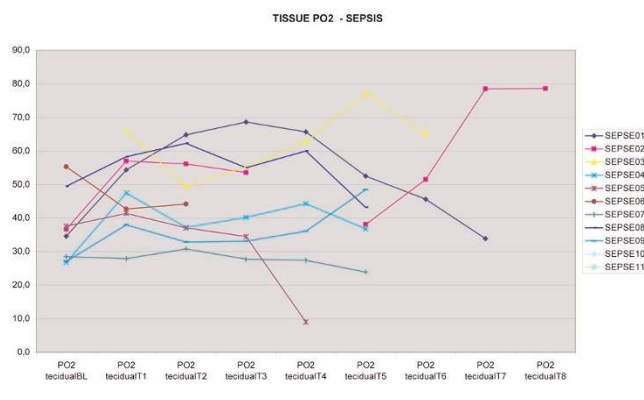
**Objective** To analyze behavior of tissue partial pressure of oxygen (pO<sub>2</sub>) measured in the liver during sepsis and to correlate its reduction with lactate levels.

**Methods** Eleven large white pigs, weight 35 kg, in general anesthesia (isoflurane, fentanyl, pancuronium), fully monitored (electrocardiography, etCO<sub>2</sub>, invasive pressure, pulmonary artery catheter, portal vein Doppler ultrasound flow, small bowel tonometry), were submitted to fecal peritonitis sepsis (1 g/kg feces plus 150 ml warm saline) after pO<sub>2</sub> and laser Doppler fluxometry probes were placed inside liver parenchyma. Laboratory and hemodynamic data were registered hourly. After the experiments,

**Figure 1 (abstract P5)**



**Figure 2 (abstract P5)**



pigs were sacrificed with sedative overdose and KCl 19.1% injection.

**Results** The model is well studied and very consistent. Hypotension occurs only in late phases (8th hour). Lactate generation seems to occur earlier (1st hour) than tissue pO<sub>2</sub> level reduction (4th hour), in septic pigs. (See Figures 1 and 2.)

**Conclusions** Lactate generation not only seems to be related to tissue hypoxia in septic pigs. Inflammation and mitochondrial dysfunction may probably play a role in this pathological process. Further studies are needed to clarify these mechanisms. Perhaps other interventions, not only oxygen uptake optimization, ought to be necessary for early reversal of septic cascade.

**P6**

**Comparison of pulse pressure variation in swine experimental models of hypovolemic shock with and without controlled positive invasive mechanical ventilation**

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Critical Care 2009, 13(Suppl 3):P6 (doi: 10.1186/cc7808)

**Introduction** Pulse pressure variation (DPP) is a very good method to predict the improvement in oxygen delivery in circulatory failure states after volume expansion. However, this method has been validated only in patients under sedation plus controlled positive pressure invasive mechanical ventilation (PCV). Our understanding

of this method in patients under spontaneous ventilation remains unclear.

**Materials and methods** In 10 male domestic pigs the pulmonary arterial pressure, aortic arch pressure, femoral arterial pressure (PP) and cardiac output by thermodilution technique were measured in four different stages: (I) basal, in spontaneous ventilation; (II) after controlled hemorrhage to simulate the hypovolemic shock in spontaneous ventilation; (III) in a hypovolemic shock state but now under PCV and breath muscle paralysis with pancuronium; (IV) after volemic resuscitation under PCV (thiopental plus fentanyl plus pancuronium). The means and medians were compared by the ANOVA and TURKEY tests respectively; *P* <0.05 was considered statistically significant. DPP was calculated in all stages by the formula:  $DPP = (100 \times (\text{maximalPP} - \text{minimalPP}) / (\text{maximalPP} + \text{minimalPP}) / 2)$ , where maximalPP = (maximal systolic pressure – maximal diastolic pressure) and minimalPP = (minimal systolic pressure – minimal diastolic pressure).

**Results** The means of DPP under spontaneous ventilation were statistically significantly higher than in other stages of the experiment, respectively: 22.3%; 42.27%; 21.8% and 10.48% with *P* = 0.039. After the PCV the DPP got back to basal values, without volemic resuscitation. The lowest value were achieved after volume expansion with *P* = 0.001 compared with stage II.

**Conclusions** The DPP in hypovolemic shock in spontaneous ventilation is higher than under PCV. It is important to find the cutoff value that has a best relationship to the response to volume resuscitation.

**Sepsis**

**P7**

**Decrease in the 30-day heart failure (HF) Rehospitalization Rate after the implementation of a HF managed protocol**

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Critical Care 2009, 13(Suppl 3):P7 (doi: 10.1186/cc7809)

**Introduction** Heart failure (HF) is associated with high morbidity and mortality rates, including frequent rehospitalization. The 30-day HF Rehospitalization Rate is an outcome quality indicator used to measure the quality of care.

**Objective** To identify changes in the 30-day HF Rehospitalization Rate after the implementation of a HF managed protocol.

**Method** A cross-sectional prospective study of 671 patients hospitalized for heart failure in a tertiary private Brazilian hospital. Patients were divided into two groups: 189 patients admitted in the pre-protocol period (January 2005 to July 2006) and 452 patients admitted in the post-protocol period (August 2006 to May 2008). Mean age was 75.0 ± 12.0 years (range: 21 to 102 years). The HF protocol was implemented on 1 August 2006 and consisted of a written protocol, on-time data collection for quality indicators, and periodic performance feedback (reports) given to the clinical and administrative staff. Data collection before the protocol implementation was done retrospectively by a nurse case-manager. Statistical analysis was performed using the chi-square test, Student's *t* test and Fisher's exact test. *P* <0.05 was considered statistically significant.

**Results** There was a significant decrease in the 30-day HF Rehospitalization Rate after, along with an increase in β-blocker, angiotensin-converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB) and smoking cessation counseling rates (Table 1).

**Table 1 (abstract P7)**

Variable	Pre-protocol	Post-protocol	P value
Age (years), mean $\pm$ SD	76.9 $\pm$ 10.2	75.0 $\pm$ 12.0	0.27
Ejection fraction (%), mean $\pm$ SD	31.0 $\pm$ 7.67	31.9 $\pm$ 7.6	1
Admitted in cardiogenic shock (%)	19.0	37.1	0.000002
$\beta$ -Blocker use (%)	53.4	67.5	0.002
ACEI/ARB use (%)	79.8	87.8	0.06
Spironolactone use (%)	29.4	47.7	0.126
Smoking cessation counseling rate (%)	5.9	62.9	0.00008
30-day HF Rehospitalization Rate	31/189 (16.40%)	33/452 (7.30%)	0.0008

**Conclusions** In the present study, the implementation of a HF managed protocol led to a significant decrease in the 30-day HF Rehospitalization Rate along with an increase in the prescription rate of evidence-based therapies, even though the rate of patients admitted in cardiogenic shock was higher.

**P8****IL-17 receptor signaling is required to control polymicrobial sepsis****A Freitas**

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*Critical Care* 2009, **13(Suppl 3)**:P8 (doi: 10.1186/cc7810)

**Introduction** Sepsis is a systemic inflammatory response resulting from the inability of the host to contain the infection locally. We previously demonstrated that during severe sepsis there is a marked failure of neutrophil migration to the infection site, which contributes to dissemination of infection, resulting in high mortality. IL-17 plays an important role in neutrophil recruitment. Herein, we investigated the role of IL-17 receptor signaling in polymicrobial sepsis induced by cecal ligation and puncture (CLP).

**Methods and results** Adult C57BL/6 WT and IL-17 receptor KO mice were subjected to nonsevere (NS-CLP) sepsis. Intraperitoneal neutrophil migration, bacteremia, cytokines and liver injury were evaluated 6 hours after surgery. The ability of IL-17 to mediate the neutrophil microbicidal activity *in vitro*, as well the neutrophil migration *in vivo* and *in vitro*, were also evaluated. It was observed that IL-17R-deficient mice, subjected to CLP-induced nonsevere sepsis, show reduced neutrophil recruitment into the peritoneal cavity, spread of infection, and increased systemic inflammatory response as compared with BL6 littermates. As a consequence, the mice showed an increased mortality rate. Moreover, IL-17 induced intraperitoneal neutrophil migration *in vivo* and *in vitro*. Besides, we demonstrated that neutrophils harvested from IL-17R-defective mice already show reduced microbicidal activity, compared with WT neutrophils, suggesting a physiological role of IL-17R signaling in the microbicidal activity of neutrophils. Furthermore, WT neutrophils treated with IL-17 showed strong enhancement of microbicidal activity by a mechanism dependent on nitric oxide.

**Conclusions** Taken together, our results demonstrate that IL-17 receptor signaling plays a critical role in host protection during polymicrobial sepsis.

**Acknowledgement** Supported by FAPESP/CNPq/FAEPA.

**P9****CCR2 expression on neutrophils leads to detrimental tissue infiltration during sepsis**

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*Critical Care* 2009, **13(Suppl 3)**:P9 (doi: 10.1186/cc7811)

Chemokines display a central role in mediating the neutrophil migration to inflammatory focus. Neutrophils respond to CXC chemokines, such as CXCL8, but are usually unresponsive to CC chemokines, such as CCL2. It is known that chemokine responsiveness in neutrophils can be modulated by some inflammatory conditions, such as sepsis. Here, we investigate whether Toll-like receptors (TLRs) modulate the expression of CCR2 in neutrophils and the consequence of this modulation on sepsis onset. Purified neutrophils from septic patients or from WT and CCR2<sup>-/-</sup> mice subjected to sepsis by cecal ligation and puncture (CLP) and neutrophils from naïve mice or healthy humans stimulated with lipoteichoic acid (LTA) or lipopolysaccharide (LPS) were assayed to CCR2 expression by FACS or immunofluorescence and the chemotaxis response to CCL2. Treatments of neutrophils from naïve mice or healthy humans with TLR agonists, LTA or LPS, induce an upregulation of the CCR2 expression, leading to CCL2 responsiveness such as chemotaxis and F-actin polymerization. CCL2 expression induced by TLR activation was blocked by NF- $\kappa$ B or synthesis protein inhibitors. Moreover, LTA-induced or LPS-induced CCL2 chemotaxis was not observed in TLR2<sup>-/-</sup> or TLR4<sup>-/-</sup> neutrophils, respectively. Interestingly, neutrophils from septic patients or septic mice presented high CCR2 expression and CCL2 responsiveness, when compared with neutrophils from healthy donors or naïve mice. *In vivo*, we found that CCR2<sup>-/-</sup> mice subjected to severe sepsis by CLP exhibited reduced neutrophil infiltration in the heart, lung and kidney and an enhanced survival rate when compared with WT mice subjected to severe sepsis. Finally, severity of illness of the septic patients, judged by their APACHE II score and PaO<sub>2</sub>/FiO<sub>2</sub> relation, had greater correlation with CCL2 responsiveness by neutrophils ( $r^2 = 0.77$ ,  $P = 0.001$  and  $r^2 = 0.59$ ,  $P = 0.001$ , respectively). Our findings demonstrated that TLR activation induced the CCR2 expression and CCL2 responsiveness in human and murine neutrophils, and this expression profile in neutrophils is involved in the detrimental infiltration of these cells in distant tissues during severe sepsis. CCR2 blockage is therefore a potential strategy for human sepsis treatment.

**P10**

**Inhibitory role of the acute phase proteins on neutrophil migration in severe sepsis**

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*Critical Care 2009, 13(Suppl 3):P10 (doi: 10.1186/cc7812)*

Reduction of neutrophil migration to infection sites correlates with bad outcome in sepsis. Acute phase proteins (APPs) were described to inhibit the neutrophil functions, such as neutrophil migration. We recently showed that  $\alpha_1$ -acid glycoprotein (AGP) is a serum factor involved in neutrophil migration failure in human severe sepsis. In mouse experimental sepsis, the serum AGP concentration was significantly increased only 6 hours after severe sepsis. However, 2 hours after severe sepsis induction in mice, essential steps for neutrophil migration are disrupted, such as a decrease on rolling and adhesion of leukocytes to the endothelium and less of the chemokine receptor CXCR2 expression on the neutrophil membrane. Therefore, AGP should not be involved in early steps of severe sepsis development. The identification of these other serum factors involved in the neutrophil migration failure could be helpful for appropriate management of severe sepsis. In this context, the objective of the present study was to identify soluble substances in the blood of septic mice that inhibit neutrophil migration in the early steps of sepsis. One pool of serum, obtained 2 hours after polymicrobial severe sepsis induction in mice, partially inhibited thioglycolate-induced neutrophil migration into the peritoneal cavity of naïve mice. Separation and identification by Blue-Sepharose, HPLC, native electrophoresis and mass spectrometry of soluble substances with inhibitory activity on neutrophil migration in this serum showed the APP hemopexin (Hx). The purified Hx, as well as the commercial sample of Hx, inhibited thioglycolate-induced or sepsis-induced neutrophil migration to the peritoneal cavity of mice. In contrast to wild-type mice, Hx-null mice that underwent severe sepsis did not present failure of neutrophil migration to infectious focus. As a consequence, these animals presented low bacteremia and high survival rate. Furthermore, Hx inhibited the neutrophil chemotaxis response evoked by C5a or MIP-2 and induces downmodulation of the CXCR2 and L-selectin. These results showed an inhibitory role of the APPs on neutrophil migration in sepsis and suggest that species-specific and time-specific inhibition of the APPs activities may be a new strategy for sepsis treatment.

**P11**

**A comparative study between conventional and antiseptic impregnated central venous catheters**

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*Critical Care 2009, 13(Suppl 3):P11 (doi: 10.1186/cc7813)*

**Introduction** Central venous catheters (CVCs) are very useful in the management of patients hospitalized in the ICU, but are not devoid of complications. Among the complications related to permanence of CVCs, infection stands out. This may increase the morbidity, mortality, costs and length of stay in the ICU. A comparative study between antiseptic-impregnated and standard catheters is therefore of great value.

**Objective** To compare the duration of standard CVCs with those impregnated with chlorhexidine–silver sulfadiazine.

**Design** A prospective, randomized, alternate, nonblind study.

**Methods** Central venous access was taken, alternating the type of CVC used in each patient. The following were recorded for each patient: sex, age, APACHE II score, site of the puncture, reason for withdrawal of the catheter and the type of catheter used. The tip of the catheter was cultured (qualitative). The patients were divided: Group I (41 patients, 54 punctures) used the standard CVC, and Group II (38 patients, 54 punctures) used the impregnated CVC.

**Results** Sixty-two patients (48.38% female) were included. We studied 108 periods of catheterization, of which 54 were standard CVCs and 54 were impregnated CVCs. The average length of stay was higher in impregnated CVCs (14.11 days) compared with standard CVCs (10.7 days). Excluding death in both groups, the length of stay of the catheter in Group I was 10.86 days, compared with 15.43 days in Group II. Adding all periods of catheterization for each group, Group I has an amount of 578 days, and 762 days for Group II. The total duration of the Group II was 31.84% higher than Group I. Regarding the reason for withdrawal of the CVC, suspected infection predominated in 77.8% of the time in standard CVCs, and 49.1% of the time in impregnated CVCs. The culture of the catheter's tip was positive on 10 occasions (18.5%) in the standard group, against eight occasions (15.1%) in the impregnated group. The predominant site of puncture in this study was the subclavian vein (56.48%), and the catheters remained much of the time at this site when compared with other sites (jugular and femoral vein). But when we considered only Group II (impregnated), the catheters located in the jugular vein remained longer. The impregnated catheters cost 40% more than conventional ones. (See Table 1.)

**Conclusions** The length of stay with the use of impregnated CVCs was higher (15.43 days) than the standard CVCs (10.86 days).

**Table 1 (abstract P11)**

Variable	Standard group		Impregnated group		P value (OR <sup>a</sup> )
	Value	95% CI	Value	95% CI	
Age (average)	52.42	***	47.43	***	0.17
Sex (female)	50%	36.1 to 63.9	54.7%	40.4 to 68.4	0.3
Subclavian vein as predominant site of puncture	46.3%	32.6 to 60.4	66.0%	51.7 to 78.5	0.03 (2.3)
GLASGOW $\leq$ 8	59.3%	45.0 to 72.4	56.6%	42.3 to 70.2	0.5 (0.9)
APACHE II score (average)	17.97	***	19.63	***	0.21
Suspected infection	77.8%	64.4 to 88.0	49.1%	35.1 to 63.1	0.002 (0.3)
Average length (excluding death)	10.86	***	15.43	***	0.005
Positive cultures	18.5%	9.3 to 31.4	15.1%	6.7 to 27.6	0.41 (1.3)

<sup>a</sup>OR of the impregnated group related to the standard group.

The rate of colonization was higher in the standard CVC. Patients who require a CVC for long periods have benefited with the use of impregnated CVCs, because they present long-term use and lower rates of colonization, avoiding complications related to the procedure of successive punctures and related to the permanence of the catheters. In view of the clinical benefits already mentioned, the benefit gained by the use of antiseptic-impregnated catheters compensated for the initial expensive cost of 40%.

#### P12

##### Changes in plasma free fatty acid levels in septic patients are associated with cardiac damage and reduction in heart rate variability

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Free fatty acids (FFAs) have been shown to produce alteration of heart rate variability (HRV) in healthy and diabetic individuals. Changes in HRV have been described in septic patients and in those with hyperglycemia and elevated plasma FFA levels. We studied whether sepsis-induced heart damage and HRV alteration are associated with plasma FFA levels in patients. Thirty-one patients with sepsis were included. The patients were divided into two groups: survivors ( $n = 12$ ) and nonsurvivors ( $n = 19$ ). The following associations were investigated: (a) troponin I elevation and HRV reduction; and (b) clinical evolution and HRV index, plasma troponin, and plasma FFA levels. Initial measurements of C-reactive protein and gravity Acute Physiology and Chronic Health Evaluation scores were similar in both groups. Overall, an increase in plasma troponin level was related to increased mortality risk. From the first day of study, the nonsurvivor group presented a reduced left ventricular stroke work systolic index and a reduced low frequency (LF) that is one of the HRV indexes. The correlation coefficient for LF values and troponin was  $r^2 = 0.75$  ( $P < 0.05$ ). All patients presented elevated plasma FFA levels on the first day of the study ( $5.11 \pm 0.53$  mg/ml), and this elevation was even greater in the nonsurvivor group compared with the survivors ( $6.88 \pm 0.13$  vs  $3.85 \pm 0.48$  mg/ml, respectively;  $P < 0.05$ ). Cardiac damage was confirmed by measurement of plasma troponin I and histological analysis. Heart dysfunction was determined by the left ventricular stroke work systolic index and the HRV index in nonsurvivor patients. A relationship was found between plasma FFA levels, Lfnu index, troponin levels, and histological changes. Plasma FFA levels emerged as a possible cause of heart damage in sepsis.

