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Basic science

P1

Decreased activation of NF- κ B and expression of related genes in IRAK-1^{SNP 532} neutrophils from volunteers exposed to endotoxin and in unstimulated neutrophils from septic patients

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Introduction Neutrophils have been involved in sepsis-induced organ damage. Neutrophils could be directly activated by TLR binding ligands including LPS. IRAK-1 is one of many intracellular proteins that are activated upon stimulation of TL receptors. This triggers a series of events that results in the migration of NF- κ B into the nucleus and the activation NF- κ B-dependent genes.

Objectives To identify a single nucleotide polymorphism at position 532 (coding SNP) in volunteers and patients with sepsis. To determine whether IRAK-1^{SNP532} results in a decrease in neutrophil NF- κ B activation in volunteers and patients with sepsis. To evaluate neutrophil gene expression patterns in IRAK-1^{SNP532} and wildtype patients with sepsis.

Methods Thirty severe sepsis patients and 34 healthy volunteers were enrolled in this study. Peripheral blood was obtained and neutrophils were isolated by plasma-percoll gradients after dextran sedimentation of erythrocytes. Neutrophils from volunteers were resuspended in RPMI and cultured with or without 100 ng/ml LPS for 60 min. The electrophoretic mobility shift assay technique was used to measure the NF- κ B activation. Real-time PCR allelic discrimination assays were developed by the assay-by-design service offered by Applied Biosystems (Foster City, CA, USA). Probe and primer combinations were designed at the single nucleotide polymorphism 532. PCR reactions were performed according to the manufacturer's manual using the Applied Biosystems 7500 Real-Time PCR system. Microarray analysis was used to evaluate the neutrophil gene expression in unstimulated neutrophils and after LPS stimulus.

Results The median AUC for NF- κ B activation was higher in wildtype genotyped neutrophils as compared with IRAK-1^{SNP532} genotyped neutrophils (85.2 vs 100.5, $P = 0.05$) (Fig. 1). In terms of kinetics pattern, we found some differences on nuclear levels of NF- κ B in neutrophils from volunteers cultured with LPS. At 30 min after LPS, the culture nuclear translocation of NF- κ B was significantly greater in wildtype genotyped neutrophils than in IRAK-1^{SNP532} genotyped neutrophils. Even after 60 min, the NF- κ B translocation remained high in wildtype genotyped neutrophils, while in IRAK-1^{SNP532} genotyped neutrophils the NF- κ B translocation was similar to baseline (Fig. 2). In unstimulated neutrophils from septic patients, the NF- κ B translocation was significantly lower in IRAK-1^{SNP532} genotyped neutrophils than in

Figure 1

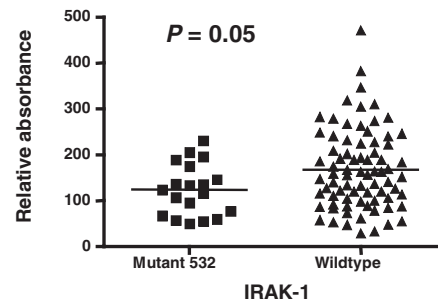


Figure 2

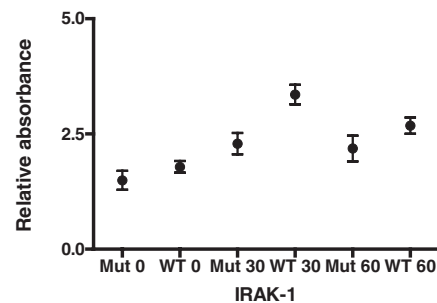
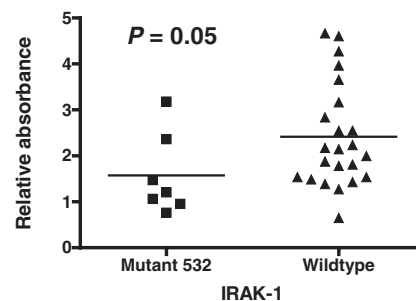


Figure 3



wildtype genotyped neutrophils (1.20 vs 2.10, $P = 0.05$) (Fig. 3). Finally, the expression of some inflammatory related genes (IL-8, IL1 β , MIP-2, COX-2, and SOD2) was decreased in IRAK-1^{SNP532} genotyped neutrophils.

Conclusion IRAK-1^{SNP532} genotyped neutrophils from volunteers (after LPS *ex vivo* challenge) and from septic patients are associated with lower NF- κ B activation and lower expression of some IRAK1-related genes. These results demonstrate that IRAK1

plays a critical role in the inflammatory response and, potentially, a polymorphism in IRAK1 may alter the immune response impacting clinical outcome.