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#### P13

##### C-reactive protein and procalcitonin in septic and HIV infection patients

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**Introduction** Sepsis is an answer from the host to infection characterized by some clinical and laboratory signs. They are neither specific nor sensitive for some infection cases, mainly in immunosuppression patients. The identification of laboratory variables for these patients could therefore be diagnosed faster. This study evaluated the role for C-reactive protein (CRP) and procalcitonin (PCT) as such diagnostic variables from sepsis in HIV/AIDS infection patients compared with non-HIV infection patients.

**Methods** A prospective study, during 1 year in the ICU of a quaternary hospital. Septic patients were identified according to the SCCM/ACCP 1992 consensus. The patients were separated into two groups: sepsis and HIV/AIDS infection (Group 1), and sepsis without HIV infection (Group 2). CPR and PCT values were determined for all patients. Patients who stayed less than 24 hours in the ICU, with liver failure, with chronic renal failure needing replacement, immediately postoperative and other cases from immunosuppression were excluded from the study.

**Results** Overall 44 patients were enrolled in the study, 22 in each group, the median age was 42 (35 to 55) years and 56.8% were male. The ICU mortality rate was 36.4%. The median APACHE II and SOFA scores at admission were, respectively, 21.5 (16 to 27) and 8.5 (5 to 10). There were no demographic and physiologic differences between both groups. While the patients from Group 1 presented lower values of CRP (159 (69 to 180) mg/dl) at the beginning of the treatment than patients from Group 2 (168 (129 to 270) mg/dl,  $P = 0.028$ ), the same was found in relation to the PCT values (0.87 (0.33 to 4.19) ng/ml in Group 1 vs 2.35 (1.03 to 5.30) ng/ml in Group 2,  $P = 0.03$ ). In addition, the leukocyte values were lower in Group 1 (7,205 (3,220 to 9,050) cells/mm<sup>3</sup>) than Group 2 (19,630 (13,140 to 25,950) cells/mm<sup>3</sup>,  $P < 0.001$ ). When evaluated, however, only in Group 1 was a higher value of CRP (160 (90 to 185) mg/dl) found in the nonsurviving patients than in surviving patients (95 (10 to 160) mg/dl,  $P = 0.008$ ). On other hand, the same was noted with PCT values; the Group 1 nonsurviving patients presented 2.1 (0.55 to 6.2) ng/ml versus 0.65 (0.27 to 2.8) ng/ml in surviving patients,  $P = 0.036$ .

**Conclusions** Septic patients with HIV/AIDS presented lower values of CRP and PCT than septic patients without HIV infection. However, the higher values of CRP and PCT in septic patients with HIV/AIDS infection determined the higher mortality rate.

#### P14

##### Loss of sarcolemmal dystrophin and dystroglycan may be a potential mechanism for myocardial dysfunction in severe sepsis

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**Objective** Myocardial function is severely compromised during sepsis. Several underlying mechanisms have been proposed to explain this fact. Evidence from our laboratory indicates that

myocardial structural changes could be responsible for sepsis-induced myocardial dysfunction. Taking into account that the contractile machinery inside the myofibers must remain intimately connected with the membrane and extracellular matrix, association provided by the dystrophin-glycoprotein complex (DGC), the present study investigated the hypothesis that loss of dystrophin and associated glycoproteins could be involved in early increased sarcolemmal permeability in experimentally induced septic cardiomyopathy.

**Methods and results** Male C57Bl/6 mice were subjected to sham operation, moderate septic injury or severe septic injury (SSI) induced by cecal ligation and puncture. SSI mice presented a large number of bacteria, high levels of TNF $\alpha$  and MIP-1 $\alpha$  in both the peritoneal cavity and blood, marked hypotension, and a high mortality rate. Using immunofluorescence and western blot analysis, a downregulation of structural protein expression, dystrophin and  $\beta$ -dystroglycan in both severe and moderate injury could be seen in septic hearts. In contrast, the immunofluorescent analysis for laminin- $\alpha_2$  did not show a difference of expression in septic hearts as compared with sham-operated hearts. In addition, the evaluation of plasma membrane permeability by intracellular albumin staining provided evidence of severe injury of the sarcolemma in SSI hearts that presented accumulation of albumin in a large number of cardiomyocytes depleted of dystrophin.

**Conclusions** Our data provide important insight regarding the alterations in the DGC resulting from severe septic injury. In this study, a significant decrease of dystrophin and  $\beta$ -dystroglycan results in loss of sarcolemmal permeability that may be partly responsible for sepsis-induced cardiac depression. These abnormal parameters emerge as therapeutic targets, and their modulation may provide beneficial effects on future cardiovascular outcomes and mortality in sepsis.

#### P15

##### **Acute effect of low-dose corticosteroids on muscle function in patients with severe sepsis and septic shock**

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**Introduction** The rationale for the use of glucocorticoids in severe sepsis and septic shock can be attributed to well-defined anti-inflammatory and hemodynamic effects recognized for decades. However, with the introduction of corticosteroid therapy for a variety of conditions, it was reported that this treatment could induce a myopathy. Animal studies have confirmed that the administration of high doses of corticosteroid can produce myopathy affecting both ventilatory and peripheral skeletal muscles. Actually, it remains uncertain whether doses of corticosteroid, typically used to manage patients with severe sepsis and septic shock, do in fact cause peripheral and respiratory muscle weakness.

**Objective** To study the effect of low-dose corticosteroids on the muscle force and submaximal exercise tolerance in septic patients.

**Design** A prospective observational study of septic patients in a 14-bed medico-surgical ICU. Thirty-seven patients with severe sepsis and septic shock received low-dose corticosteroids or not.

**Materials and methods** We collected data from septic patients from 2008. Muscle force and submaximal exercise tolerance were assessed at discharge from the hospital. Maximal inspiratory pressure (Pimax) was measured using pressure transducers; submaximal exercise tolerance was assessed by a 6-minute walk

distance test; quadriceps and handgrip strength on the dominant side were evaluated using an isometric dynamometer.

**Results** A total of 26 patients received low-dose corticosteroids, and 11 patients did not, during the study period. Age, SOFA, and time of hospital stay data were similar in the two groups. The APACHE and time of ICU stay values were significantly different between the group with corticosteroids versus the noncorticosteroid group ( $P < 0.05$ ). The Pimax values were not different from those predicted for each group ( $60 \pm 43\%$  and  $56 \pm 34\%$ , no corticosteroids vs corticosteroids), and the walking distance was not different. However, the peripheral muscle quadriceps presented  $46 \pm 21.8\%$  versus  $70 \pm 40\%$  ( $P < 0.05$ ), respectively, with corticosteroids or not.

**Conclusions** Low-dose corticosteroids did not alter Pimax and submaximal exercise tolerance on discharge from hospital. However, corticosteroids produced a significant reduction in peripheral muscle quadriceps. All patients presented a significant reduction of predicted force of quadriceps, showing corticosteroids can be responsible for the loss of peripheral muscular force.

#### P16

##### **Mass cell degranulation contributes to neutrophil migration failure and susceptibility of diabetic mice to polymicrobial sepsis**

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*Critical Care 2009, 13(Suppl 3):P16 (doi: 10.1186/cc7818)*

**Introduction** The major cause of mortality and morbidity of patients and experimental animals with diabetes mellitus is sepsis due to their high susceptibility to microbial infections. However, the mechanisms involved in this increased susceptibility are unclear.

**Objective** In the present study we investigated the effect of the mast cell degranulation in neutrophil migration failure observed in diabetic mice after polymicrobial sepsis induced by cecal ligation and puncture (CLP).

**Methods** On the fifth day after Balb/c mice became diabetic through intravenous administration of alloxan (40 mg/kg), they were pretreated for 4 days with the mast cell degranulator (compound 48/80; 0.6 mg/kg on day 1; 1.0 mg/kg on day 2; 1.2 mg/kg on day 3; and 2.4 mg/kg on day 4, twice a day, i.p.). Mild sepsis (MS) was performed 24 hours after the last dose and the experiments were conducted 6 hours later.

**Results** Nondiabetic mice subjected to MS showed 100% survival during 7 days, whereas all diabetic mice died within 24 hours of observation. The diabetic mice were highly susceptible to sepsis due to an incapacity to promote neutrophil migration to the peritoneal cavity accompanied by bacteremia and overexpression of the inflammatory response, determined by high levels of circulating TNF $\alpha$  and MIP-2 and lung neutrophil sequestration. The reduction of the neutrophil migration correlated with decreased CXCR2 receptor expression on the neutrophil membrane. However, diabetic mice submitted to MS and daily pretreatment with compound 48/80 did not display failure of neutrophil migration to infectious focus. As a consequence, these animals exhibited low bacteremia and a high survival rate. In addition, the pretreatment of diabetic mice with compound 48/80 significantly blocked the increase of serum TNF $\alpha$  and MIP-2 levels after septic stimulus. Accordingly, the reduction of the membrane expression of CXCR2 in neutrophils observed in diabetic mice after MS was significantly re-established in diabetic mice pretreated with compound 48/80.

**Conclusions** These results suggest that in diabetic mice undergoing polymicrobial infection, mast cells play a key role in the neutrophil migration failure due to reduction of the CXCR2 expression, resulting



in bacterial spreading and systemic release of mediators, and as a consequence augmented susceptibility to sepsis development.

**Acknowledgements** Financial support from FAPESP, CNPq and FAEPA.

## P17

### Prognosis scores on septic shock and severe sepsis in older people

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**Introduction** The elements related to prognosis of older people admitted to hospital on severe sepsis and septic shock are not well settled.

**Objective** To impute a prognostic score for older people admitted to hospital on severe sepsis and septic shock considering the death rate within 28 days.

**Materials and methods** The follow-up of 152 patients aged  $\geq 65$ , admitted to the ICU, for severe sepsis/septic shock during 28 days. The APACHE II and the Lawton dependence scales were applied on the first day while the SOFA was applied on days 1, 3, 5, and 7. Regarding statistical analysis, the chi-squared test and the Student *t* test were used. It was considered relevant when  $P < 0.05$ .

**Results** Age varied from 65 to 102 years ( $82 \pm 9$  years), with 64.5% women. The global mortality was 47.4%, in which 93.1% of deceased patients had been diagnosed with septic shock. The APACHE II and SOFA averages on days 1, 3, 5, and 7 were higher for the nonsurvivors, as well as the  $\Delta$ SOFA 3 – 1 and 5 – 3 (Table 1). Patients with limited functional capacity measured by the Lawton scale had higher chance of dying (OR = 0.5, 95% CI = 0.26 to 0.98,  $P = 0.04$ ).

**Table 1 (abstract P17)**

Score	Survivors	Nonsurvivors	<i>P</i> value
APACHE II	17.29 $\pm$ 4.78 (80)	20.61 $\pm$ 6.52 (72)	<0.001
SOFA 1	6.04 $\pm$ 3.27 (80)	8.56 $\pm$ 3.19 (72)	<0.001
SOFA 3	5.04 $\pm$ 3.06 (80)	9.25 $\pm$ 4.08 (69)	<0.001
SOFA 5	4.37 $\pm$ 2.89 (73)	8.67 $\pm$ 3.41 (57)	<0.001
SOFA 7	4.12 $\pm$ 2.75 (67)	8.34 $\pm$ 3.65 (53)	<0.001
$\Delta$ SOFA 3 – 1	-1.0 $\pm$ 2.00 (80)	0.42 $\pm$ 2.37 (69)	<0.001
$\Delta$ SOFA 5 – 3	-0.91 $\pm$ 2.22 (73)	0.17 $\pm$ 1.95 (57)	<0.01

Data presented as average  $\pm$  SD (*n*).

**Conclusions** The prognosis scores APACHE II and SOFA and the Lawton scale can be applicable to the older population with septic shock/severe sepsis, properly distinguishing survivors from non-survivors.

## P18

### Factors related to the mortality of patients with severe sepsis and septic shock

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**Introduction** It is important to know the factors related to the mortality of the increasing number of older people admitted to the ICU.

**Objective** To evaluate variables related to intrahospital mortality within 28 days of older people diagnosed with severe sepsis and septic shock admitted to a clinical ICU.

**Methods** Clinical and laboratory variables of 152 patients  $\geq 65$  years old admitted with severe sepsis and septic shock were assembled during 28 days. The variables were obtained on days 1, 3, 5, 7, 14 and 28. The chi-square and Mann–Whitney tests were used for statistical analysis. Results were considered relevant when  $P < 0.05$ .

**Results** The average age was  $82 \pm 9$  years, with 64.5% women, and the mortality rate was 47.4%. Mortality was related to lower ICU length of stay ( $P < 0.001$ ), shock (OR = 10.42, 95% CI = 3.79 to 28.62), high levels of lactate on the third day ( $P = 0.05$ ), and positive troponin I on days 1 and 3 ( $P < 0.001$ ).

**Conclusions** Persistence of high levels of lactate, total amount of organic failures, shock, mechanical ventilation needs and previous renal disease were related to mortality in older people diagnosed with severe sepsis and septic shock.

## P19

### Association between sex and mortality in patients with sepsis admitted to the ICU: gender and sex hormones influence the response to sepsis?

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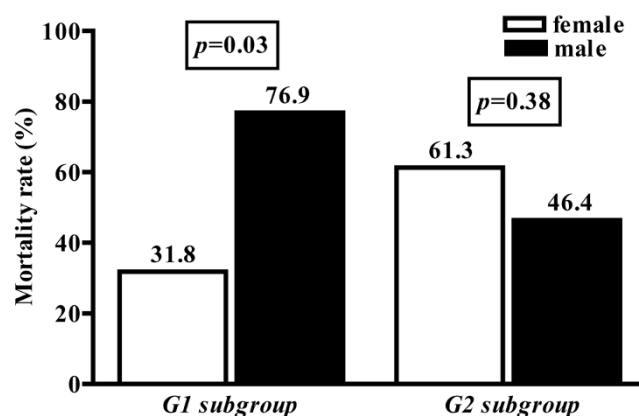
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**Introduction** Studies have demonstrated an impact of gender dimorphism on immune and organ responsiveness and in the susceptibility to and morbidity from shock, trauma, and sepsis. We performed a comparative analysis of mortality in two subgroups of patients with sepsis, differentiated by age and sex, admitted to the ICU (UTI) of a teaching hospital.

**Methods** From December 2005 to April 2008, 97 patients admitted to the ICU with a diagnosis of sepsis were separated into two subgroups based on age: (G1) the subgroup aged 14 to 40 years old, and the other subgroup (G2) aged over 50 years old. The subgroups were characterized for the demographic data, prognostic indicators (APACHE II score, organ dysfunction at admission and circulatory shock) and outcome (mortality).

**Figure 1 (abstract P19)**



Mortality rates in G1 and G2 subgroups.

**Results** The G1 subgroup ( $n = 35$ ) had 22 (62.9%) female patients and the G2 subgroup ( $n = 62$ ) had 34 (54.8%) female patients. The mean APACHE II scores were not statistically different between female and male patients of G1 ( $21.0 \pm 9.3$  vs  $24.8 \pm 6.1$  points,  $P = 0.21$ ) and of G2 ( $23.8 \pm 6.6$  vs  $24.4 \pm 9.3$  points,  $P = 0.8$ ) subgroups. There was no statistically significant difference in the incidence of multiple organ dysfunctions ( $P = 0.89$ ) or progression to circulatory shock ( $P = 0.46$ ) among females and males in the two subgroups. The general mortality rate was lower in female than in male patients from the G1 subgroup; a reverse trend was observed in subgroup G2 (Figure 1).

**Conclusions** Females under 40 years old, in the fertile period, had lower mortality than males in sepsis, and there was a trend to lower mortality in men over 50 years old, possibly due to dimorphism in immune and organ responsiveness related to sex and age.

## P20

### Epidemiology of sepsis in a Brazilian teaching hospital

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**Introduction** Sepsis is a great concern in public health due to high incidence and mortality. The objective of the present study is to estimate the incidence and mortality rate of sepsis in a tertiary public hospital, in Londrina, Paraná, Brazil.

**Methods** An observational longitudinal study of patients admitted to the ICU in a 2-year period. Demographic and diagnostic data were collected on admission. APACHE II and SOFA scores were obtained as originally described. Patients were monitored daily for diagnostic criteria of sepsis according to ACCP/SCCM Consensus Meeting Definitions, until death or hospital discharge.

**Results:** We analyzed 1,179 patients during the study period. SIRS was present in 1,048 (88.9%) patients on admission, and was associated with infection in 554 (46.9%) patients. Sepsis was diagnosed in 30 (2.5%) patients, severe sepsis in 269 (22.8%) patients and septic shock in 255 (21.6%) patients on admission. Observing the total ICU length of stay, there were 64 (5.4%) cases of sepsis, 353 (29.9%) cases of severe sepsis and 412 (34.9%) cases of septic shock. Pneumonia was the most frequent infection site (66.5%). Comparing patients according to the presence of sepsis, male sex was more frequent among septic patients (60.0%) compared with nonseptic patients (52.9%) ( $P = 0.015$ ). Septic patients were older ( $P < 0.001$ ) and presented a longer ICU and hospital length of stay ( $P < 0.001$ ). Chronic diseases were more frequent among septic patients (16.6%) than nonseptic patients (8.9%) ( $P < 0.001$ ). APACHE II and SOFA scores were higher in septic patients ( $P < 0.001$ ). The mortality rate was 32.8% (95% CI = 21.6 to 45.7%) for patients with sepsis, 49.9% (95% CI = 44.5 to 55.2%) for severe sepsis and 72.7% (95% CI = 68.1 to 76.9%) for septic shock.

**Conclusions** We detected high incidence and mortality rate of sepsis in our sample of patients.

## P21

### Serial evaluation of SOFA score in a Brazilian teaching hospital

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**Objective** To evaluate the application of the Sequential Organ Failure Assessment (SOFA) in describing the severity of organ dysfunctions and the associated mortality rates in critically ill patients of a teaching hospital.

**Methods** A prospective longitudinal study was performed at University Hospital – Londrina State University between January 2004 and December 2005. For static evaluation, we considered the daily SOFA, SOFA Max and Mean SOFA. To analyze dynamic changes in the SOFA scores, we stratified the patients into three groups: low (0 to 5), medium (6 to 9) and high (>10) SOFA upon ICU admission. The three groups of patients were evaluated after 48 hours in the ICU to detect whether the SOFA scores decreased, increased or were unchanged. The discriminative power of SOFA was evaluated using ROC curves.

**Results** We analyzed 1,164 adult patients with a mean age of  $56.7 \pm 19.1$  years, and a hospital mortality rate of 47.9%. The Mean SOFA for all of the patients was 6.38 upon admission and was statistically higher in nonsurvivors ( $P\chi^2_{trend} = 272.08$ ,  $P < 0.001$ , increase rate = 0.13). The SOFA score on the third day in the ICU had the highest area under the curve for hospital mortality (AUC =  $0.817 \pm 0.0133$ , 95% CI = 0.792 to 0.840). Organ failure occurred in 699 patients. Respiratory failure was most frequent, but cardiovascular failure had the highest associated risk of death (RR = 4.10, 95% CI = 3.12 to 5.38,  $P < 0.001$ ).

**Conclusions** Applying SOFA to critically ill patients admitted to the adult ICU effectively described the severity of organ dysfunctions, and higher SOFA scores had a positive association with mortality.

## P22

### Delayed admission to the ICU increases mortality in septic shock

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**Objective** To evaluate the association between delay in ICU admission and mortality in patients with septic shock, which is known to be higher in public hospitals.

**Methods** A prospective cohort study of patients referred to the ICU of University Hospital – Londrina State University, from January to December 2005, including 574 patients, following access protocol to the ICU in chronological order. The main outcome analyzed was the hospital mortality rate. Delay in admission due to lack of an available bed for immediate admission was considered the exposure factor in bivariate analysis between the two groups of patients (delayed admission and immediate admission). We also evaluated APACHE II and SOFA scores.

**Results** Among the 574 patients analyzed, 127 (22.1%) cases had septic shock as the admission diagnosis. Most of these patients with septic shock (66.9%) were in the group of delayed admission and more frequently they came from the emergency department (52.8%). There was no difference between the groups at bed solicitation related to age, sex, comorbidities, and SOFA and APACHE II scores. At admission, patients in the delayed admission group presented an increase in APACHE II and SOFA scores. They also had higher scores and nosocomial infection rates compared with the immediate admission group. Pneumonia was the most frequent site of infection in both groups. The hospital mortality rate was higher in the delayed admission group (82.4%) compared with the immediate admission group (64.3%) ( $P=0.042$ ), relative risk 1.28 (95% CI = 1.01 to 1.64;  $P=0.042$ ). Kaplan-Meier survival curves showed a tendency to lower survival rate for the delayed admission group ( $P=0.05$ ).

**Conclusions** Delay in ICU admission results in increased risk of death in patients with septic shock. Higher APACHE II and SOFA scores of patients in the late admission group probably reflect clinical deterioration during the time delay.

## P23

### Caspase-1-deficient mice are more resistant to severe sepsis

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The establishment of a local inflammatory response with production of cytokines/chemokines and the consequent neutrophil recruitment are critical to control an infection. In this context, our group had demonstrated an impairment of neutrophil migration toward the infectious focus in severe sepsis. The failure of neutrophil migration is markedly associated with increased systemic cytokines levels and high mortality of the severe sepsis, either in experimental models or in patients. Recently, the participation of Toll-like receptors (TLRs) in the failure of neutrophil migration was described. Caspase-1 seems to be important in the activation of TLR signaling pathways. Moreover, it is also critical to the activation of inflammatory cytokines IL-1 $\beta$ , IL-18 and IL-33. The aim of the present study was to evaluate the participation of caspase-1 during severe sepsis. The caspase-1-deficient mice presented increased resistance to severe sepsis induced by CLP. However, IL-18 and ST2 (receptor of IL-33)-deficient mice did not present a reduction of mortality after sepsis. The treatment with antagonist of IL-1 receptor was also unable to modify the survival rate of wild-type mice that underwent severe sepsis. These data indicate that the reduction in levels of these cytokines is not critical for reduction of mortality observed in caspase-1-deficient mice. The reduction in mortality of caspase-1-deficient mice was associated with decreased systemic levels of TNF $\alpha$  and IL-6. Despite the unaltered local levels of cytokines and chemokines, caspase-1-deficient mice that underwent severe sepsis presented a marked increase in neutrophil migration to the peritoneal cavity, which was supported by an increased rolling and adhesion of leukocytes in these mice. As consequence, a reduced bacterial growth in peritoneal exudates and blood was observed in these animals, although neutrophils from caspase-1-deficient and wild-type mice presented similar killing and cellular viability. Thus, in the absence of caspase-1, neutrophil migration to the peritoneal cavity is increased and culminates in a reduction of mortality because of efficient control of the infection.

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## P24

### Heme oxygenase and soluble guanylate cyclase mediate the neutrophil migration failure to the lung in severe sepsis induced by pneumonia

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**Background** Sepsis is the main cause of mortality in ICUs. Primary sources of infection influence the risk of severe sepsis development, and pneumonia is a leading source of this disease. Neutrophils play a critical role in the host defense against acute pulmonary infection since neutrophil-depleted mice with pneumonia had delayed pulmonary bacterial clearance and high mortality. The heme oxygenase (HO) and soluble guanylate cyclase (sGC) activities are known to downregulate inflammatory events, such as neutrophil migration. In the present study we evaluated the role of HO and sGC activities on neutrophil migration to the lung during severe sepsis induced by pneumonia.

**Methods** C57BL/6 male mice (18 to 22 g) underwent severe sepsis (SS, 4 x 10<sup>8</sup> CFU/mice) and mild sepsis (MS, 1 x 10<sup>7</sup> CFU/mice) by intratracheal administration of *Klebsiella pneumoniae*. A SS mice group was pretreated with HO-1-specific inhibitor (ZnPP IX) or a specific inhibitor of sGC (ODQ). Mice were killed 6 hours after bacteria administration and alveolar neutrophil migration and pulmonary parenchyma leukocyte sequestration were evaluated.

**Results** Mice subjected to SS presented a failure of the neutrophil migration towards alveoli and an increased leukocyte sequestration into pulmonary parenchyma tissue when compared with mice subjected to MS. The HO-1 or sGC inhibition in SS mice partially restored the neutrophil migration to pulmonary alveoli and reduced the leukocyte sequestration into the pulmonary parenchyma.

**Conclusions** These results suggest that HO-1 and sGC activities mediate the neutrophil migration failure to the lung.

## Infection

### P25

#### A three-step approach to reduce ventilator-associated pneumonia

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*Critical Care* 2009, **13(Suppl 3)**:P25 (doi: 10.1186/cc7827)

**Introduction** Ventilator-associated pneumonia (VAP) is frequent and has been associated with substantial morbidity, mortality and excess of cost. We hypothesized that the three most important determinants for the rates of VAP are the process of diagnosis, the adoption of standards of care during the time spent on ventilation (adhesion to the ventilator bundle formerly described by the Institute for Health Care Improvement) and the reduction of time spent on ventilation (exposition to risk). Our aim was to reduce rates of VAP by adopting a diagnostic algorithm, measuring adhesion to the bundle and spontaneous breathing trials to all awake patients on mechanical ventilation (MV) sequentially in a 12-bed general ICU.

**Methods** Traditionally the diagnosis of VAP was made by the attending physician and there was no determined policy to deal with sedation and adhesion to the ventilator bundle. At the beginning of 2007, we adopted a diagnostic algorithm that included the CPIS and bronchoalveolar lavage cultures. In December 2007, we started auditing adhesion to the items of the bundle and promoting educational discussions about the importance of preventing VAP. These audits were done once a day during the afternoon in the form of a checklist. Daily interruption of sedation was done by the staff nurse every day at 8 o'clock in the morning, unless paralytic drugs were in use. In August 2008, we formalized the spontaneous breathing trial as an approach for ventilated patients who were awoken with the intention to decrease the time spent on MV.

**Results** In 2006, the rate of VAP was 32.8/1,000 ventilator days and the average time of MV was 13 days. In 2007, after the diagnostic algorithm, the rate of VAP fell to 21.1/1,000 ventilator days and the average time spent on MV to 10.7 days. In the first 7 months of 2008, after the adoption of the ventilator bundle (with rates of adhesion of: 84% to the head-of-bed; 97% to daily interruption of sedation; 99% to deep vein thrombosis and stress ulcer prophylaxis), the rate of VAP fell to 10.5/1,000 ventilator days and the average time of MV to 8.9 days. Finally, from August 2008 to January 2009, after the adoption of the spontaneous breathing trial, the rate of VAP is 8.66/1,000 ventilator days and the average time spent on MV is 6.6 days.

**Conclusions** Adoption of a diagnostic algorithm may decrease the overdiagnosis of VAP, and this approach combined with a more aggressive strategy of discontinuing MV and adhesion to standards of care for ventilated patients can result in a great impact on the rates of VAP.

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## Cardiology

### P26

#### Does clopidogrel worsen the outcomes of patients submitted to CABG during hospitalization for acute myocardial infarction?

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**Introduction** Clopidogrel is recommended for patients with acute myocardial infarction (AMI); however concern exists regarding those patients submitted to coronary artery bypass surgery (CABG). We estimated the incidence of CABG during AMI hospitalization, and evaluated whether early treatment with clopidogrel is harmful to this population.

**Methods** We studied 941 patients with AMI (71% male, age  $68 \pm 15$  years) using prospective data recorded between 2003 and 2008. Variables are presented as the median and interquartile range, or relative frequencies. The effect of clopidogrel on hospital mortality and the hospitalization period was adjusted for prognostic markers

(left ventricular ejection fraction, age and Killip class) using logistic or Cox regression, respectively. We also evaluated the effects of clopidogrel on the subgroup of patients submitted to CABG through the inclusion of interaction terms in a multivariate analysis.

**Results** Clopidogrel was used in 641 (69%) patients. CABG was performed in 44 patients (4.6%), and 17 of them (40%) received clopidogrel. Clopidogrel was interrupted before surgery in all patients (time without clopidogrel: 4.5 days (1.5 to 6.5)). Among patients submitted to CABG, the hospitalization period (13 days (12 to 30) with clopidogrel vs 12 days (10 to 18) without clopidogrel;  $P=0.12$ ) and blood transfusions (3.7 units (2.4 to 5.4) with clopidogrel vs 2.2 units (0.9 to 2.3) without clopidogrel;  $P=0.24$ ) were not affected by clopidogrel. The mortality rate remained the same in both groups (15% with clopidogrel vs 20% without clopidogrel;  $P=0.7$ ). After an adjusted analysis, we compared the effects of clopidogrel in the RM subgroup with the rest of the population. In analyses adjusted for possible confounders, clopidogrel was associated with reduced length of stay (hazard ratio for discharge = 1.3; 95% CI = 1.1 to 1.5) and reduced mortality rate (odds ratio = 0.36; 95% CI = 0.2 to 0.7). However, in the subgroup of patients submitted to CABG, clopidogrel increased the length of stay (hazard ratio for discharge = 0.62; 95% CI = 0.3 to 1.2; test for heterogeneity  $P=0.04$ ), and, although not statistically significant, it might also have an adverse effect on mortality (odds ratio = 1.8; 95% CI = 0.2 to 15.7; test for heterogeneity  $P=0.156$ ).

**Conclusions** The early use of clopidogrel increased the length of stay in patients submitted to CABG during hospitalization for AMI. Clopidogrel's effect on mortality in the CABG subgroup could not be estimated with precision in this sample.

### P27

#### Animal models and methodology of case simulation: effective strategy in the training of physicians, residents and nurses in the use of the intra-aortic balloon pump

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*Critical Care* 2009, **13(Suppl 3)**:P27 (doi: 10.1186/cc7829)

**Introduction** Intra-aortic balloon counter-pulsation (IABP) is standard of care in treatment of cardiogenic shock. In critical care units (CCUs), even in tertiary centers of high complexity, the low incidence of cases with indication for use of this device can hinder the training and maintenance of a well-trained medical and multi-professional team, confident about the indications, implantation techniques and management of the IABP, translating into higher risk of complications. Thus, using the resources of experimentation and techniques of teaching methodology (role-playing), we conducted a practical training of skills in implantation and management of the IABP for doctors, residents and nurses.

**Objectives** To describe a proposal for practical skills training in implantation and management of the IABP for doctors, residents and critical care specialized nurses.

**Methods** Training was divided into two parts: (A) theoretical training: taught by medical cardiologists, with emphasis on the operation mechanism and indications for equipment usage; and (B) practical training: four steps were taken: (1) revision of insertion techniques (aided by multimedia resources combined with images of movie computer graphics illustrating the technical details); (2) insertion practical training, two pigs were used to check the correct positioning of the catheter tip by radiography; (3) triggering training; and (4) recognition and conduct face to real

problems using the device – role-play method and simulator resources (identification and intervention in eight different medical scenarios were taught). We evaluate satisfaction and cognitive skills before and after the training period.

**Results** Four residents, one critical care physician and eight critical care nurses were trained. The results of satisfaction assessment were excellent/good in all items evaluated. Pre-tests and post-tests performed with nurse professionals showed improvement in cognitive performance. Residents performed only post-tests and their performances were excellent.

**Conclusions** The training performed, using multimedia and animal experimentation resources, based on modern teaching-learning methodological concepts is appropriate for the training of medical professionals and nurses who work in ICUs.

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#### P28

##### Standard values for transthoracic three-dimensional echocardiographic new systolic-derived speckle tracking parameters in a normal population

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**Introduction** There is a paucity of information describing 3D echocardiographic new systolic-derived speckle tracking parameters of a normal population. We sought to evaluate by 3D echo: rotation, twist, torsion regional, torsion basal, radial 3D strain, and 3D displacement – in a population with normal ECG, 2D and 3D echocardiographic analyses. This information may be relevant for cardiac resynchronization therapy (CRT) evaluation in patients with advanced heart failure in ICUs.

**Methods** We evaluated 27 healthy volunteers (16 males, 43 ± 14 years), who were referred for routine echocardiography, presented normal cardiac structure on ECG, 2D and RT3DE, and had no previous history of cardiac diseases. We analyzed the 3D left ventricle ejection fraction (LVEF), left ventricle end diastolic volume (LVEDV), left ventricle end systolic volume (LVESV), and 3D echo rotation, twist, torsion regional, torsion basal, radial 3D strain, and 3D displacement. We employed a commercially available machine (Artida, Toshiba, Japan). Data were analyzed by quantifying the statistical distribution (mean, median, SD, relative SD, coefficient of skewness, coefficient of kurtosis, Kolmogorov and D'Agostino-Pearson test, percentiles, 95% CI).

**Results** 3D LVEF ranged from 49 to 67% (58.4 ± 5.6); LVEDV from 62.4 to 100.3 ml (92.9 ± 17.4); LVESV from 20.4 to 47.2 ml (43.2 ± 18.1); rotation ranged from 2.6 to 11.2° (6 ± 1.9), twist ranged from 0.7 to 20.6° (7.9 ± 4.5), torsion regional ranged from 0.9 to 6.6°/cm (3.7 ± 1.6), torsion basal ranged from 0.2 to 8.1°/cm (3.1 ± 1.9), radial 3D strain ranged from 4.4 to 67.5% (31.1 ± 17.2), and 3D displacement ranged from 6.3 to 11 mm

(8.6 ± 1.4). Data were obtained from 21/27 (77.8%) volunteers who presented adequate quality imaging for analysis.

**Conclusions** The present study allows for the quantification of 3D echocardiographic new systolic-derived speckle tracking parameters in normal subjects, providing a comparison for patients with heart failure who may be candidates for CRT.

#### P29

##### Real-time three-dimensional echocardiographic left ventricular systolic assessment: head-to-head comparison with cardiac computed tomography

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**Introduction** There is a paucity of information concerning side-by-side comparison of real-time 3D echocardiography (RT3DE) and cardiac computed tomography (CCT) ventricular systolic performance assessment. We sought to compare those techniques with different temporal and spatial resolution, regarding left ventricle (LV) systolic function and volumes.

**Methods** We studied 67 consecutive patients (37 males, 55 ± 11 years) by RT3DE and by 64-slice CCT. We analysed by both techniques the LVEF, LVEDV and LVESV, and by RT3DE the LV dyssynchrony percentage indexes (DI%) (6, 12, 16 segment model). RT3DE and CCT data were compared by coefficients of determination (*r*: Pearson), Bland-Altman test and linear regression, 95% CI.

**Results** RT3DE data: LVEF ranged from 30 to 78.6 (63.1 ± 7.33)%; LVEDV ranged from 44.1 to 210 (104.9 ± 29.7) ml; LVESV from 11.4 to 149 (38.9 ± 19.3) ml; 6S DI% ranged from 0.25 to 29.7 (1.92 ± 4.67)%; 12S DI% ranged from 0.29 to 26.78 (2.10 ± 5.10)%; 16S DI% ranged from 0.29 to 27.81 (2.57 ± 4.37)%. CCT data: LVEF ranged from 28 to 86 (66 ± 8.4)%; LVEDV ranged from 51 to 212 (110.3 ± 31.2) ml; LVESV from 7 to 152 (38.2 ± 19.2) ml. Correlations relative to RT3DE and CCT were: LVEF (*r* = 0.74, *P* < 0.0001, 95% CI = 0.6169 to 0.8379); LVEDV (*r* = 0.8213, *P* < 0.0001, 95% CI = 0.7229 to 0.8870); LVESV (*r* = 0.9096, *P* < 0.0001, 95% CI = 0.8929 to 0.9627). RT3DE (*x*) LVEF was compared with CCT (*y*) LVEF as:  $y = 19.7862 + 0.6525x$ ,  $R^2 = 0.5586$ , *P* < 0.0001, coefficient slope = 0.6525; RT3DE (*x*) LVEDV was compared with CCT (*y*) LVEDV as:  $y = 15.7057 + 0.7823x$ ,  $R^2 = 0.6745$ , coefficient slope = 0.7823, *P* < 0.0001; and RT3DE (*x*) LVESV was compared with CCT (*y*) LVESV as:  $y = 2.7997 + 0.9439x$ ,  $R^2 = 0.8828$ , coefficient slope = 0.9439, *P* < 0.0001.