P2

Gene expression and intracellular NF-κB activation after HMGB1 and LPS stimuli in neutrophils from septic patients

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Introduction Neutrophils play a major role in sepsis-induced organ dysfunction, especially in the lung. HMGB1 has emerged as a late cytokine and is implicated in the perpetuation of inflammatory stimulus and organ dysfunction development as well. There are limited data about neutrophil response patterns to HMGB1 in septic patients, and whether those patterns could be different from those following LPS exposure.

Objectives To evaluate the differences of gene expression and activation of NF-κB, Akt, and p38MAPK in blood neutrophils from septic patients exposed to HMGB1 and LPS; and to compare response patterns between blood neutrophils from patients and healthy volunteers.

Methods Twenty-two sepsis-induced acute lung injury patients and 34 healthy volunteers were enrolled in this study. The primary clinical variables collected were the 28-day survival and the presence of shock at ICU admission. Peripheral blood was obtained and neutrophils were isolated by plasma-percoll gradients after dextran sedimentation of erythrocytes. Neutrophils were resuspended in RPMI and cultured with or without 1000 ng/ml rHMGB1 or with or without 100 ng/ml LPS for 15, 30, and 60 min. The electrophoretic mobility shift assay technique was used to measure the NF-κB translocation, while western blot analysis was used to determine Akt phosphorylation and an ELISA was used to determine p38MAPK phosphorylation. Microarray analysis was used to evaluate the neutrophil gene expression in unstimulated neutrophils and after either HMGB1 stimulus or LPS stimulus. *P* < 0.05 was considered significant.

Results Although with some similarities, HMGB1 and LPS induced distinct patterns of gene expression in peripheral blood neutrophils from septic patients. A Venn diagram (Fig. 1) displays genes upregulated greater than twofold that are both common and unique after both stimuli. Using functional ontology, the genes upregulated by both HMGB1 and LPS primarily consisted of cytokines, chemokines, coagulation-related proteins, phosphatases, and transcriptional regulators factors. Importantly, while HMGB1 induced an HMGB1-related gene downregulation, LPS did not induce any changes in HMGB1 gene expression in these patients. Regarding intracellular activation, both HMGB1 and LPS increased translocation of NF-κB and the phosphorylation of Akt and p38MAPK in neutrophils from septic patients. However, there were some differences in terms of the degree and kinetics of activation between neutrophils cultured with LPS and HMGB1 (Fig. 2). There are no important differences in terms of intracellular activation when we compared neutrophils from septic patients with those from volunteers. Finally, neither NF-κB translocation nor kinase phosphorylation was associated with sepsis severity. However, the majority of genes in unstimulated neutrophils and after HMGB1 had a higher expression in mild patients. In contrast, CCL20, CCRL2, CIAS1, PTGER, PTX3, and MAP3K8 had a higher expression in severe patients only after LPS stimulus.

Figure 1

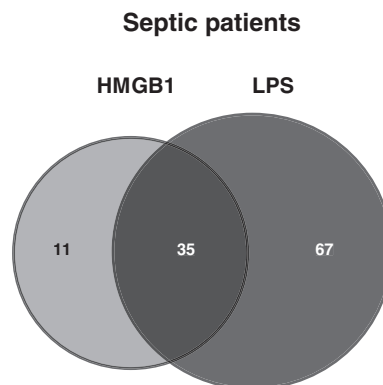
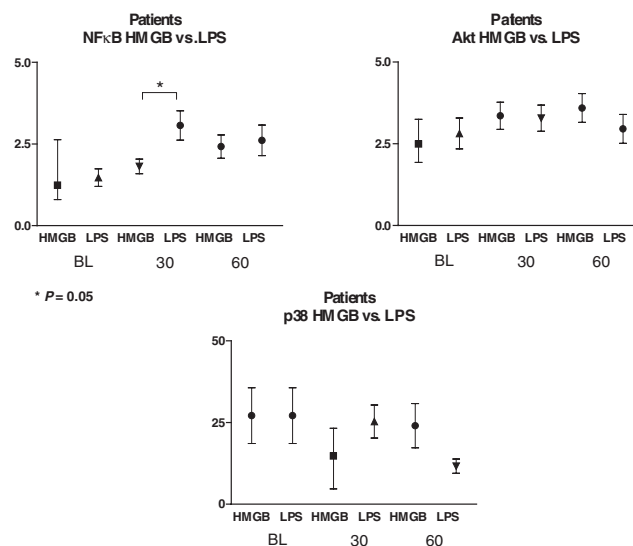


Figure 2



Conclusion Although with some similarities, HMGB1 and LPS induced distinct pattern of gene expression in neutrophils from septic patients. Both stimuli were able to increase intracellular activation and this activation was similar to that found in neutrophils from volunteers, showing that even after sepsis stimulus the neutrophil keeps its ability to respond to a second hit.