**Conclusions** In this series, adequate correlation was observed between real-time 3D echocardiography and cardiac computed tomography regarding ventricular systolic function and geometry assessment.

#### P30

##### Inhospital mortality of patients with left ventricle dysfunction admitted with acute decompensated heart failure: the role of renal function during hospitalization

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*Critical Care* 2009, **13(Suppl 3)**:P30 (doi: 10.1186/cc7832)

**Background** Heart failure is a high morbidity and mortality condition with a growing number of hospitalizations due to

decompensation. Understanding the parameters associated with higher mortality in acute decompensated heart failure (ADHF) may result in better therapeutic strategies. Registries in ADHF developed mortality risk scores; however, national data are scarce. **Objective** To determine the parameters related to in-hospital mortality in patients admitted with ADHF to a high-complexity Brazilian private hospital.

**Methods** From January 2006 to December 2007 clinical parameters associated with in-hospital mortality were analysed for 386 patients admitted with ADHF. The inclusion criteria consisted of patients with left ventricle ejection fraction  $\leq 45\%$ .

**Results** Univariable analysis of patients who died during hospitalization demonstrated older age (82 vs 74 years,  $P = 0.0001$ ) and at admission: lower systolic arterial pressure (116 vs 130 mmHg,  $P = 0.0174$ ), reduced pulse pressure (46 vs 53 mmHg,  $P = 0.0403$ ), higher urea (95 vs 70 mg/dl,  $P = 0.0069$ ) and creatinine levels (2 vs 1.5 mg/dl,  $P = 0.0157$ ). During hospitalization, higher urea and creatinine levels were consequently higher differentially compared with admission (urea delta: 65 vs 16 mg/dl,  $P < 0.0001$  and creatinine delta: 1 vs 0.3 mg/dl,  $P < 0.0001$ ) and also demonstrated a relation to mortality. There was statistical significance related to higher BNP (1,600 vs 950,  $P = 0.0235$ ), in-hospital length of stay (31 vs 10 days,  $P < 0.0001$ ) and the use of an intra-aortic balloon pump ( $P = 0.0295$ ). The multivariable logistic regression analysis demonstrated that the independent parameters related to in-hospital mortality included older age ( $P = 0.02$ ) and higher in-hospital urea ( $P = 0.02$ ) and creatinine ( $P = 0.02$ ) levels.

**Conclusions** ADHF registries raise the renal function as an important mortality admission risk factor. Nevertheless in this cohort, worsening renal function during hospitalization was an independent mortality predictor. In this context, renal function preservation must be attempted as a mortality reduction strategy in the setting of ADHF patients.

**P31**

**Risk stratification of acute decompensated heart failure in-hospital mortality using the adhere CART method: is there validation in a Brazilian cohort?**

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Critical Care 2009, 13(Suppl 3):P31 (doi: 10.1186/cc7833)*

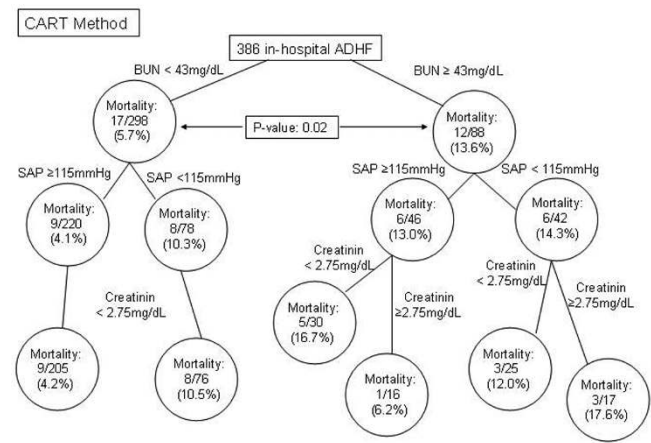
**Background** Risk scores for in-hospital mortality in acute decompensated heart failure (ADHF) using admission parameters have been used. The ADHERE registry developed the CART method using a regression tree analysis, which defined three sequential parameters: BUN (blood urea nitrogen) (above 43 mg/dl), systolic arterial pressure (below 115 mmHg) and seric creatinine (above 2.75 mg/dl).

**Objective** To verify the validity of the ADHERE CART method to stratify the risk of in-hospital mortality of patients admitted with ADHF in a high-complexity Brazilian hospital.

**Methods** Three hundred and eighty-six patients were admitted to a high-complexity private Brazilian hospital with ADHF from January 2006 to December 2007. On a retrospective form they were submitted to an in-hospital risk stratification using the ADHERE CART model. The inclusion criteria consisted of patients with heart failure at admission and left ventricle ejection fraction  $< 45\%$ .

**Results** The CART method parameters were reproduced in our data; however, just BUN demonstrated statistical significance in mortality ( $P = 0.02$ ). After this point there was no difference. (See Figure 1.)

**Figure 1 (abstract P31)**



**Conclusions** Only BUN had an impact on the in-hospital mortality stratification in this population. The absence of heart failure with preserved ejection fraction and the reduced number of patients could be the reason for low correlation. National registries in ADHF are fundamental to determine in an unequivocal manner the mortality factors in the Brazilian population making possible the development of risk stratification scores fitting our reality.

**P32**

**Occult renal insufficiency: creatinine clearance as an indicator of outcome in acute decompensated heart failure patients**

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Critical Care 2009, 13(Suppl 3):P32 (doi: 10.1186/cc8734)*

**Objective** The aim of this analysis was to evaluate whether renal function estimated by calculated creatinine clearance may add information in order to stratify the mortality and length of stay in patients with acute decompensated heart failure.

**Methods** We conducted a retrospective review of the records of 766 inpatients hospitalized with heart failure. Renal function was categorized as normal renal function (NRF) (serum creatinine  $\leq 1.1$  mg/dl and creatinine clearance  $> 60$  ml/min), occult renal insufficiency (ORI) (serum creatinine  $\leq 1.1$  mg/dl and creatinine clearance  $\leq 60$  ml/min), mild renal insufficiency (MRI) (1.1 mg/dl  $<$  serum creatinine  $\leq 1.5$  mg/dl and creatinine clearance  $< 60$  ml/min) or moderate to severe renal insufficiency (MSRI) (serum creatinine  $> 1.5$  mg/dl and creatinine clearance  $< 60$  ml/min).

**Results** Out of 765 patients in the sample, 174 (22.71%) had normal renal function, 205 (26.76%) had mild RI, 260 (33.94%) had moderate to severe RI, and 126 (16.45%) had occult renal insufficiency. The mortality rates were: 3.4% (NRF), 3.4% (MRI) –  $P = NS$  vs NRF, 7.9% (ORI) –  $P = 0.05$  versus NRF, and 13% (MSRI) –  $P < 0.05$  versus NRF. Lengths of stay were different among the groups: MRI 12 days, ORI 14 days, and MSRI 16 days ( $P < 0.05$  between groups).

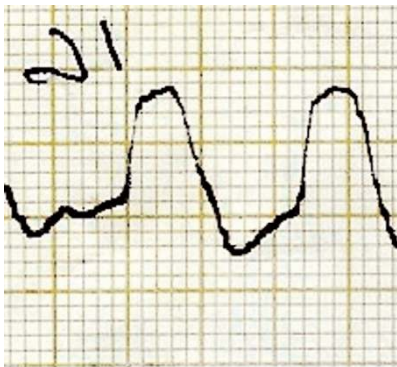
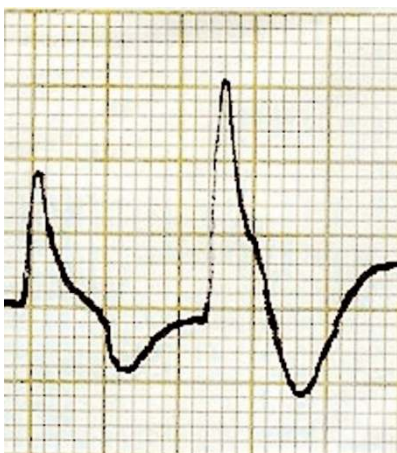
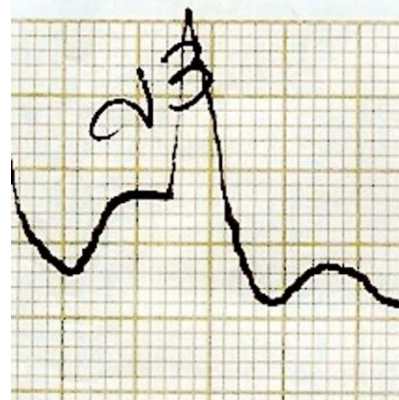
**Conclusions** The calculated creatinine clearance added information in order to stratify risk in heart failure patients requiring hospitalization. By identifying patients with ORI, creatinine clearance helped to find patients at risk not shown when only serum creatinine was used.

**P33****ST segment elevation in lead aVR and left main coronary infarction in the post-resuscitated patient**

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Lead aVR is an electrocardiographic lead that is frequently ignored [1,2]. Many clinicians consider lead aVR as a not useful electrocardiogram one. Instead of this, we report a patient that was resuscitated from a ventricular fibrillation and presented with ST-elevation in lead aVR (Figures 1 and 2) and right bundle branch block. The patient was immediately transferred to the cath lab and a left main coronary artery occlusion (LMCA) was visualized [3]. In this emergency scenario the patient had another cardiac arrest in pulseless electric activity and we proceeded with percutaneous revascularization of the LMCA (Figure 3). The patient returned to spontaneous circulation and after 14 days was dispatched from hospital without neurologic sequelae. The rapid diagnosis of such events is critical to guiding early intervention and appropriate disposition in many patients with ACS. Electrocardiography is an appropriate bedside tool used in the ED to make a rapid diagnosis of ACS especially using the aVR lead, allowing physicians to select appropriate therapy and to predict potential cardiovascular complications.

**Figure 1 (abstract P33)****Figure 2 (abstract P33)****Figure 3 (abstract P33)****References**

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**P34****Cardiac surgery for ascending aortic dissection has a good short-term and medium-term prognosis in a paired-matched analysis**

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*Critical Care* 2009, **13(Suppl 3)**:P34 (doi: 10.1186/cc7836)

**Introduction** Aortic dissection has an ominous prognosis if it is not promptly surgically corrected. Despite surgical intervention, patients suffer from high morbidity–mortality. Our aim was to compare the incidence of postoperative complications and 1-month and 6-month mortality of ascending aortic dissection surgical correction with paired matched controls for elective aortic aneurysm correction and urgent coronary artery bypass graft surgery (CABG).

**Methods** Ascending aortic dissection (AAD) and aneurysm correction surgeries were gathered from February 2005 to June 2008, in a private community ICU. Demographic data, comorbidities and cardiac ejection fraction were collected. Euroscore, Ontario and APACHE II scores were calculated to analyze patients' severity of illness. Surgical characteristics (elective or urgent indications) and perioperative data were also compared. AAD patients were compared against elective aortic aneurysms (ascending aorta controls) and all CABG (standard cardiac procedure control) surgeries. Besides, aortic dissection and aneurysm surgeries were compared with paired matched CABG control patients, according to age ( $\pm 3$  years), gender, elective/urgent procedure and surgical team. At first, simple comparisons were made between ascending aorta and CABG surgeries. Aortic dissection and aneurysm groups were analyzed against each other; and finally AAD patients were compared with paired

matched CABG brackets for morbidity (postoperative complications and ICU and hospital lengths of stay) and 1-month and 6-month mortality.

**Results** Twelve patients were operated for AAD correction and 10 for ascending aortic aneurysm, while 246 patients were submitted to CABG surgery. Ascending aorta surgical patients were younger (mean  $\pm$  SD, 60.8  $\pm$  16.2 vs 66.1  $\pm$  10.2,  $P = 0.03$ ) when compared with CABG brackets. APACHE II, Euroscore and Ontario were higher for aorta patients ( $P < 0.01$ ). Rates of urgent procedures were also similar in ascending aorta and CABG patients (54 vs 39%,  $P = NS$ ). Incidences of postoperative complications were significantly higher in the aorta group (77 vs 36%,  $P < 0.001$ ), as well as higher ICU length of stay (8.7  $\pm$  16.1 vs 3.3  $\pm$  4.5 days,  $P < 0.001$ ), but similar ICU mortality (4.5 vs 3.2%,  $P = NS$ ). When AAD patients were compared with the aneurysm group, the main differences were: more urgent procedures in ascending aortic dissection patients (91 vs 10%,  $P < 0.001$ ), longer length of mechanical ventilation (45.1  $\pm$  57.5 vs 7.3  $\pm$  6.1,  $P = 0.05$ ), and length of hospital stay (34.6  $\pm$  35.8 vs 10.6  $\pm$  4.7,  $P = 0.05$ ). Incidences of postoperative complications and 1-month and 6-month mortality were similar in these groups. After matching paired CABG patients to the AAD group, significantly worse results were found for the last group: Euroscore (10.1  $\pm$  3.3 vs 5.9  $\pm$  4.1,  $P = 0.02$ ) and Ontario (7.0  $\pm$  1.2 vs 4.3  $\pm$  3.0,  $P = 0.01$ ) scores, higher incidence of postoperative complications (91 vs 45%,  $P = 0.03$ ), and longer hospital length of stay (34.6  $\pm$  35.8 vs 12.9  $\pm$  8.5 days,  $P = 0.05$ ). However, 1-month and 6-month mortality was very similar in both groups (8 and 16%, respectively;  $P = NS$ ).

**Conclusions** Although AAD surgical correction is associated with increased incidence of postoperative complications and hospital length of stay, 1-month and 6-month mortality is very similar to elective aortic aneurysm repair and paired matched CABG controls.

**P35**

**High risk for obstructive sleep apnea in patients with acute coronary syndrome: initial experience from a coronary unit**

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**Introduction** Previous studies from outpatients suggested that obstructive sleep apnea (OSA) is associated with an increased risk for acute myocardial infarction and stroke. However, the evidence in inpatients is scanty. The main aim of the present study was to evaluate the risk for OSA in consecutive patients with acute coronary syndrome (ACS) admitted to a coronary unit.

**Methods** We initially evaluated 94 newly diagnosed patients with ACS. All participants performed a clinical evaluation and questionnaires about the risk for OSA (Berlin questionnaire) and subjective daytime sleepiness (Epworth questionnaire). A total score  $>10$  was considered excessive daytime sleepiness. A value of  $P < 0.05$  was considered significant.

**Results** Four patients refused to participate. Of the 90 patients (18 with unstable angina and 72 with myocardial infarction), the prevalence of high risk for OSA in patients with ACS was 58% (52 patients). Only four patients (7.7%) with high risk had a previous diagnosis of OSA. The mean age and body mass index were similar ( $P > 0.1$ ) in patients with low and high risk for OSA (61  $\pm$  14 vs 64  $\pm$  12 years and 26.2  $\pm$  3.7 vs 27.9  $\pm$  7.0 kg/m<sup>2</sup>, respectively). However, patients with high risk presented an increased subjective daytime sleepiness than patients with low risk for OSA (10  $\pm$  6 vs 7  $\pm$  4;  $P = 0.007$ ).

**Conclusions** High risk for OSA is common in consecutive patients with ACS but is frequently underdiagnosed and consequently undertreated. Future studies should be performed to evaluate the clinical impact of OSA in patients with ACS.

**P36**

**Unstable angina and non-ST-segment elevation myocardial infarction: an analysis by TIMI score**

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**Objective** The TIMI score was created to categorize the patient's risk of death and ischemic events, providing the basis for therapeutic decision-making. In the present study, the characteristics of patients with acute coronary syndrome (ACS) were analyzed using the TIMI score.

**Materials and methods** From October 2003 to February 2009, data for 740 patients with ACS were collected prospectively; 570 (77.0%) were classified by TIMI score. From these 570 patients, 327 (56.21%) were admitted with unstable angina and non-ST-segment elevation myocardial infarction (NSTEMI). Statistical analysis was made with the chi-square test with Yate's correction.

**Results** Out of the 327 patients, 148 (45.2%) had unstable angina and 179 (54.8%) NSTEMI. The mean age was 64.2 years and 64.8% were men. The details of each group of TIMI score are presented in Table 1. The mortality in the group submitted to angioplasty was 0%, in the group submitted to coronary artery bypass graft surgery (CABG) was 0.8% (one patient) and in the group submitted to clinical treatment was 7.2% (15 patients). In

**Table 1 (abstract P36)**

TIMI score	n	Mean age	Mortality (%)	Clinical treatment	Mortality (%)	Angioplasty	Mortality (%)	CABG	Also thrombolytic therapy (n)	Mortality (%)
0	02	54.5	-	02	-	-	-	-	-	-
1	29	58.9	3.4	20	5.0	08	-	01	-	-
2	58	57.8	1.7	31	3.2	17	-	10	-	-
3	75	65.5	4.0	48	6.2	14	-	13	1	-
4	76	69.6	7.8	50	10	13	-	13	-	7.6
5	63	70.6	6.3	41	9.7	13	-	09	-	-
6	17	71.5	5.8	10	10	03	-	04	-	-
7	07	65	-	04	-	01	-	02	1	1
Total	327	64.2	4.8	206	7.2	69	0	52	02	0.8
P value	-	-	-	-	0.0189	-	$>0.05$	-	-	$>0.05$



the group submitted to CABG, two patients were submitted to thrombolytic therapy (TIMI score 3 and TIMI score 7) without mortality.

**Conclusions** The mortality was significantly higher in the group with clinical treatment ( $P = 0.0189$ ). The comparative study about the mortality of each group of TIMI score was not statistically significant: there was no correlation of TIMI score and mortality.

## Nephrology

### P37

#### Does intensive insulin therapy really reduce the incidence of acute renal injury in critically ill patients? An analysis using the rifle criteria

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*Critical Care* 2009, **13**(Suppl 3):P37 (doi: 10.1186/cc7839)

**Introduction** In 2001, Van den Berghe and colleagues introduced the concept of strict glycemic control in the critically ill patient [1]. The impact of this new approach was particularly significant when the renal outcome of the patients was evaluated. While some subsequent studies corroborated Van den Berghe and colleagues' results, others could not demonstrate any benefit of intensive insulin therapy on mortality and renal outcome. One of the difficulties in comparing the incidence of acute renal dysfunction is the lack of consensus about its definition. The RIFLE criteria, proposed in 2004 [2], had the objective of standardizing this definition.

**Objective** To compare the incidence and severity of acute kidney injury (AKI) in critically ill patients submitted to two different regimens of glycemic control, using the RIFLE criteria.

**Methods** Analysis of 228 patients who had been previously included in a prospective study, randomized to intensive insulin therapy (Group 1) or to a carbohydrate restrictive strategy (Group 2). The RIFLE criteria were established according to the creatinine values on the first day and the last day of the ICU stay, and the highest value obtained during this period. The renal outcome was evaluated through the comparison of the last RIFLE score obtained during the ICU stay and the RIFLE score at admission, and then classified as favorable, stable or unfavorable.

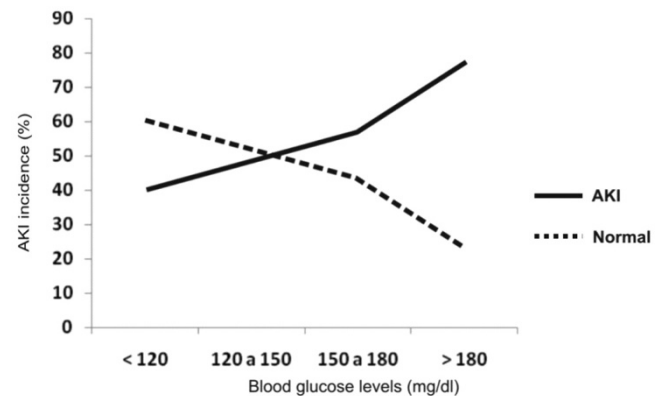
**Results** The two groups were comparable regarding demographic data, APACHE III score and comorbidities. The median blood glucose levels were 132.6 mg/dl in Group 1 and 142.0 mg/dl in Group 2 ( $P = 0.02$ ). Hypoglycemia occurred in 20 (18.1%) patients in Group 1 and in five (4.2%) patients in Group 2 ( $P = 0.001$ ). AKI developed in 52% of the patients and was associated with a higher mortality (39.4%) as compared with those who did not have AKI (8.2%) ( $P < 0.001$ ). The renal function outcome was

**Table 1 (abstract P37)**

#### Results

Renal outcome	Group 1 (n = 118)	Group 2 (n = 110)	P value
Unfavorable	17	20	
Stable	64	76	0.27
Favorable	29	22	

**Figure 1 (abstract P37)**



Acute kidney injury (AKI) according to glycemic levels.

comparable between the two groups ( $P = 0.37$ ) (Table 1). On the other hand, we have observed a significant correlation between the blood glucose levels and the incidence of AKI ( $P = 0.007$ ) (Figure 1). In the multivariate logistic regression analysis, only previous diabetes mellitus and age higher than 60 years were risk factors for AKI. Independent risk factors for mortality were hypoglycemia and APACHE III score  $> 60$ .

**Conclusions** Intensive insulin therapy does not reduce the incidence of acute kidney injury evaluated through the RIFLE criteria when compared with a carbohydrate restrictive strategy. However, we have observed that an increase in the blood glucose levels beyond normal values is associated with an increase in the incidence of AKI. This, as well as the higher incidence of hypoglycemia, suggests that a carbohydrate restrictive strategy is safer than and as efficient as intensive insulin therapy in preventing AKI in critically ill patients.

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## Pneumology

### P38

#### Experience in the intensive management of early postoperative lung transplantation patients of the Complexo Hospitalar Santa Casa Group of Porto Alegre, Brazil

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**Introduction** After James Hardy's pioneer initiative (1963) and the advance of lung preservation techniques, the progress of immunosuppressive treatment with the discovery of cyclosporine and the

implementation of international guidelines for the selection of lung transplantation donors and candidates [1-3], lung transplantation became the treatment of choice for many lung diseases in the terminal state. However, lung transplantation morbidity and mortality rates remain elevated, and early postoperative state care is indispensable for a positive outcome. The aim of the present study is to examine the experience in the intensive management of early postoperative lung transplantation patients of the Complexo Hospitalar Santa Casa Group of Porto Alegre, Brazil.

**Methods** A retrospective cohort study was performed, based on early postoperative data (May 1989 to January 2009) of cadaver donor lung transplantation patients of the Complexo Hospitalar Santa Casa Group of Porto Alegre, Brazil. Statistical analysis was made with SPSS using chi-square tests and Fisher tests for categorical variables, and using Mann-Whitney tests and Student *t* tests for quantitative variables.

**Results** Of 300 lung transplantation patients, 108 cases had been reviewed at the time of this study. One hundred were single-lung transplantation patients. Sixty-two were males. The mean age was 52 years (9 to 72 years). Thirty-seven percent of patients had lung emphysema; 36% had idiopathic pulmonary fibrosis; 9.3% had lymphangioleiomyomatosis; 2.8% had cystic fibrosis; 2.8% had pneumoconiosis; 1.9% had  $\alpha_1$ -antitrypsin deficiency; 1.9% had McLoud disease; 1% had pulmonary emphysema and pulmonary fibrosis; 0.9% had sarcoidosis, 0.9% had bronchiolitis obliterans; and 0.9% had pulmonary arterial hypertension. During the surgical procedure, the ischemia mean time was 187.5 minutes (5 to 360 minutes), and 15.7% of patients were in extracorporeal circulation. The mean systolic pulmonary arterial pressure at the beginning of surgery was 37.25 mmHg (11 to 88 mmHg), and was 26.42 mmHg (10 to 44 mmHg) at the end of surgery. In the early postoperative state, the mean APACHE score was 17.43 (9 to 33) and the mean SAPS III was 30 (14 to 49). The mean time of stay in the ICU was 9.5 days (1 to 192 days), the mean time of intubation was 12.5 hours (1 to 432 hours) after the surgery, and 14% of patients needed reintubation. The mean PaO<sub>2</sub>/FiO<sub>2</sub> ratio in the immediate postoperative period was 203, and was 266 in the first 24 hours postoperative. The mean systolic pulmonary arterial pressure was 26.1 mmHg (11 to 76 mmHg), and the mean wedge pulmonary arterial pressure was 9.8 mmHg (1 to 22 mmHg). The median time of vasopressor was 26 hours (1 to 336 hours). Thirty-four patients had ischemia/reperfusion injury (light = 7.4%, mild = 7.4% and severe = 15.7%) and 43.5% had acute rejection in the first 30 days postoperative (light = 12%, mild = 13% and severe = 10%). Forty-three patients had infectious complications in the early postoperative stage; the respiratory system was the most compromised (40%). Only four patients had surgical complications that forced their return to the operating room (hemothorax = three patients, bilateral pneumothorax = one patient). The most common clinical complications were acute renal insufficiency (13%, and 8.3% of them needed dialysis), intestinal perforation (3.7%), delirium (2%), and stroke (0.9%). The mortality rate at 28 days was 22%, and at 90 days was 25%.

The variables that correlated with mortality at 28 and 90 days were ischemia/reperfusion injury (*P* = 0.022 and *P* = 0.05, respectively), the PaO<sub>2</sub>/FiO<sub>2</sub> ratio in the first 24 hours postoperative (*P* = 0.003 and *P* = 0.004, respectively), acute renal insufficiency with need for dialysis (*P* < 0.001), need for reintubation (*P* = 0.03 and *P* = 0.012, respectively), and acute rejection in the first month postoperative (*P* = 0.029 and *P* = 0.012, respectively).

**Conclusions** Lung transplantation is the treatment of choice for many lung diseases in the terminal state. However, a number of postoperative complications can affect the outcome. Improvement of early postoperative care to prevent complications is indispensable for a positive outcome.

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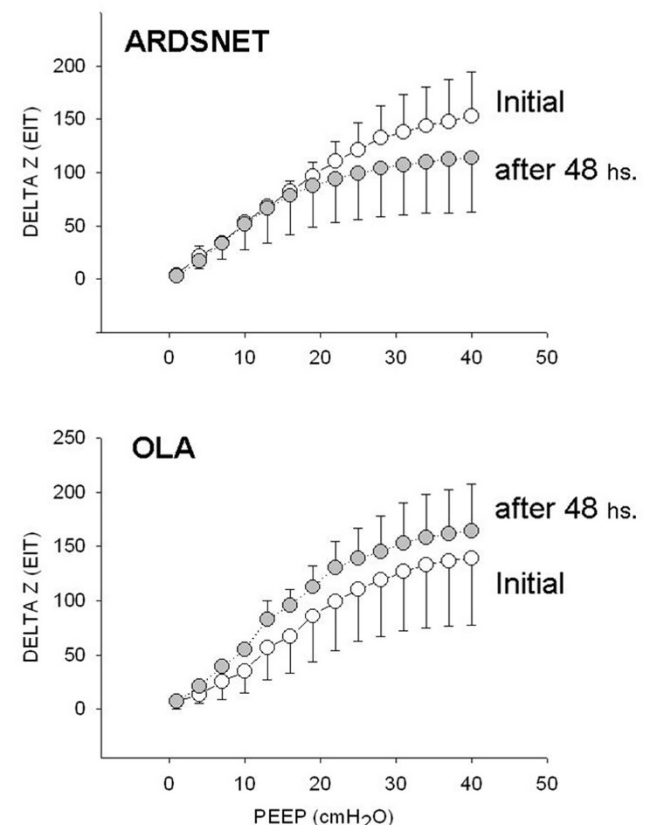
**P39**

**Long-term effects of two protective-ventilation strategies in an ARDS model: Open Lung Approach by EIT versus ARDSnet**

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*Critical Care* 2009, 13(Suppl 3):P39 (doi: 10.1186/cc7841)

Different ventilatory strategies for the acute respiratory distress syndrome have been proposed. The Open Lung Approach (OLA) emphasizes the recruitment of airway units with avoidance of tidal recruitment. The ARDSnet strategy simply emphasizes the

**Figure 1 (abstract P39)**



reduction of  $V_T$  and hyperdistension. We studied the long-term consequences of both strategies in a controlled experiment where pigs were randomized and submitted to one of both strategies for 48 hours. Lung injury was induced by saline lavage followed by 3 hours of injurious mechanical ventilation. In the OLA arm, PEEP was selected by the EIT after a recruitment maneuver (RM), trying to keep lung collapse to a minimum, while the ARDSnet group followed a PEEP x  $FiO_2$  table. We scrutinized lung function at the end of a 48-hour period of lung protection, after a standardized RM. The concept was to provide equivalent conditions for lungs to perform, irrespective of lung history or treatment in previous days, in terms of gas exchange or alveolar stability during slow-deflation maneuvers. Before sacrifice and after maximum RM, we collected blood gases and expiratory pressure versus  $\Delta Z$  (impedance changes by electric impedance tomography). Oxygenation and alveolar stability were equally impaired in both arms after injury. However, at the end of the 48 hours there was significant improvement in the capacity of oxygenation in the OLA arm (mean = 494 mmHg;  $P = 0.043$ ), but not in the ARDSnet arm (mean = 278;  $P = 0.285$ ). The potential to maintain airspace volumes improved along the protective period in the OLA arm, but deteriorated in the ARDSnet arm. (See Figure 1.)

**Conclusions** Even after full reversal of atelectasias, lung function seems to be severely impaired after 48 hours of the ARDSnet strategy, as compared with OLA.

#### P40

##### **Nosocomial pneumonia and the main victim: the older person – measures for ventilator-associated pneumonia control**

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**Introduction** Respiratory infections are responsible for an elevated number of older patient admissions to the ICU, and nosocomial pneumonia (NP) carries a worse prognosis for these patients. Preventive measures are even more important for nosocomial infection control in the case of ventilator-associated pneumonia (VAP).

**Materials and methods** A tertiary 205-bed hospital with 650 to 850 admissions/month, more than 65% corresponding to older patient ICU admissions. A preventive VAP package has been established focusing on reduced infection rates due to VAP high lethality in older patients. From October 2008 to January 2009, NP cases were followed and the VAP preventive measures package applied for VAP control: (I) elevation of the head of the bed to 30 to 45°; (II) daily sedative interruption; (III) peptic ulcer disease prophylaxis; and (IV) deep venous thrombosis prophylaxis.

**Results** Forty-nine patients had NP, 42 were older than 60 years (85.7%). Seventeen cases were VAP, and 15 were older patients (88.2%). Distribution: October 2008 = 11 cases (90.9% older patients), seven VAP cases (85.7% older patients); November 2008 = six cases (83.3% older patients), two VAP cases (50% older patients); December 2008 = 17 cases (70.6% older patients), two VAP cases (100% older patients); and January 2009 = 15 cases (100% older patients), six VAP cases (100% older patients). The older patients/ICU days (E/ID) rate by month was 91%, 89%, 90% and 80%. The percentage of patients who accomplished all four preventive measures for VAP (all-or-nothing approach), from December 2008 to January 2009: (I) 98.6% to 97.7%; (II) 79.8% to 80.4%; (III) 96.8% to 97.2%; (IV) 97.1% to 95.6%; (76.9% to

78%). *Pseudomonas aeruginosa* was the most prevalent pathogen (45%). The 50th percentiles for VAP cases/1,000-day MV rates in 2008 varied from 4.74 to 15.89 between ICU units. The NP lethality rate was 8.2%. The older patients' death rate was 75%.

**Conclusions** The VAP rate in older patients increased in January probably because of the decrease of the E/ID rate in this month. Our data show that NP and VAP occur mostly among older patients, and implementing VAP preventive measures packages by ICU staff might positively impact NP and VAP outcomes. Our results suggest that VAP rates in these ICUs began to decrease dramatically following the preventive measures package implementation.

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#### P41

##### **Cardiopulmonary effects of titrating positive end-expiratory pressure to match abdominal pressure on an experimental model of abdominal hypertension and acute lung injury**

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*Critical Care* 2009, **13(Suppl 3)**:P41 (doi: 10.1186/cc7843)

**Objective** There is some controversy in the literature on how patients with concomitant intra-abdominal hypertension (IAH) and acute lung injury (ALI) should be ventilated. It has been suggested that application of external positive end-expiratory pressure (PEEP) matching abdominal pressure could improve ventilatory performance during ALI and IAH [1]. Our purpose with the present study was to evaluate the cardiopulmonary effects of PEEP matching abdominal pressure (AP) in an experimental model of IAH and ALI.

**Methods** Eight anesthetized pigs were instrumented and then submitted to IAH of 20 mmHg for 30 minutes with a  $CO_2$  insufflator. Respiratory and hemodynamic parameters were measured and then also after ALI was induced by lung lavage with saline (3 ml/kg) and Tween (2.5%). Pressure x volume curves of the respiratory system were performed by a quasi-static low flow method during IAH and ALI, and PEEP was then adjusted to 27 cmH<sub>2</sub>O for 30 minutes.

**Results** IAH decreased pulmonary and respiratory system static compliances and increased airway resistance, alveolar-arterial oxygen gradient and respiratory dead space. The presence of concomitant ALI exacerbates these findings. Thirty minutes of mechanical ventilation with PEEP identical to AP moderately improved oxygenation and respiratory mechanics. Even though cardiac output was maintained through an increased heart rate, this short course of increased PEEP caused an important decline in the stroke index and right ventricle ejection fraction.

**Conclusions** Concomitant IAH and ALI produce important impairments in the respiratory physiology. PEEP equalization to AP may improve the respiratory performance, but with a secondary hemodynamic derangement.

**Acknowledgement** Supported by Research and Education Institute, Hospital Sírio-Libanês.

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**P42**

**Epidemiology and clinical characterization of patients with acute respiratory failure admitted to a general ICU**

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Critical Care 2009, 13(Suppl 3):P42 (doi: 10.1186/cc7844)

**Objective** To study the prevalence and mortality of ARF and characteristics of the patients with ARF admitted to a general ICU.

**Methods** During 6 months, all adult patients admitted to a 17-bed ICU in Salvador, Bahia, Brazil who had ARF defined as a patient receiving mechanical ventilation for more than 24 hours were prospectively studied.

**Results** From March to August 2008, there were 411 admissions to the ICU. From these, 82 (20%) patients received mechanical ventilation for more than 24 hours with a median duration of 4 days (varied from 1 to 69 days). The characteristics of patients with ARF are presented in Table 1. These patients were older than the total population admitted to the ICU (68 vs 65 years,  $P < 0.05$ ), had higher APACHE II score (19 vs 13,  $P < 0.0001$ ), higher ICU stay (10.5 vs 3.0 days,  $P < 0.001$ ) and higher mortality (51.2 vs 17.5%,  $P < 0.0001$ ). Mortality of ARF patients was associated with old age, odds ratio of 3.0 for death for patients older than 70 years (95% CI = 1.2 to 7.5), and development of complications in the ICU (OR = 8.4, 95% CI = 3.1 to 22.8).

**Table 1 (abstract P42)**

**Characteristics of 82 patients with acute respiratory failure**

Characteristic	Median (variation)
Age	68 (18 to 92)
APACHE II score	19 (4 to 32)
Sex male (n (%))	37 (45.1%)
Chronic disease (n (%))	77 (93.9%)
Length of stay in the ICU (days)	10.5 (1 to 71)
Cause of ARF (n (%))	
Sepsis	26 (31.7%)
Altered level of consciousness	20 (24.4%)
Shock	18 (21.9%)
Pneumonia	13 (15.8%)
Complication in the ICU (n (%))	42 (51.2%)
Multiple organ failure	12 (14.6%)
Acute kidney injury	10 (12.2%)
Ventilator-associated pneumonia	8 (9.7%)
Mortality in the ICU (n (%))	42 (51.2%)

**Conclusions** ARF prevalence was 20% in the studied population. The main cause of ARF was sepsis, these patients were older, more severely ill, had higher ICU stay and mortality than the total population admitted to the ICU and were often complicated with multiple organ failure.