P3

Macrophage chemoattractant protein 1 and outcome in cardiopulmonary bypass

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Introduction Cardiopulmonary bypass (CPB) is associated with systemic inflammation that involves a number of cytokines, and, despite scarce data, macrophage chemoattractant protein 1 (MCP-1) could be implicated in postoperative organ dysfunction. This pilot study attempted to describe perioperative circulating

levels of MCP-1 and to investigate possible correlations with the intensity of postoperative organ dysfunction.

Methods Under informed consent, 20 patients submitted to cardiac surgery with CPB were consecutively studied. MCP-1, macrophage migration inhibitory factor (MIF), IL-6 and IL-10 were assayed by ELISA in peripheral blood sampled at anesthesia induction and 3, 6, 10 and 24 hours post-CPB. Data were analyzed by ANOVA for repeated measures with the Bonferroni test, and the two-tailed Spearman test for correlations with postoperative outcomes, as measured by the multiple organ dysfunction score at the third postoperative day (MODSd3). Significance was assumed for $P < 0.05$.

Results Similar to MIF and IL-6, blood levels of MCP-1 significantly changed after CPB. From baseline levels (69.44 ± 15.92 pg/ml), MCP-1 reached peak values 3 hours post-CPB (387.11 ± 108.87 pg/ml), and progressively declined thereafter. MODSd3 was associated with the levels of MCP-1 measured at anesthesia induction ($P = 0.010$, $\rho = 0.606$) and at 6 hours post-CPB ($P = 0.037$, $\rho = 0.508$). Levels of IL-6, 6 hours post-CPB, were also associated with MODSd3 ($P = 0.008$, $\rho = 0.616$).

Conclusion CPB-induced levels of MCP-1 and IL-6 were related to postoperative outcome. Additionally, preoperative levels of MCP-1 were also related to postoperative outcome. Although of limited sample size, these findings can stimulate further studies to explore the role of MCP-1 in the prediction of, and also as a potential therapeutic target in, post-CPB organ failure.

P4

Macrophage migration inhibitory factor as a diagnostic tool for acute coronary syndrome

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Introduction Inflammatory activity is recognizably enrolled in the physiopathological basis of acute coronary syndrome (ACS). Considering the diagnostic challenge related to ACS when typical electrocardiographic (EKG) findings are absent, we evaluated the role of migration inhibitory factor (MIF), soluble CD40 ligand (CD40L) and IL-6 in this scenario.

Design A prospective, observational, cohort pilot study.

Setting The emergency division at a tertiary care cardiology center.

Methods Under informed consent, patients whose main complaint was chest pain were considered eligible. Exclusion criteria consisted of associated neoplastic, infectious or inflammatory disease as well as EKG with ST-segment elevation above 1 mm. Within the first 12 hours of admission, venous blood was sampled for sCD40L, MIF and IL-6 assays (ELISA-sandwich; R&D Systems, Minneapolis, MN, USA). A high risk for ACS was defined by nuclear image, angiographic and/or enzymatic criteria (troponin I > 1.0).

Results From 195 patients included, 69 (35.4%) were considered under high risk for ACS and 126 (64.6%) as non-ACS patients. Within the overall patients, a positive bidirectional correlation was observed between sCD40L and MIF, and a negative correlation was observed between each of these and IL-6. After principal component analysis, non-parametric tests showed significant differences between the two groups concerning levels of MIF ($P < 0.0001$) and IL-6 ($P = 0.012$). For discrimination of patients under high risk for ACS, areas under the receiver operator curves for MIF and IL-6 were 0.69 and 0.61, respectively.

Conclusion In spite of complex interactions among inflammatory mediators, levels of MIF are independently related and possibly have a role in the identification of patients under high risk for ACS among those with chest pain without ST-segment elevation. Further studies are needed to explore MIF potential as a new diagnostic tool in ACS.

P5

Study of polymorphisms in the genes for TNF- α in pediatric patients in the ICU of Instituto Fernandes Figueira – Fundação Oswaldo Cruz

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Recent advances in molecular biology and genomics have led to increased understanding of the pathophysiological process directly relevant for pediatric intensive care, such as sepsis, ARDS and multiple system organ failure. Several point mutations, called single nucleotide polymorphisms (SNPs), have been identified. The gene of the inflammatory cytokine TNF- α has been indicated as an important candidate for such studies since it has an important function on immuno-inflammatory response, and important SNPs have already been identified. Among these, those that can be detached are those located at positions -863 (C \rightarrow A) and -308 (G \rightarrow A) in its promoter region, which can be related directly with the expression of this cytokine and, consequently, with the regulation of the circulating levels of the protein. The aim of this study was to evaluate the polymorphism of the TNF- α gene in positions -863 and -308 in the group of pediatric patients with sepsis/SIRS in the ICU of the Fernandes Figueira Institute – FIOCRUZ. The DNA was extracted from samples of whole blood and with swabs containing oral mucosal cells (in patients that had received blood transfusion) with a mixture of detergents. The molecular determination of the genotypes was carried out using the techniques of PCR-restriction fragment length polymorphism for position -308 and PCR-amplification refractory mutational system for position -863. Eighty-five patients of both sexes and with age varying between 0 and 12 years, with sepsis/SIRS, were admitted. The genotypic frequencies were GG (0.8) and GA (0.2) for -308, and CC (0.77), CA (0.22) and AA (0.01) for -863. The allelic frequency for -308 was G (0.9) and A (0.1), while for -863 it was C (0.88) and A (0.12). Through the analysis of the possible genotypic combinations, it was observed that the more frequent haplotype was CG (0.78) and, using analyses of maximum likelihood, it was verified that the locus did not meet in linkage disequilibrium. The population in this study was in Hardy-Weinberg equilibrium for both the studied polymorphisms. The present study evaluated the genetic characterization of locus TNF- α in this population of pediatric patients with sepsis/SIRS of the metropolitan region of Rio de Janeiro, being comparable with population data of studies in other countries. However, other studies using controls groups should be performed to verify the utility of these polymorphisms as molecular markers for sepsis severity or susceptibility.

Cardiology

P6

Electrocardiographic disturbances after cardiac surgery in patients with coronary disease

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Crit Care 2005, **9(Suppl 2)**:P6 (DOI 10.1186/cc3550)

Introduction The risk of mayor cardiovascular events in the postoperative period can reach up to 25%, particularly if there were CAD antecedents.

Methods A prospective study in patients with CAD diagnosed by complementary examination (arteriography) or clinical history (MI, angina), monitored in the first 24 hours of the postoperative period, using the system of continuous electrocardiography monitoring (Holter®) of three canals and myocardial injury markers (CPK, MB and troponin).

Results Initial inclusions involved seven (70%) male patients and three (30%) female patients; the age varied from 48 to 90 years, with an average of 66 years and a mode of 56 years. The APACHE varied score from 4 to 14 with a mode of 14, and the median risk of death was 5%. Three patients (30%) had antecedents of coronary artery bypass graft and three (30%) patients of angioplasty; four patients had recent coronary arteriography with injuries of up to 60% in up to two vases. Arrhythmias had been present in all the patients, being supraventricular extrasystole and supraventricular tachycardia in five (50%) patients and ventricular extrasystole in five (50%) patients. Three (30%) patients had presented silent myocardial ischemia with disturbances in the ST segment varying from 2.0 to 3.4 mm in at least two canals, with positive trooping in two (20%) patients, although an echocardiogram of stress with dobutamine (previous to surgery) was negatively affected in two of these patients. We did not have death occurrence, having only prolongation of hospital internment in the three patients with myocardial ischemia.

Conclusion The occurrence of myocardial ischemia in patients with CAD can be a frequent event and, despite evaluation daily post surgery, must always rigorously be monitored.

Reference

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P7

Clinical impact of atrial electric stabilization in patients with chronic atrial fibrillation undergoing cardiac surgery

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Crit Care 2005, **9(Suppl 2)**:P7 (DOI 10.1186/cc3551)

Introduction Atrial fibrillation (AF) is frequent in patients undergoing cardiac surgery (CS). Despite the high prevalence of chronic AF in patients with valvular heart disease, few studies have assessed the clinical evolution of these patients when undergoing CS.

Objective To assess the clinical outcome of patients with chronic AF undergoing CS who evolved with electric atrial stabilization in the immediate postoperative period (IPO).

Methods A prospective and observational study of patients undergoing CS with extracorporeal circulation (ECC) divided into two groups: Group 1 (G1), patients who maintained AF; and Group 2 (G2), patients who reverted to AF in the IPO. The following preoperative (PRE) parameters were assessed: left ventricular (LV) and right ventricular function; functional class; left atrium (LA) size (>5 mm); LV hypertrophy (>12 mm); presence of SAH, DM, COPD, CAD; use of AA drugs; and LBBB. The following perioperative (PER) parameters were assessed: atrial thrombus; plication of the atrial auricle; time of ECC and of anoxia; and chemical and/or electric CV. The following variables influenced the clinical outcome: mechanical ventilation time (MVT), ICU length of stay (ICULOS), hospital length of stay (HLOS), and maintenance of AF. The statistical analysis involved the following tests: Student *t* test, Fisher exact test, and Mann-Whitney test.

Results G1 comprised 21 patients (14 women, 66.6%) with a mean age of 52.6 years, and G2 comprised 33 patients (15 women, 45%) with a mean age of 49.8 years (*P* = not significant). No statistical difference was observed in regard to the PRE and PER variables, except for the LA size >5 mm (G1 85.7%, G2 45%, *P* = 0.0031), MVT, ICULOS, and HLOS. Of G1 patients, only one (4.7%) reverted his rhythm to sinus rhythm, while 24 patients (72.7%) in G2 maintained their sinus rhythm until ICU discharge (*P* = 0.000022).