**P43**

**Risk factors and mortality associated with acute respiratory failure in the ICU**

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Critical Care 2009, 13(Suppl 3):P43 (doi: 10.1186/cc7845)

**Introduction** Acute respiratory failure (ARF) is a common medical problem in the ICU.

**Table 1 (abstract P43)**

**Chi-square of risk factor indicators to ARF**

Risk factor	Acute respiratory failure (n (%))			$\chi^2$	P value
	At admission (n = 336)	During ICU stay (n = 26)	No (n = 144)		
Pneumonia	73 (85.9)	0 (0)	2 (14.1)	18.58	<0.001
Pulmonary embolism	23 (92)	1 (4)	1 (4)	8.2	0.016
Hypovolemic shock	8 (44.4)	3 (16.7)	7 (38.9)	6.9	0.031

**Methods** A retrospective study in the general ICU of a quaternary hospital from December 2005 to April 2008.

**Results** Five hundred and four patients with the mean age of 53.9 ± 19.9 years and a female majority (56.3%) were included. APACHE II (25.0 ± 7.9 vs 17.9 ± 8.1,  $P < 0.001$ ), length of stay (9 (5 to 14) vs 3 (1 to 5) days,  $P < 0.001$ ) and mortality rate (52.0% vs 22.1%,  $P < 0.001$ ) were higher in patients that developed ARF during the ICU stay, compared with those without ARF. The risk factors most frequently associated with ARF were pulmonary embolism, pneumonia and hypovolemic shock (Table 1).

**Conclusions** Pulmonary embolism, pneumonia and hypovolemic shock were risk factors most associated with ARF, and patients that developed ARF during the ICU stay had high mortality.

**P44**

**A comparison of three alveolar recruitment maneuver approaches in acute lung injury and acute respiratory distress syndrome**

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Critical Care 2009, 13(Suppl 3):P44 (doi: 10.1186/cc7846)

**Objective** To evaluate three alveolar recruitment maneuvers (ARM) in patients with acute lung injury and acute respiratory distress syndrome.

**Methods** Twenty-four patients randomized in three similar groups were evaluated. Each group received one kind of ARM. Group 1: progressive levels of positive end-expiratory pressure (PEEP) with a fixed pressure control (PC). The PC was kept at 15 cmH<sub>2</sub>O and the PEEP levels were increased every 2 minutes: 25, 30, 35, 40 and 45 cmH<sub>2</sub>O. Group 2: progressive levels of PC with a fixed PEEP level. The PEEP level was kept at 15 cmH<sub>2</sub>O and the PC levels were increased every 2 minutes: 20, 25, 30, 35 and 40 cmH<sub>2</sub>O. Group 3: progressive levels of PC with a fixed PEEP level plus progressive levels of PEEP with a fixed PC level. Initially, the PEEP level was kept at 15 cmH<sub>2</sub>O and the PC levels were increased every 1 minute: 20, 25, 30, 35 and 40 cmH<sub>2</sub>O. Immediately after, the PC was kept at 15 cmH<sub>2</sub>O and the PEEP levels were increased every 1 minute: 25, 30, 35, 40 and 45 cmH<sub>2</sub>O. The PaO<sub>2</sub>/FiO<sub>2</sub> ratio, Cst,rs and PaCO<sub>2</sub> were evaluated before and after 1 hour of the ARM in each group alone and were later compared among the three groups by the Wilcoxon test.  $P < 0.05$  was considered significant. The ventilator used was the Bennet 840.

**Results** The PaO<sub>2</sub>/FiO<sub>2</sub> ratio improved significantly in the three groups after the ARM. There are no statistical differences in Cst,rs and PaCO<sub>2</sub> after the ARM in the three groups. The initial PaO<sub>2</sub>/FiO<sub>2</sub> ratio was: Group 1 (138.75), Group 2 (143.75) and Group 3 (131.12). When compared among the three groups, the PaO<sub>2</sub>/FiO<sub>2</sub> ratio in Group 3 presented a significant improvement in comparison with Group 1 and Group 2: 257.87 vs 195.25 ( $P < 0.05$ ) and 257.87 vs 194.75 ( $P = 0.02$ ), respectively.

According to the PaO<sub>2</sub>/FiO<sub>2</sub> ratio, there are no differences between Group 1 and Group 2 (195.25 vs 194.75;  $P = 0.878$ ).

**Conclusions** ARM was effective in improving the PaO<sub>2</sub>/FiO<sub>2</sub> ratio in the three groups. The three ARM were similar in improving the Cst,rs and PaCO<sub>2</sub>. In our study, the ARM showed better results according to the PaO<sub>2</sub>/FiO<sub>2</sub> ratio when performed initially with progressive levels of PC and later with progressive levels of PEEP in comparison with the other two approaches.

#### P45

##### Effects of expiratory trigger setting on respiratory parameters of nonchronic obstructive pulmonary disease patients

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*Critical Care* 2009, **13(Suppl 3)**:P45 (doi: 10.1186/cc7847)

**Objective** To observe the effects of expiratory trigger (ET) setting on the following respiratory parameters in nonchronic obstructive pulmonary disease (COPD) patients: respiratory rate (RR), frequency to tidal volume ratio (f/Vt ratio), tidal volume (Vt), minute volume (Ve), oxygen saturation (SpO<sub>2</sub>), duty cycle (Ti/Ttot).

**Materials and methods** Twenty-four stable patients were evaluated. All patients were ventilated in pressure support ventilation, with pressure support between 8 and 12 cmH<sub>2</sub>O (to obtain Vt between 7 and 8 ml/kg), positive end-expiratory pressure between 5 and 7 cmH<sub>2</sub>O, fraction of inspired oxygen (FiO<sub>2</sub>) ≤40% (to obtain SpO<sub>2</sub> ≥96%). The expiratory trigger was set at 1%, 25%, 50% and 70%, for a 5-minute period each. The RR, f/Vt ratio, Vt, Ve, SpO<sub>2</sub>, and Ti/Ttot were measured at each percentage of ET. Analysis of variance for repeated measures was used to analyze variations during the four ET values and to verify variations out of the comfort zone, defined as: RR >30 bpm, f/Vt >100 breath/min/l, Vt <300 ml, Ve >10 l, SpO<sub>2</sub> <90%, Ti/Ttot >0.45. The Bonferroni test was used to identify which values were significantly different among the multiple comparisons. A probability of less than 0.05 was considered significant. The ventilator used was the Bennet 840.

**Results** All respiratory parameters presented significant variations when the comparisons were made from 1% to 70% of ET ( $P = 0.0001$ ), and 0.0003 for Ti/Ttot. The Vt, RR and f/Vt ratio presented significant increase in the percentage of patients that showed these parameters out of the comfort zone ( $P = 0.0025$ ,  $P = 0.0002$  and  $P = 0.007$ , respectively). No respiratory parameter presented significant variations when the comparisons were made from 1% to 25% of ET.

**Conclusions** In non-COPD patients, the use of ET at 1% or 25% has no effect on the respiratory parameters. The increase of ET to 50% or more can worsen the respiratory parameters and lead to rapid shallow breathing, suggesting that these values should be avoided in non-COPD patients.

#### P46

##### Clinical and epidemiological features of a series of 73 cases of pulmonary embolism admitted to an ICU

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**Introduction** Pulmonary embolism (PE) is a clinical syndrome resulting from occlusion of the pulmonary arterial circulation from one or more emboli. In the United States, its incidence is estimated at 1/1,000 hospital admissions per year [1].

**Objective** To describe the clinical and epidemiological data of patients admitted to an ICU due to PE.

**Materials and methods** From January 2006 to February 2009, 73 patients diagnosed with PE were admitted to the ICU of Hospital Santa Lúcia, Brasília, Brazil. The study is an observational research in which the data were prospectively collected through interviews with patients and their families and by consultation of medical charts and laboratorial tests.

**Results** Seventy-three patients were analyzed, 42 female (57.53%) and 31 male (42.27%). The mean age was 59.53 ± 18.90 years (17 to 91). The mean body mass index was 29.77 ± 8.04 kg/m<sup>2</sup> (18.97 to 63.26). A total of 76.71% of patients were older than 40 years of age. The risk factors with higher prevalence for PE were recent surgery – up to 6 months before admission (31.50%), previous PE or deep venous thrombosis (DVT) (30.13%), immobility (30.13%), venous insufficiency (30.13%) and obesity (27.39%). Thirty-three patients (45.20%) had a sedentary lifestyle and 26 patients (35.61%) presented systemic arterial hypertension. Dyspnea was the most prevalent (84.93% of patients) clinical manifestation, followed by chest pain (52.05%), cough (38.35%) and sweating (26.02%). The D-dimer was determined in 19 patients (26.02%), which was positive in 17 (89.47%). Computerized tomography was performed in 69 patients (94.52%), lower limb compression venous ultrasonography in 21 patients (28.76%), echocardiography in 20 patients (27.39%) and scintigraphy in 10 patients (13.69%). The rate of complications of thromboembolic event was about 19.17% ( $n = 14$ ), and the most prevalent was respiratory failure with 10 cases (13.69%), followed by pneumonia (5.47%), hemorrhage (4.1%), pulmonary edema and sepsis, each one with two patients (2.73%). Low-molecular-weight heparin was used in 35 patients (47.94%), unfractionated heparin in 28 patients (38.35%), thrombolytics in eight patients (10.95%) and inferior vena cava filter in two patients (2.73%). The hospital mortality was 8.21%. The mean length of stay in the ICU was 5.45 ± 11.61 days (0 to 83). Patients who had dyspnea (84.93%) on admission and those who needed orotracheal intubation had a higher mortality rate, with statistical significance ( $P = 0.0405$  and  $P = 0.0305$ , respectively).

**Conclusions** The most prevalent risk factors for PE were recent surgery, previous PE or DVT, restriction of mobility, venous insufficiency and obesity [1,2]. Dyspnea and chest pain were the most prevalent clinical manifestations [1,2]. The D-dimer was performed in a small percentage of patients. Computerized tomography was performed in 94.52% of patients, as it is an important diagnostic test for its high sensitivity and specificity [1]. The presence of dyspnea and orotracheal intubation were risk factors for mortality.

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#### P47

##### Measures for the prevention of pneumonia associated with mechanical ventilation in neurological patients

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**Introduction** Pneumonia associated with ventilation (VAP) develops after 48 hours of orotracheal intubation (OTI) and mechanical

ventilation (MV). It develops because of the imbalance between the patient's defense mechanisms and the microbial agent. The patient using OTI loses the natural barrier, eliminating the cough reflex and promoting the accumulation of secretions above the cuff, and therefore could facilitate colonization and the aspiration of contaminated secretions. The incidence of VAP is high, varying between 6% and 52%, depending on the studied population, on the type of UTI and on the type of diagnosis technique used; therefore, in spite of being an extremely important infection, it is one of the most difficult diagnoses in critically ill patients. When compared with other nosocomial infections, such as the one of the urinary tract and skin, where the mortality is between 1% and 4%, VAP becomes an important mortality predictor, since this varies between 24% and 50%, and could be more than 70% when caused by multiresistant microorganisms. Patients seriously ill with diagnoses of trauma – it reviles cerebral, vascular accident – are of particularly larger risk for VAP, the incidence estimated to be between 40 and 50%. Programs of basic education have been recognizing that the occurrence of VAP can be reduced in 50% or more using several interventions to prevent the colonization and the aspiration of secretions as well as gastric content. The increasing frequency of resistant microorganisms represents a serious health problem. The ICU is a great source of resistant microorganisms. Therefore, prevention should be part of the strategies of handling VAP. The mortality of this pathology can be reduced by the identification of the risk factors and of the prevention.

**Objective** To determine the impact of nurse care prevention of VAP in the neurological patient.

**Methods** The study was accomplished in the ICU. The sample constituted patients admitted to the ICU that required MV for more than 48 hours with neurologic disorders. The following data were collected: nurse order and accomplishment of oral hygiene and use of chlorhexidine 0.2%, six times per day in the patients with neurological problems; the adhesion was controlled by the ICU Nurses Neurological Team and accompanied the infection control for VAP.

**Results** The results in the period of August 2008 to January 2009 were 92 patients with neurological disorders, and the ICU maintained a rate of patients/day of 1,272.8, with MV/day of 236. In this period new cases of VAP were not registered; in comparison with the same period of 2007, there were 32 cases notified with a rate of patients/day of 754, with MV/day of 275 and 86 patients with neurological diagnoses. The ICU patients are submitted to the institutional and managed protocols of quality for the multiprofessional team, each one should receive care in the ICU infection prevention, and this care expresses the nurse care to warranty the aim of the prevention measures. Also, execution and measurement for improvement of nurse care were shown.

**Conclusions** In this study, submitted MV patients presented a decrease of VAP when the package of care was instituted and the main nurse guaranteed the nurse order and the accomplishment of oral hygiene adapted for the MV patient. We suggest the implantation of care and these routines can help in the prevention of infections in the ICU.

## Neurology

P48

### Management of hyperglycemia in patients with acute ischemic stroke: comparison of two strategies

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**Introduction** The 2001 study of Van den Berghe and colleagues demonstrating important benefits of intensive insulin therapy in critically ill patients [1] led to the hypothesis that aggressive control of hyperglycemia in patients with acute stroke could limit brain damage and improve clinical outcome. The best strategy to control hyperglycemia is open to discussion.

**Objective** To compare the safety and efficacy of two different strategies for glycemic control in acute ischemic stroke patients, evaluating the outcome through the Glasgow Outcome Scale Extended [2], hospital mortality and NIHSS during the ICU stay.

**Methods** Included in the study were all patients admitted to a general ICU with acute ischemic stroke. Patients randomized to Group 1 (intensive insulin therapy) received continuous intravenous insulin infusion adjusted to maintain blood glucose levels below 140 mg/dl. Group 2 patients (carbohydrate restrictive strategy) received intravenous hydration with a glucose-free solution (Ringer III) and enteral nutritional formula containing 33.3% carbohydrates. These patients received regular insulin subcutaneously according to a sliding scale, aiming to maintain blood glucose levels below 150 mg/dl. We evaluated glycemic variability (SD of blood glucose concentration x 100/mean blood glucose level),  $\Delta$ NIHH (discharge – admittance NIHH), hospital mortality and the Glasgow Outcome Scale Extended.

**Results** Thirty-four patients were submitted to randomization, 14 to Group 1 and 20 to Group 2. Both groups were comparable regarding age, gender, APACHE II score, prevalence of diabetes mellitus and systemic hypertension. There was also no difference between the two groups regarding admittance Glasgow Coma Score and NIHH. Patients in Group 1 received 35.7 (6.7 to 49.8) units of regular insulin per day, whereas patients in Group 2 received 0.0 (0 to 7.2) ( $P = 0.001$ ). The mean blood glucose level in Group 1 was  $139.2 \pm 25.9$  mg/dl and in Group 2 was  $146.9 \pm 39.3$  mg/dl ( $P = 0.52$ ). Hypoglycemia occurred in one patient in Group 1 and in two patients in Group 2 ( $P = 1.0$ ). Glycemic variability was 27.0 in Group 1 and 20.1 in Group 2 ( $P = 0.075$ ), and was significantly higher among patients who died during the hospital stay (29.6) compared with those discharged (20.3) ( $P = 0.02$ ). Four (28.5%) patients in Group 1 and six (30%) patients in Group 2 died during the hospital stay ( $P = 1.0$ ). The  $\Delta$ NIHH was  $-2$  in Group 1 and  $-4.3$  in Group 2 ( $P = 0.3$ ). The Extended Glasgow Outcome Scale, used to evaluate functional outcome after hospital discharge, showed that one (10%) patient in Group 1 and five (41.6%) patients in Group 2 had a favorable outcome (moderate disability and good recovery) ( $P = 0.1$ , relative difference of 76%).

**Conclusions** The present study shows a trend toward better outcomes in the group of patients submitted to a more conservative approach of glycemic control, although without statistical significance. A glycemic variability significantly higher in the intensive insulin therapy group may explain, at least in part, our results.

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P49

**Improved quality of stroke care after multidisciplinary training****FCP Cunha, FMS Coelho, MS Pedott, M Borgerth, C Engelsmann, MA Bueno***Hospital M'Boi Mirim, São Paulo – SP, Brazil**Critical Care* 2009, **13(Suppl 3)**:P49 (doi: 10.1186/cc7851)

**Introduction** Stroke continues to have a devastating impact on public health, and it remains a leading cause of death and disability. Unfortunately, it is possible to find prehospital and hospital approaches that do not treat this pathology as a true medical emergency. Hospitals providing care for patients with acute stroke should organize clinical protocols and pathways for effective implementation of acute therapies.

**Methods** The survey was conducted in a new secondary hospital in São Paulo, Brazil from May 2008 to December 2008. A retrospective study of the medical records of patients with stroke diagnosis analyzing clinical treatment given before and after a training course (administered in August 2008) provided to medical staff and nurses that work in the Accident and Emergency Department. Median times from admission to head CT, prescription of aspirin, statins and deep venous thrombosis prophylaxis were the indicators evaluated.

**Results** Before the training, the median time between admission and the first CT scan was 3 hours; aspirin was prescribed for 63.3% of the patients and statins for 5.3%. Deep venous thrombosis prophylaxis was used only in 36.3% of eligible patients. After theoretical and practical training administered in the Albert Einstein Realistic Simulation Center, the timing for brain imaging had decreased to 1.33 hours, 85.9% of patients had received aspirin and 28.6% had taken statin. Deep venous thrombosis prophylaxis had been provided to 45.88% of eligible patients.

**Conclusions** The present study shows that training and monitoring are important for efficiency and the best results for stroke. We conclude that continuous education involving multidisciplinary teams improves the quality of care for patients.

P50

**Serum glucose variability and brain-serum glucose ratio predict metabolic distress and mortality after severe brain injury****P Kurtz, JM Schmidt, J Claassen, R Helbok, K Hanafi, L Fernandez, M Presciutti, ND Ostapkovich, RM Stuart, ES Connolly, K Lee, N Badjatia, SA Mayer***Columbia University Medical Center, New York, USA**Critical Care* 2009, **13(Suppl 3)**:P50 (doi: 10.1186/cc7852)

**Objective** Cerebral glucose metabolism and energy production are affected by serum glucose levels. The objective of the present study was to assess whether serum glucose variability and the ratio between cerebral and serum glucose are associated with cerebral metabolic distress and outcome after severe brain injury.