Conclusion In this sample, LA size was the major predictor of maintenance of AF, which did not determine greater morbidity. Once AF is reverted, however, one should not restrain efforts to maintain atrial electric stability.

P8

Clinical impact of the prophylactic use of intra-aortic counterpulsation in high-risk patients undergoing myocardial revascularization

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Crit Care 2005, **9(Suppl 2)**:P8 (DOI 10.1186/cc3552)

Introduction The use of the intra-aortic balloon (IAB) has been well established in the clinical management of patients with problems such as refractory myocardial ischemia, cardiogenic shock, and difficulty in weaning from extracorporeal circulation (ECC). However, the literature lacks evidence supporting the 'prophylactic' use of the IAB in high-risk patients undergoing myocardial revascularization (MR).

Objective To assess the clinical outcome of surgical high-risk (HR) patients undergoing MR, who received a 'prophylactic' IAB.

Methods A prospective and observational study of a population undergoing elective MR. High-risk patients were defined as those having severe LV dysfunction (EF <35%) on TT ECHO and/or lesion in the left main coronary artery (obstruction >50% of the luminal diameter). The sample was divided into two groups: Group 1 (G1) with 'prophylactic' IAB, and Group 2 (G2) without IAB. The influence of the following variables on clinical outcome was assessed: use of amines; fluid balance (FB) in the perioperative period (PER); time of ECC, anoxia, and mechanical ventilation (MVT); ICU length of stay (ICULOS); hospital length of stay (HLOS); complications of the procedure; and death.

Results G1 comprised 16 patients (87.5% men) with a mean age of 61.6 (SD 8.6) years, and G2 comprised 39 patients (87.1% men) with a mean age of 56 (SD 8.0) years (*P* = not significant). No difference was observed between the groups regarding the

other base variables, except for BMI ($P = 0.00035$). In regard to clinical outcome, only FB in the PER (G1 median 1695 ml, interquartile interval [IiQ] 923–1865; G2 median 2061 ml, IiQ 1257–2860, $P = 0.03$) and MVT (G1 median 11.5 hours, IiQ 7–26 hours; G2 median 8 hours, IiQ 5–12 hours) had statistical significance. No significance was observed regarding the use of amines, time of ECC, ICULOS, HLOS, and death. No complications inherent to IAB use were observed.

Conclusion The 'prophylactic' use of the IAB showed no benefit regarding morbidity and mortality in the population studied. The greater blood volume replacement and prolonged MVT emphasize the need for care when indicating this procedure.

P9

Neurologic complications in cardiac surgery: can risk scores be applied?

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Introduction Neurologic complications (NC) in cardiac surgery are not rare (5–15%). Their etiopathogeny is multifactorial, and the risk factors are numerous. Neurologic complications result in high morbidity and mortality rates, and high hospital costs. Most risk scores assess mortality, and the risk for stroke assessed by the AHA/ACC score refers only to patients with coronary disease. One may thus question whether risk scores for NC can be applied in a general population.

Objective To assess the risk scores of patients with NC undergoing cardiac surgery.

Methods A retrospective observational study including information about 1431 patients from a databank, of whom 45 (3.1%) had reversible or permanent neurologic deficit. The sample was divided into two groups: Group 1 (G1), patients with NC; and Group 2 (G2), the historic control. The Cleveland score, Euroscore, and AHA/ACC score for stroke were assessed, as was the occurrence of death. The Student t test was used for analyzing the means of continuous variables.

Results G1 comprised 24 men (53.3%), and the mean age of patients was 63.5 (SD 13.6) years. The surgeries were as follows: 26 myocardial revascularizations (57.7%), 12 valvular replacements (26.6%), one combined (2.2%), two congenital (4.4%), and three aortic surgeries (6.6%). The means of the Cleveland score, Euroscore, and AHA/ACC score were: in G1: 4.5 (SD 3.3), 6.1 (SD 4.2), and 4.1 (SD 2.6), respectively; and in G2: 2.9 (SD 2.6), 3.6 (SD 2.8), and 2.5 (SD 2.5), respectively, with statistical significance ($P < 0.0001$, $P < 0.0001$, and $P < 0.0001$). The mortality rate was 24.4% in G1 and 9.2% in G2 ($P = 0.002$).

Conclusion The risk scores for cardiac surgery applied for mortality reflected a greater incidence of neurologic complications in this population.

P10

Cardiogenic shock: an experimental animal model

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Objective To create an experimental animal model of cardiogenic shock for learning and to test new therapeutic strategies.

Methods Adult white pigs (70 kg) received both intravenous anesthesia (acepromazine 0.3 mg/kg, midazolam 0.2 mg/kg, fentanyl 250 µg/kg, thiopental sodium 12.5 mg/kg and pancuronium 0.4 mg/kg) and inhaled anesthesia (halothane 1%), and were intubated and mechanically ventilated. An arterial line was obtained through dissection and puncture of the common femoral artery. A continuous cardiac output catheter (Edwards Lifescience, USA) was introduced through the dissected internal jugular vein and was positioned using the arterial pulmonary pressure curve, allowing monitoring of the right atrial pressure, pulmonary artery pressure, pulmonary wedge pressure (PAop) and SvO₂. Through median sternotomy, the pericardium was opened longitudinally and the heart was exposed. The baseline ECG and hemodynamic data were recorded and after a 6-0 polypropylene suture was passed under the proximal anterior descending coronary artery that was snared for up to 10–15 min. An ECG was then obtained to show typical ischemic alterations, and a regional myocardium color change and regional myocardial hypocontractility were observed. The presence of cardiogenic shock was defined by cardiac output index < 1.8 l/min/m², PAop > 20 mmHg and mean arterial pressure < 50 mmHg. The carotid artery and external jugular vein were cannulated and ECMO support was used (flow 100–150 ml/kg/min) after induced cardiogenic shock.

Results The model was tested in eight animals. Four animals died immediately after coronary occlusion because of ventricular fibrillation, and cardiogenic shock was reproduced in the other four animals and these animals were kept alive for 4 hours with supportive interventions (inotropic drugs and ECMO).

Conclusions The experimental animal model created by ischemic myocardial infarction induced cardiogenic shock and can be used to study and test new therapeutic strategies.

P11

Improvement of cardiac hemodynamics with inhaled nitric oxide after surgery in patients with mitral stenosis and severe pulmonary hypertension

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Background Mitral stenosis is frequently associated with increased pulmonary vascular resistance (PVR), pulmonary hypertension and right ventricular dysfunction that persist even after surgery. Inhaled nitric oxide (NO) has been shown to selectively reduce PVR in patients with pulmonary hypertension. We tested the hypothesis that NO would improve the hemodynamic effects and short-term clinical outcomes of patients with mitral stenosis and severe pulmonary hypertension undergoing cardiac surgery.

Methods Twenty-seven patients (three male, 24 female) with a mean age of 46.9 ± 12.9 years with mitral stenosis and elevated pulmonary artery systolic pressure (PASP) were randomly allocated to receive continuously inhaled NO at 10 parts per million (NO group) or oxygen therapy (control) for 48 hours immediately after surgery. The hemodynamic data, the number and doses of vasoactive drugs, the duration of stay in the ICU and short-term complications (infections, respiratory and/or renal failure, and death) were assessed.

Results The mean mitral valve area, gradient and PASP were 0.88 ± 0.20 cm², 15.7 ± 5.0 mmHg and 70.9 ± 10.3 mmHg, res-

pectively, for all patients. After 48 hours, patients receiving NO showed an increased cardiac index compared with patients receiving oxygen therapy, with a reduction in the number of vasoactive drugs used. There was a significant reduction in PASP in both groups compared with preoperative levels but no differences were observed between the groups. A tendency towards a reduction in pulmonary vascular resistance, ICU stay and acute complications was observed in the NO group but did not reach statistical significance.

Table 1

Group (n = 27)	NO (n = 14)	O ₂ (n = 13)	P
Cardiac index (l/min/m ²)	3.93 ± 0.9	2.65 ± 1.3	0.03
Number of vasoactive drugs used (n)	2.15 ± 0.15	2.57 ± 0.17	0.05
ICU stay (days)	5.88 ± 3.0	6.85 ± 2.3	0.4
Complications – infections, renal insufficiency, death (%)	25	50	0.36

Conclusions Use of inhaled NO immediately after surgery in patients with mitral stenosis and severe pulmonary hypertension improves cardiac hemodynamics and may have clinical benefits in short-term outcomes.

P12

Fast-track program in cardiovascular surgery

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Objective To study a group of patients included in a fast-track program after cardiovascular surgery concerning the medical, economical, psychological and dynamic conditions of the protocol in the ICU.

Materials and methods Seventy patients operated on from August to December 2000 were included. Inclusion criteria were: age, no operation events, hemodynamic stability and no comorbidity. Early extubation was achieved using bendiazepan antagonist (Flumazenil) and respiratory physiotherapy with noninvasive ventilation (CPAP or BIPAP). ICU discharge was on the first postoperative day.

Results Among the 70 patients, 57% were male with a mean age of 56.2 years. With regard to the type of operation, 74% were submitted to coronary bypass surgery, 17.1% to valve surgery, and 8.9% to another type of operation. The average extubation time was 153 min; 22% had hypertension and 2.8% were reintubated. From the psychological point of view, 95% of patients considered the shorter ICU stay satisfactory. With regard to the dynamics of the ICU, there was a 50% decrease in duration of ICU stay, and an increase of 30% in patient admission and a reduction of 40% in cost. No patient had significant clinical complication and no one was readmitted.