**Methods** We studied 46 consecutive patients that underwent multimodality monitoring with intracranial pressure, PbtO<sub>2</sub> and microdialysis in a neurological ICU of a university hospital. The relationship between brain-serum glucose ratio and cerebral metabolic distress, as measured by microdialysis lactate/pyruvate ratio (LPR)  $\geq 40$ , was analyzed for every hour of measurement. The relationship between daily serum glucose variability, as measured by the standard deviation (SD) and the mean amplitude glycemic excursions (MAGE), and metabolic distress was analyzed for every

day of monitoring. Mortality was analyzed at hospital discharge. All analyses used general linear models of logistic function for dichotomized outcomes utilizing generalized estimating equations accounting for within-subject and between-subject effects.

**Results** The mean age was 55 years (IQR 42 to 64), 27 (59%) patients were female and the median admission Glasgow Coma Scale (GCS) was 7 (IQR 5 to 9). Diagnoses included subarachnoid hemorrhage (61%), intracerebral hemorrhage (22%), traumatic brain injury (13%) and cardiac arrest (4%), and 28% were dead at discharge. A total of 5,264 neuromonitoring hours and 300 days were analyzed. In a multivariable model, brain/serum glucose ratios below the median (12%) were independently associated with increased risk of metabolic distress (adjusted OR = 6.1 (4.5 to 8.2),  $P < 0.0001$ ). In a similar multivariable model analyzing daily averaged data, increased serum glucose variability was also independently associated with higher risk of cerebral metabolic distress (adj OR = 1.8 (1.3 to 2.5),  $P < 0.0001$  for SD; and adj OR = 1.2 (1.02 to 1.4),  $P = 0.03$  for MAGE). Both analyses were adjusted for significant covariates such as GCS, cerebral perfusion pressure and serum glucose levels. An averaged brain/serum glucose ratio lower than the median and an increased serum glucose variability were independently associated with mortality at hospital discharge after adjusting for age and APACHE II score (adj OR = 6.9 (1.6 to 36.7),  $P = 0.01$ ; and adj OR = 7.2 (1.3 to 41.7),  $P = 0.03$ , respectively).

**Conclusions** The ratio between brain and serum glucose levels as well as serum glucose variability are associated with cerebral metabolic distress and increased mortality at hospital discharge in patients with severe brain injury.

P51

**Addition of new criteria to the Sequential Organ Failure Assessment for the patients with subarachnoid hemorrhage****SK Macedo, BC Oliveira, DBP Lima, ACF Silva, NF Bastos***Hospital São José do Avaí, Itaperuna – RJ, Brazil**Critical Care* 2009, **13(Suppl 3)**:P51 (doi: 10.1186/cc7853)

**Introduction** Subarachnoid hemorrhage (SAH) is defined by an acute bleeding in the cisterns of the brain. It occurs in 15.7% of 100,000 inhabitants per year and generally is due to saccular aneurysm rupture. Approximately 30% of the patients die because of the first bleeding episode and 45% by the end of the first month; whereas 48% of these patients show severe neurological disorder. Generally the early occlusion of the aneurysm is recommended to prevent recurrent bleeding and to create conditions for the treatment of vasospasm. The purpose of the treatment is to prevent or reverse ischemic disabilities through the hemodynamic therapy (hypervolemia, hypertension, hemodilution and hyperdynamism – 4 H therapy). The Sequential Organ Failure Assessment (SOFA) was originally created for sepsis, but its quality is now used in other medical conditions. Therefore, we add some criteria to the index to assess patients with SAH.

**Objective** Besides the SOFA score, to evaluate serum glucose, arterial lactate, magnesium, calcium, sodium, hourly diuresis and axillary temperature as prognostic factors in patients with SAH.

**Study design** A prospective observational study carried out between March 2007 and December 2008 in the neurovascular ICU at São José do Avaí Hospital, Itaperuna, RJ, Brazil. Study patients were those diagnosed with SAH by computerized tomography (CT) of the skull.

**Methods** Informed consent was obtained for each patient/family; APACHE II (criteria for admission) and SOFA weekly, serum

**Table 1 (abstract P51)**

Characteristic	Group I		Group II	
	% (n)	95% CI	% (n)	95% CI
Patients	60.4 (55)	49.6 to 70.5	39.6 (36)	29.5 to 70.5
Age (years)				
Average	52.2	-	52.8	-
Interval	29 to 77	-	17 to 91	-
Female	72.7 (40)	59.0 to 83.9	77.8 (28)	60.8 to 89.9
SAH	5.5 (3)	1.1 to 15.1	0 (0)	0 to 9.7
Fisher II	52.7 (29)	38.8 to 66.3	41.7 (15)	25.5 to 59.2
Fisher IV	41.8 (23)	28.7 to 55.9	58.3 (21)	40.8 to 74.5
APACHE II (admission)				
Average	11.9	-	17.9	-
≥20	10.9 (6)	4.1 to 22.2	36.1 (13)	20.8 to 53.8

**Table 2 (abstract P51)**

Criteria	Group I (n = 55)		Group II (n = 36)		P value		
	Frequency%	(95% CI)	OR	Frequency%		(95% CI)	
Arterial lactate ≥2.0	50.9	(37.1 to 64.6)	1.0	50.0	(32.9 to 67.1)	0.96	0.5
Serum calcium (<1.12 or >1.32)	49.1	(35.4 to 62.9)	1.0	55.6	(38.1 to 72.1)	1.3	0.3
Serum glucose (<70 or >150 mg/dl)	23.6	(13.2 to 37.0)	1.0	36.1	(20.8 to 53.8)	1.8	0.1
Serum magnesium (<1.7 or >2.4)	10.9	(4.1 to 22.2)	1	0	(0 to 9.7)	0	0.04
Serum sodium (<135 or >145)	23.6	(13.2 to 37.0)	1.0	55.6	(38.1 to 72.1)	4.0	0.002
Hourly diuresis (<0.5 or >1.5 ml/kg/hour)	78.2	(65.0 to 88.2)	1.0	72.2	(54.8 to 85.8)	0.7	0.3
Axillary temperature	16.4	(7.8 to 28.8)	1.0	30.6	(16.3 to 48.1)	2.2	0.06

glucose, lactate, calcium, sodium and magnesium; and measurement of the axillary temperature and hourly diuresis were the additional prognostic factors. The study enrolled 91 patients diagnosed with SAH, confirmed by CT of the skull in the neurovascular ICU at São José do Avai Hospital. The conduct in relation to the approach of these new criteria was the same in all patients evaluated. The patients were divided into two groups according to their development in the ICU: Group I – patients who had good evolution (out of ICU); and Group II – patients who progressed to death in the ICU (Table 1).

**Results** Among 91 patients, 68 (74.72%) were female and 23 (25.27%) were male. The APACHE II for admission varied from 2 to 34, with an average of 15.5. The maximum spent time in the ICU was 49 days (two patients). Group I had 55 patients (60.4%) and the 36 remaining patients (39.6%) were classified as Group II. Table 2 presents the results of the criteria examined in the study obtained in both groups.

**Conclusions** We can conclude that the group of patients with SAH has a female predominance (68:23). The APACHE II score in Group I was 11.9, while in Group II it was 17.9. Regarding the criteria used to assess patients with SAH, it was observed that the only criterion that showed statistical significance in the prediction of death was the serum sodium ( $P = 0.002$ ). The other criteria evaluated did not have statistical significance in predicting the prognosis of patients. A new complementary study is necessary to standardize these additional criteria to SOFA as an assessing method of prognosis of patients with SAH, but we can conclude that the change in values of serum sodium has fundamental importance on the development of this group of patients.

**P52**

**Implementation of the protocol of decompressive craniectomy: does it really improve outcome?**

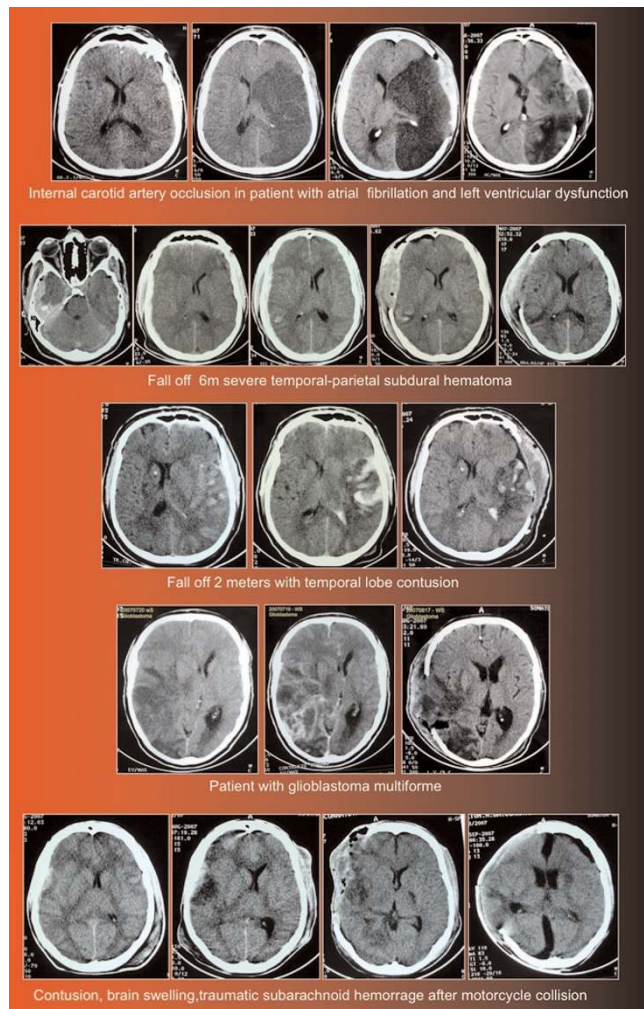
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**Introduction** Treatment of traumatic brain injury (TBI) and other conditions that increase intracranial pressure (ICP) continues to be a challenge for intensivists and neurosurgeons. Despite adequate monitoring, the mortality and morbidity rate remain high. Decompressive craniectomy (DC) can be performed where maximum medical therapy has failed to reduce ICP.

**Objective** To analyze the viability of the DC protocol, since implementation, in the former 23 months. To identify the applicability of the protocol as an instrument for DC indication.

**Methods** A prospective, descriptive, series study, realized by the UPG-UCI of the Emergency and Neurosurgery Service. Criteria for ICU admission: age >18 years and <60 years, <48 hours at admission (except patients with tumor), Glasgow Coma Scale (GCS) >4, decline for 3 points with the first GCS, extensive unilateral brain trauma, intraoperative evidence of brain swelling; image evidence of intracranial hypertension (ICH), stroke or brain trauma with mass effect and midline shift. Maximum medical therapy to reduce ICP, when possible: drainage of cerebrospinal



**Figure 1 (abstract P52)**

fluid; induced hyperventilation; intravenous hyperosmotic solutions; head elevation; sedation and neuromuscular paralysis; barbiturate coma; and hypothermia. The protocol includes clinical, neurological and image signs. The patients' evolution was appraised by 3-month mortality, GCS and modified Rankin Scale.

**Results** Since the implementation of the DC protocol, from January 2007 to November 2008, seven clinical cases were admitted, all males, mean age of 39 years (21 to 60). Amongst them, three patients (42.8%) received specialized neurointensive care since admission. The primary mechanisms of injury include: fall of 2 m with severe concussion, fall of 6 m with subdural hematoma, carotid occlusion with hemispheric ischemia, tumor (glioblastoma multiforme), two motorcycle collisions with TBI, and gunshot with temporal contusion and subdural hematoma. The mean time between the admittance and DC was 29 hours 30 minutes (2 to 48 hours) (one tumor). None of the patients died. The mean GCS was: on admittance, 12 (8 to 15); pre-DC, 9 (6 to 15); 1 week, 12 (9 to 15); 3 months, 14 (11 to 15). The admittance GCS was higher than the pre-DC in all patients, and also the 1-week GCS was higher than the pre-DC. The mean modified Rankin scale was 1.75 (0 to 3). (See Figure 1.)

**Conclusions** Implementation of the protocol, based on recent studies, allows one to establish, with more accuracy, the best

indication for DC, improving outcome. Despite small casualties, DC was effective to treat otherwise uncontrollable ICH and improved cerebral perfusion pressure. All patients presented a satisfactory clinical evolution and outcome after the procedure. The neurointensive care unit allowed an adequate treatment indication and management of these complex patients.

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#### P53

#### Effects of chest physiotherapy and passive mobilization on intracranial pressure and cerebral perfusion pressure in traumatic brain injury patients

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**Objective** To evaluate the effects of respiratory physiotherapy and passive mobilization on intracranial pressure (ICP) and cerebral perfusion pressure (CPP).

**Methods** Sixty patients with traumatic brain injury (TBI) with Glasgow Coma Scale (GCS)  $\leq 8$  and normal ICP and CPP were evaluated. A 30° head-up position was used during the study. ICP and CPP were monitored during the following procedures: chest compression, vibration associated with chest compression, unilateral continuous chest compression, tracheal suction with open circuit and closed circuit, passive mobilization of arms and legs, hip rotation, scapular mobilization in lateral decubitus and lateral flexion of the lower trunk. The procedures were interrupted when the ICP and CPP reached 20 mmHg and 70 mmHg, respectively. The Wilcoxon test was used to evaluate changes in ICP during the procedures. The MacNemar test was used to verify the rate of patients that reached ICP and CPP of 20 mmHg and 70 mmHg, respectively.

**Results** Initial ICP and CPP were  $12.1 \pm 2.6$  mmHg and  $87 \pm 8.3$  mmHg, respectively. Four procedures changed ICP and CPP significantly: lateral flexion of the lower trunk ( $17.4 \pm 2.5$  mmHg and  $81.7 \pm 8.1$  mmHg, respectively;  $P = 0.0001$ ), unilateral continuous chest compression ( $17.2 \pm 2.6$  mmHg and  $81.9 \pm 8.3$  mmHg, respectively;  $P = 0.0001$ ), tracheal suction with open circuit ( $17.7 \pm 2.5$  mmHg and  $81.4 \pm 8.2$  mmHg, respectively;  $P = 0.0001$ ) and tracheal suction with closed circuit ( $16.2 \pm 2.2$  mmHg and  $82.9 \pm 7.9$  mmHg, respectively;  $P = 0.0001$ ). Continuous chest compression, tracheal suction with open circuit and lateral flexion of the lower trunk frequently reached ICP of 20 mmHg (13.3%,  $P = 0.013$ ; 20%,  $P = 0.0014$ ; and 16.7%,  $P = 0.004$ , respectively). Tracheal suction with closed circuit did not reach ICP of 20 mmHg.

**Conclusions** Unilateral continuous chest compression and lateral flexion of the lower trunk should be avoided in the acute phase of TBI patients. Tracheal suction is unavoidable, but should be done carefully and preferably with a closed circuit.

**P54**

**Effect of magnesium on prophylaxis of vasospasm, morbidity, and mortality in subarachnoid hemorrhage patients**

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*Critical Care 2009, 13(Suppl 3):P54 (doi: 10.1186/cc7856)*

**Introduction** We propose this study in order to reach two end points: (a) vasospasm clinical incidence, confirmed by CT; and (b) the mortality of these patients in 28 days. The study shows a comparison of a group of patients that used Mg (Intervention Group 1) from those that did not (Control Group 2).

**Methods** After institutional approval and informed consent, a prospective, randomized, nonblind study was performed between February and November 2008. The main goal of the study was to achieve a Mg serum concentration from 2.5 to 3.5 mg/dl, using a solution of Mg 2% (SG 5% 400 ml + MgSO<sub>4</sub> 10% 100 ml/24 hours), during the first 14 days of aneurysm rupture. Admission criteria: patients diagnosed with SAH and Δt <96 hours. Exclusion criteria: patients with SAH and Δt >96 hours.

**Results** In a previous study evaluation we analysed a total of 56 patients, with 26 in Group 1 and 30 in Group 2 (Tables 1 and 2). Main results: Group 1 – vasospasm frequency 26.9% (n = 7) and mortality 19.2% (n = 5) in 28 days; Group 2 – vasospasm frequency 46.7% (n = 14) and mortality 33.3% (n = 10) in 28 days.

**Table 1 (abstract P54)**

	APACHE II	Average Mg level
Group I (n = 26)	8.2	2.32
Group II (n = 30)	15.6	1.9

**Table 2 (abstract P54)**

	Group I (n = 26)			Group II (n = 30)			P value
	Freq. (% (n))	95% CI	OR	Freq. (% (n))	95% CI	OR	
Vasospasm	26.9 (7)	11.6 to 47.8	0.4	46.7 (14)	28.3 to 65.7	1	0.1
Mortality in 28 days	19.2 (5)	6.6 to 39.4	0.5	33.3 (10)	17.3 to 52.8	1	0.2

CI, confidence interval; Freq., frequency; OR, odds ratio.

**Conclusions** According to the outcome, we can conclude that Group 1 obtained a greater protection for vasospasm incidence and a decrease of mortality in comparison with Group 2. The P value was not significant due to a still small number of patients.

**Nutrition metabolism**

**P55**

**Evaluation of nursing perceptions about three insulin protocols for blood glucose control in critical care**

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**Introduction** In order to implement a tight glycemic control protocol in the ICU it is essential to obtain active nurse involvement. Our

objective was to evaluate nurse's perception about three different blood glucose control protocols for critically ill patients.

**Methods** As part of a randomized control trial (RCT) comparing three blood glucose control protocols in ICU patients, we issued a questionnaire to all nurses who participated in the study to evaluate their perception on protocol efficacy, benefits, safety, risks and feasibility and a question asking which protocol the nurses would like to be adopted in their ICU. The RCT arms were: computer-assisted insulin protocol (CAIP) with continuous insulin infusion to maintain blood glucose between 100 and 130 mg/dl; Leuven protocol with insulin infusion to maintain blood glucose between 80 and 110 mg/dl; and conventional treatment with subcutaneous insulin if glucose >150 mg/dl.

**Results** Sixty nurses answered the questionnaires. CAIP was considered the most efficient by 57% of the nurses. About 58% of the nurses evaluated its performance as good or very good, compared with 22% for the Leuven protocol (P <0.001) and 40% for conventional treatment (P = 0.08). CAIP was considered easier to use than the Leuven protocol (P <0.001) and as easy as conventional treatment (P = 0.78). Fifty-six percent of the nurses chose CAIP as the protocol they would like to be adopted in their institution.