Conclusion A reduction of ICU stay was possible in selected patients with satisfactory medical and psychological conditions, as well as cost containment and greater availability of beds.

P13

Gap care in diagnostic and prognostic evaluation of chest pain in the elderly

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Introduction Despite the greater prevalence of coronary disease, aortic pathology and pulmonary thrombolysis in elderly patients, some studies have shown under-utilization of diagnostic and therapeutic resources in this age group.

Methods A total of 541 patients (220 [46%] female) attended the Hospital Pró-Cardíaco Chest Pain Center, Rio de Janeiro, Brazil, from January to December 2004. The patients were divided into four age groups: I: <65 years, n = 264 (48.7%); II: between 65 and 74 years, n = 131 (24.2%); III: between 75 and 84 years, n = 104 (19.2%); and IV: >85 years, n = 42 (7.7%).

Diagnostic and/or risk stratification tests (treadmill stress test, myocardial scintigraphy, pulmonary scintigraphy, stress echocardiogram, angio-tomography, angio-magnetic resonance, trans-esophageal echocardiography, coronariography) were analyzed and patients were divided into two groups: DIAG (patients with at least one test done) and NO DIAG (patients without any test done). The intrahospital mortality (MORT) rate was also analyzed and compared between the age groups.

Results Table 1 shows the diagnostic test evaluation and the intrahospital mortality rate according to age group.

Table 1

	<65 years	65–74 years	75–84 years	>85 years	P value
NO DIAG	60 (22.7%)	25 (19.1%)	34 (32.7%)	27 (64.3%)	<0.001
DIAG	204 (77.3%)	106 (80.9%)	70 (67.3%)	15 (35.7%)	<0.001
MORT	0 (0%)	1 (0.7%)	2 (1.9%)	1 (2.3%)	0.01

Conclusion Elderly patients, especially the 'oldest old', that come to the emergency room with chest pain have a greater likelihood of discharge without any diagnostic and/risk stratification test being performed, compared with younger patients. The intrahospital mortality rate increased with age. These findings show a gap in care of the elderly with chest pain, with in turn may be associated with a worse prognosis in that population.

P14

Treatment of acute coronary syndrome without ST-segment elevations in the elderly

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Introduction Studies have shown the efficacy of new strategies in acute coronary syndrome without ST-segment elevations (ACSWSTE). However, its implementation does not seem satisfactory, especially in elderly patients.

Objective To analyze the employment of the guidelines in the treatment of ACSWSTE.

Methods We analyzed two groups of patients in the ICU – GI, <65 years old ($n = 20$) and GII, ≥ 65 years old ($n = 34$) – based on alterations in the electrocardiogram (ECG), echocardiogram and cardiac enzymes. The invasive strategy, drug therapy, medical treatment, percutaneous and surgical revascularization were also studied. The Student *t* test, the chi-square test, and the Fisher's exact test were employed with a significance level of 5%.

Results The mean age was 68 ± 14 years; 61% were female. The risk factors were as follows: arterial hypertension – 76%, dislipidemia – 35%, diabetes – 32%, tobacco smoking – 24%. Around 54% had chronic coronary disease, and 24% and 22% had been previously submitted to angioplasty and revascularization surgery, respectively. On admission, 43% of the patients were under ASA therapy, 35% used AECI, 32% were under beta-blocker therapy, 28% used nitrate calcium antagonist, and 22% used statins. Hemodynamic instability and arrhythmias occurred in 6% and intensity of pain was, on average, 6 ± 2 . Non-specific ECG and inversion of the T wave occurred in 41% of the patients, and infra-ST elevations ($P = 0.046$) occurred in 20%. A larger number of patients in GII tested positive for troponin I and they presented larger global dysfunction ($P = 0.032$), segmental dysfunction ($P = 0.036$), TIMI risk score ($P = 0.012$), use of amiodarone ($P = 0.038$), and clopidogrel ($P = 0.016$) compared with GI, who used more beta-blockers ($P = 0.044$). The other variables were the same for both groups.

Conclusion We did not find significant differences in the therapy of elderly patients with ASWSTE, which suggests that the strategies adopted in the ICU have been satisfactorily used.

P15

D-dimer for myocardial infarction diagnosis in patients with acute coronary syndrome admitted to a chest pain unit

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Background D-dimer (Dd) is a thrombosis marker and is a well-established test for venous thromboembolism but its use for acute coronary syndromes (ACS) has few studies. We evaluated the accuracy of Dd for diagnosing non-ST-segment elevation myocardial infarction (NSTEMI).

Methods From January 2002 to December 2003, 531 patients were admitted to a chest pain unit (67.4 ± 13.5 years; 294 [55.4%] male) with probable ACS. Dd, electrocardiogram (EKG) and troponin I (Tnl) were systematically performed at admission, whereas EKG and Tnl were repeated 6 hours later. NSTEMI criteria were Tnl ≥ 1.0 ng/ml at any moment combined with the absence of ST elevation. The chi-square test evaluated the association between NSTEMI and positive Dd (≥ 500 ng/ml). We evaluated the operational characteristics of this diagnostic test as well.