**Conclusions** CAIP was more efficacious, safer and easier to use than the Leuven protocol. Compared with conventional treatment, the feasibility and safety of CAIP were considered similar. Most nurses chose CAIP as the protocol they would like to be adopted in their ICU.

**Epidemiology/quality of life/administration**

**P56**

**Adherence to quality of care measures in critically ill cancer patients: a pilot study**

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**Introduction** In recent years several interventions to increase the quality of care and patient safety in the ICU have been proposed. Daily checklists have been introduced and are feasible and straightforward instruments to measure adherence to quality of care. Critically ill cancer patients are especially susceptible to ICU-acquired complications such as thrombosis, infection and delirium among several other morbid conditions. We developed and implemented a checklist to evaluate the process of care measures in this specific group of patients.

**Methods** We prospectively performed a daily checklist for consecutive patients admitted to the ICU between 1 January and 15 February 2009. The checklist included: feeding, analgesia, DVT prophylaxis, elevated head of the bed (HOB), stress ulcer (SU) prophylaxis and delirium. Data were inserted into an electronic database and automatic real-time reports were generated.

**Results** One hundred and four patients were evaluated, 52 (50%) scheduled surgery, 43 (41.3%) medical patients and 9 (8.6%) emergency surgery. The SAPS3 score was 49.3 ± 23.2. Global ICU mortality was 22.1%. The main reasons for ICU admission were postoperative monitoring (n = 52/50%) and sepsis (n = 28/26.9%). The frequency of adherence to the measured processes of care was: nutrition = 85.1%, analgesia = 92.7%, DVT prophylaxis = 72.3%, HOB = 55.3%, SU prophylaxis = 78.2%, and delirium was detected in 12.8%.

**Conclusions** The use of a daily checklist is useful for the detection of adherence rates to process of care measures. Despite the use of a systematic approach, some evidence-based quality measures are not fully translated into clinical practice. The identification of such measures provides a potential target for future research and educational interventions.

#### P57

##### Guillan-Barré syndrome affects the quality of life after discharge from the ICU

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**Introduction** There are some patients with Guillan-Barré syndrome (GBS) that require intensive care, either owing to the accentuated progression of their clinical history or because of evolution towards acute respiratory failure. Most of the time, there are deep sequelae that cause impacts on the quality of life (QOL) of these patients. There is no specific score for the assessment of physical and/or motor inability in GBS patients.

**Objective** To assess the QOL of GBS patients admitted to the ICU, after hospital discharge, utilizing the SF-36 and the Barthel Index.

**Methods** The GBS incidence in the population of patients admitted to the ICU of Hospital Estadual do Grajaú in the period from April 2005 to October 2008 was reviewed and a study file was elaborated with demographic data. For the patients' follow-up, telephone contact was established and, after consent was granted,

those who agreed responded to SF-36 and Barthel Index questionnaires. Telephone contact was not possible only in one patient. Additionally, the professional activity of the patient was evaluated before and after the disorder.

**Results** In this sample, seven patients presented a GBS diagnosis, reflecting 0.5% of the total group. Out of the seven patients, six presented previous infections. The mean average ICU length of stay was 14.4 days. Three patients required mechanical ventilation (42.8%). Tracheotomy was performed in two patients. All of them were supplied with immunoglobulins. The evaluation report results as per the Barthel Index and the SF-36 are presented in Tables 1 and 2, respectively.

**Conclusions** GBS patients undergo an impact on QOL, although there was a considerable physical recovery after a period of 1 to 2 years. These results may help doctors to be aware that a careful neurological examination may be complemented with the opinion of the patients regarding their QOL.

#### P58

##### Risk factors of reduced functional capacity of ICU patients at hospital discharge

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**Introduction** Increasing interest has been focused on survival beyond the ICU stay. Functional capacity, as described by simple everyday activities, can be severely compromised after ICU and hospital stay. Our aim was to identify patients' risk factors for reduced functional capacity at hospital discharge on the first 2 days after ICU admission.

**Table 1 (abstract P57)**

##### Results of the Barthel Index questionnaires relating to the daily activities of GBS patients

Activity	01	02	03	04	05	06
Feeding	10	10	10	10	10	05
Cleanliness	05	05	05	05	05	00
Evacuation	10	10	10	10	10	10
Diuresis	10	10	05	10	10	10
Dressing	10	05	10	10	10	00
Transference chair/bed	15	15	15	10	15	00
Toilet	10	10	10	10	10	00
Mobility	15	15	15	15	15	00
Stairs	10	10	10	10	10	00
Bath	05	05	05	05	15	00
Total	100	95	95	95	100	25

0 is the worst value and 100 the best result.

**Table 2 (abstract P57)**

##### Results of the SF-36 questionnaire relating to eight major masteries

Patient	01	02	03	04	05	06
Functional capability	100	55	65	40	0	0
Physical limitation	100	0	0	0	0	0
General health status	100	31	42	10	10	42
Vitality	60	27	85	30	77	72
Social aspects	50	50	100	37.5	12.5	25
Emotional limitation	100	0	0	0	0	0
Mental state	52	96	88	28	48	48
Pain	100	31	42	10	10	42

100 is the best result and 0 the worst value.

**Methods** A prospective cohort of medical and surgical patients admitted to a private ICU from September to December 2008 was studied. The analyzed demographic data were age, gender, height and weight (body mass index (BMI)). Functional capacity was measured by the Barthel Index (BI), described as totally dependent, partially dependent or independent capacity for feeding, bath, self-care, dressing, urinary and fecal continence, bathroom use, bed to chair transference, short walking, and climbing stairs. The BI was scored from 0 to 100 points, and was calculated on ICU admission and immediately before hospital discharge. A reduced BI was defined as less than 80 points. The admission diagnosis was classified by organ/tissue systems (respiratory, cardiovascular, neurological, gastrointestinal, renal, orthopedic, gynecologic, head/neck surgery, trauma, and infection/sepsis). Acute severity of illness was calculated (SAPS II and SOFA scores) on day 1 of admission. Comorbidities were classified as the Charlson Index, and recent (<5 years) neoplasm was separately analyzed. Use of mechanical ventilation (MV) was considered a unique risk factor. Numeric data were described as median (interquartile 25 to 75 interval) or absolute values and percentage. Univariate analysis was conducted initially for all research variables according to a BI cutoff of 80 points. Logistic regression was performed with inclusion of variables with  $P < 0.10$  in bivariate analysis.

**Results** A total of 374 patients were admitted to the ICU in the study period. The median age was 68.5 years (57 to 79), 47% were male. BMI was 25 (22 to 28). The ICU length of stay was 2 days (1 to 3), with 2% ICU mortality. There was a predominance of surgical patients (69%). The most common causes of ICU admission were respiratory, cardiovascular, gastrointestinal and orthopedic diseases. The SAPS II score was 22 points (15 to 28), and SOFA on day 1 was 1 (0 to 2). Any comorbidity was present in 194 (52%) patients, with a Charlson Index of 1 point (0 to 2). Recent neoplasm was present in 97 (26%) cases. MV was necessary for 30 (8%) patients. The BI was calculated for 318 patients who were discharged from hospital: ICU admission index 80 (70 to 100) and discharge 100 (80 to 100). The most common disabilities on ICU admission were dressing (19%), bathroom use (18%), bed to chair transference (54%), short walking (55%), and climbing stairs (99%). At hospital discharge, disabilities remained significant for bathroom use (19%), bed to chair transference (42%), short walking (41%), and climbing stairs (39%). Risk factors for a BI at discharge less than 80 points were: age >65 years (odds = 3.18; 95% CI = 1.75 to 5.79), SAPS II >22 points (2.15; 1.25 to 3.67), use of MV (2.67; 1.03 to 6.91), medical type of admission (1.76; 0.99 to 3.11), orthopedic admission (2.59; 1.34 to 5.04), and initial BI <80 points (24.11; 11.76 to 49.42). After logistic regression, the initial BI, age, and orthopedic admission diagnosis were significant predictors for reduced discharge BI.

**Conclusions** An initial worse functional capacity, age and orthopedic diagnosis are strong predictors for a reduced BI at hospital discharge.

P59

**Orotracheal intubation: medical knowledge and clinical practices in ICUs**

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*Critical Care 2009, 13(Suppl 3):P59 (doi: 10.1186/cc7861)*

**Introduction** Orotracheal intubation (OT) is considered one of the main procedures in ICUs; however, it involves risks and compli-

cations. So, a deep theoretical knowledge of proper techniques is of utmost importance and, under ideal conditions, OT should follow a strict protocol. The present study aimed to evaluate medical knowledge about OT techniques and to identify the usual procedures.

**Methods** A prospective study involving three different ICUs in a university hospital: anesthesiology ICU (ANEST), pneumology ICU (PNEUMO) and emergency room ICU (ER). All doctors that work in the ICUs and agreed to take part in the study completed, anonymously, a questionnaire containing demographic data and questions about OT. Statistical analysis was performed using EPI-INFO and results were considered significant if  $P < 0.05$ .

**Results** Forty-six questionnaires were obtained from ANEST, 15 from PNEUMO and 19 from ER, corresponding to 86% of the doctors working in those units. Doctors from ANEST were significantly older than those from the other ICUs ( $33.6 \pm 4.6$ ,  $29.6 \pm 6.6$  and  $29.9 \pm 5.3$  for ANEST, PNEUMO and ER, respectively,  $P = 0.006$ ), with only 26.3% being residents (93.3% and 68.4% for PNEUMO and ER,  $P = 0.001$ ), 43.5% were board-certified intensivists (6.7% and 10.5% for PNEUMO and ER,  $P = 0.003$ ) and 77.3% had already attended a difficult airway training course (13.3% and 10.5% for PNEUMO and ER,  $P = 0.000$ ). ANEST and ER have their own airway protocol and it is known by 95.5% and 26.3% of their doctors. Some clinical practices recommended in the airway protocol were generally adopted as the associated use of opioid and hypnotic (98.7%) and pre-oxygenation (91.3%). Midazolam was the preferred hypnotic; however, ANEST doctors use etomidate more frequently than PNEUMO and ER doctors. A suboccipital pad was always used by 45%, without differences among ICUs. Some practices are more frequently adopted by ANEST physicians than those from the others, such as routine use of muscle relaxant (65.2%, 13.3% and 26.3%, respectively, for ANEST, PNEUMO and ER,  $P = 0.000$ ) and always considering ICU patients as nonfasting (34.8%, 13.3% and 10.5%, respectively, for ANEST, PNEUMO and ER,  $P = 0.002$ ). Although the majority claimed to know the difference between rapid sequence and classic induction (93.3, 63.7 and 89.5 for ANEST, PNEUMO and ER,  $P = 0.02$ ), they did not correctly point out those differences (mean note -  $2.28 \pm 0.92$ ,  $2.1 \pm 0.87$  and  $1.9 \pm 0.75$ , respectively, for ANEST, PNEUMO and ER,  $P = 0.379$ ). Almost 100% of the doctors use the Sellick maneuver; however, only 15% in the correct moment and only 26.3 until OT is appropriately checked.

**Conclusions** Medical knowledge about OT is not satisfactory, even among highly qualified doctors for this procedure. It is necessary to evaluate clinical practice to check compliance with the questionnaires answers and with clinical protocols. It would be possible, therefore, to identify iatrogenesis and complications that poor compliance may cause.

P60

**Measurable outcomes of quality improvement in a critical care unit: the impact of a daily multidisciplinary round**

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*Critical Care 2009, 13(Suppl 3):P60 (doi: 10.1186/cc7862)*

**Introduction** The use of care bundles in the prevention of ventilator-associated pneumonia (VAP) and other ICU complications has been increasing in critical care practice. However, the effective implementation of these strategies represents a challenge in a critical care unit. Multidisciplinary rounds (MDR) enable all members of the team caring for critically ill patients to come together and offer

expertise in patient care. This intervention has proven successful in medical and surgical settings. The objective of the present study was to assess the effectiveness of a daily MDR to improve compliance with the VAP bundle recommendations and other beneficial prophylactic measures in a high-volume critical care unit.

**Methods** A prospective before–after design was used to examine the effectiveness of daily MDR in promoting compliance with prophylactic measures for VAP, deep venous thrombosis or pulmonary embolism, central line infection and other ICU complications. Compliance was assessed for 1 month before institution of the MDR and it was assessed for the next month after implementation of MDR.

**Results** During the study period, daily survey information was collected. The demographic characteristics of the ICU patients surveyed remained constant. Implementation of the MDR facilitated improvement of all measures. Compliance with VAP prevention measures of head-of-bed elevation  $>30^\circ$  (47.2% vs 72.5%), sedation holiday (35.0% vs 92.0%), and prophylaxis for both peptic ulcer disease (90.2% vs 92.3%) and deep venous thrombosis (72% vs 92%) were all increased. A decrease in central line duration  $>72$  hours (90.4% vs 70.8%), ventilator duration  $>72$  hours (85.0% vs 72%) and duration of ICU stay (4.7 days vs 3.9 days) was also noted.

**Conclusions** Our study demonstrates that implementation of the MDR can make an impact not only in the rates of compliance with standard-of-care prophylactic measures, but also in the reduction of central line, ventilator and ICU stay duration in a high-volume critical care unit.

#### P61

##### **Incidence of accidental extubation in patients on mechanical ventilation in the ICU of Distrito Federal**

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*Critical Care* 2009, **13(Suppl 3):P61** (doi: 10.1186/cc7863)

**Objective** To investigate and analyze the events of accidental extubation in the ICU of Hospital Santa Luzia, Brasília.

**Methods** The study was carried out from 1 July 2008 to 31 December 2008. In this period, 864 patients were admitted and 178 of them were submitted to mechanical ventilation.

**Results** In this period of 864 patients, 51.74% were male and 48.26% female. There was a predominance of patients aged over 71 years (27.66%): patients up to 20 years (18.63%), from 21 to 30 years (5.32%), from 31 to 40 years (6.6%), from 41 to 50 years (10.3%), from 51 to 60 years (14.47%), and from 61 to 70 years (17.01%). The mean APACHE II index was 10 ( $\pm$  7.46) and mean SAPS II was 30.87 ( $\pm$  13.31). In this period, 178 (20.60%) patients were submitted to mechanical ventilation. We observed three (1.68%) cases of accidental extubation. None of the cases required reintubation. It was necessary to use noninvasive mechanical ventilation in two patients, only in one situation was the patient in the process of weaning. In two cases there was failure to control the exchange of fixing the orotracheal tube, and the other failed in containing the patient due to psychomotor agitation during the hygiene of nursing care. Only one case occurred during the night duty, in which was found 100% occupancy of the ICU and a decrease in the number of nursing assistants by licensed health. There were no cases of death.

**Conclusions** The monitoring conducted by the physiotherapy team and the existence of routines for exchange of a fixed endotracheal tube favor a low incidence of adverse events of accidental extubation. Although there have been no cases of death, the search for preventive mechanisms confirms the quality of care.

## **Surgery/trauma**

#### P62

##### **Central venous catheterization: a randomized comparison between external and internal jugular access**

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*Critical Care* 2009, **13(Suppl 3):P62** (doi: 10.1186/cc7864)

**Introduction** Central venous catheterization is a routine procedure in intensive care and the internal jugular access (IJA) is often used due to its high success rate. However, complications can happen in up to 4.2% of internal jugular punctures and IJA is contraindicated in the presence of coagulopathy. The external jugular access (EJA) is underused, has low complications rates and is successful in up to 90% of cases. So far, there has been no randomized, controlled trial comparing both accesses.

**Objective** To determine the success and early complication rates of internal and external jugular vein access.

**Methods** A prospective, randomized study, performed in two adult general ICUs. Inclusion criteria: all patients who need central venous catheterization with a visible external jugular vein and no contraindication for the IJA. All included venous catheterizations were performed by the first-year and second-year critical care residents, supervised by a staff physician. Admission type, APACHE II score and outcomes were recorded.

**Results** Sixty-nine patients were included. The mean APACHE II score was 22.8 (standard deviation = 6.4). Thirty-three patients (47.8%) were randomized to EJA and 36 (52.2%) to IJA. The percentage of success was 72.7% with EJA and 88.9% with IJA (risk ratio = 0.82; 95% CI = 0.64 to 1.04;  $P$  = 0.09). Complications occurred in 2/33 (6%) EJA patients and in 1/33 (3%) IJA patient (risk ratio = 2.1; 95% CI = 0.2 to 22.6;  $P$  = 0.28). Besides central venous catheterization failure, the only complications were carotid puncture (one patient in IJA) and external hematoma (two patients in EJA).

**Conclusions** The external jugular venous access is a good alternative to internal venous catheterization and it is associated with minor and low complication rates. Our results show a lower but not significant probability of success with the EJA. However, considering that the procedure was done by physicians not familiar with the technique, we did not find definite evidence to indicate that IJA is superior to EJA.

#### P63

##### **Liver transplantation in 48 patients with fulminant hepatic failure**

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Fulminant hepatic failure (FHF) is the most dramatic hepatic disease and is associated with high mortality. Urgent liver transplantation (LT) is the treatment of choice for these patients. From January 2002 to November 2008, 86 patients presented to the hospital with FHF. All patients met the King's College criteria at the time of listing for urgent LT. Drug hepatotoxicity was the most common etiology, affecting 37% of the patients. Methyldopa was the most frequent agent. Thirty-five percent of the patients had cryptogenic FHF, and 14% due to acute hepatitis B virus infection. From 86 patients with FHF, 48 were submitted to LT (36 women

and 12 men). During this period there were 181 patients submitted to nonurgent LT. The mean time interval between listing and LT was 2.2 days. MELD scores ranged between 26 and 61 by the time of LT (mean, 41). Patients' median age was 37 years (range, 16 to 70). According to the Briceno score, 75% of hepatic grafts were retrieved from extended criteria donors. Donors were 40 years old or more in 54% of the cases (mean age of 41 years). The 1-year patient actuarial survival rate of transplanted patients with FHF was 57.1% and the 3-year actuarial survival rate was

54.1%. Forty-two percent of the patients died early after the transplant. The main cause of early mortality was sepsis/multisystem organ failure, and late mortality was related to immunosuppressive therapy noncompliance. The mean patient follow-up was 16 months (range, 0 to 57). Another 36 patients with FHF referred to us died while awaiting LT. Only one patient survived without LT. In conclusion, despite the high mortality rate, urgent LT is still the best therapy for patients with FHF.