Results Eighty-one (15.3%) patients met NSTEMI criteria. Overall, Dd was positive in 218 patients, from which 47 (21.6%) had NSTEMI. For the diagnosis of NSTEMI, Dd has shown a 58% sensibility, 62% specificity, 21.6% positive predictive value and 89.1% negative predictive value, resulting in 51.4% global accuracy. The positive likelihood ratio was 1.53 and the negative likelihood ratio was 0.68.

Conclusion Dd can be useful for NSTEMI exclusion as part of a chest pain unit routine blood sample protocol.

P16

On-pump versus off-pump coronary artery bypass grafting: relationship between complications and released cytokines after on-pump surgery

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Introduction Extracorporeal circulation may trigger an extensive inflammatory response and the release of cytokines, which can induce myocardial ischemia.

Objective The goal of this study was to evaluate the relationship between inflammatory markers and biochemical evidence of myocardial cell injury in patients who underwent coronary bypass grafting (CABG) with (on-pump) or without (off-pump) extracorporeal circulation.

Methods All patients had myocardial infarction with multivessel coronary artery disease with preserved ventricular function and without renal failure or other cardiac diseases. The mean age was 46.6 ± 12.5 years. Cytokines were measured 6 and 24 hours postoperatively by ELISA and immunoassay, and were correlated to the occurrence of the following clinical complications: fever, atrial fibrillation, significant pericardial effusion, pulmonary complications, and release of CK-MB and troponin I.

Results Of the 724 CABGs performed in a single-center tertiary hospital, 218 were off-pump and 506 were on-pump. The mean age was 46.6 ± 12.5 years and the mean time of extracorporeal circulation was 72 ± 23 min. Clinical complications were more frequent among on-pump patients (Table 1). This was associated with higher levels of C-reactive protein, CK-MB and troponin I, but not IL-6 (Table 2).

Table 1

Complication	On-pump	Off-pump	P
Atrial fibrillation	32	15	<0.002
Pericardial effusion, severe	4	0	<0.0001
Fever	6	2	0.03
Pulmonary	13	6	<0.002

Table 2

Cytokine	On-pump	Off-pump	P
C-reactive protein	11.2	4.6	<0.001
IL-6	0.6	0.5	Not significant
Troponin I	0.358	0.126	0.02
CK-MB	23.6	7.8	0.003

Conclusions Postoperative complications and biochemical evidence of myocardial cell damage after CABG were more frequent among on-pump patients, and this was correlated with higher serum levels of C-reactive protein.

P17

Prediction of right ventricular dysfunction in patients with pulmonary embolism

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Crit Care 2005, **9(Suppl 2)**:P17 (DOI 10.1186/cc3561)

Purpose Right ventricular dysfunction (RVD) is associated with adverse events in patients with pulmonary embolism (PE). An early diagnosis of RVD is thus necessary and may lead to a more aggressive approach. We investigated clinical, electrocardiographic and chest X-ray variables in patients with confirmed pulmonary embolism and proposed a model for prediction of RVD.

Methods A multicenter cohort included 625 patients, from January 1998 to May 2003, admitted with diagnosis of pulmonary embolism confirmed by: pulmonary angiography, helical computer tomography, magnetic resonance, echocardiography or lung scan. From 550 patients who had a 2D echocardiogram, 191 (34%) met RVD criteria (ventricular dilatation or hypokinesia). We investigated 28 clinical (risk factors, signs and symptoms), electrocardiographic and chest X-ray findings in those patients for correlation with RVD. After univariate analysis, we selected variables ($P < 0.20$) for logistic regression. C-statistics were determined and the independent variables were applied for building a model for RVD prediction.

Results In univariate analysis, gender, recent surgery (<30 days), chronic cor pulmonale, chest pain, tachycardia (>100 beats/min), syncope, tachypnea (>20 breaths/min), arterial hypotension (systolic BP <90 mmHg), cyanosis, right axis deviation, S1Q3T3 pattern, right bundle block (RBB) and T-wave inversion (V1–V4 leads) were selected for multivariate analysis. In logistic regression, recent surgery (OR = 0.37, $P = 0.004$), tachypnea (OR = 1.89, $P = 0.001$), hypotension (OR = 2.00, $P = 0.002$), S1Q3T3 pattern (OR = 3.33, $P < 0.001$), RBB (OR = 2.22, $P < 0.001$) and T-wave inversion (V1–V4 leads) (OR = 2.80, $P < 0.01$) were independent variables for prediction of RVD. The C-statistic was 0.71 and the resulting model presented a linear trend ($P < 0.01$).

Conclusion In this proposed model, simple bedside information such as recent surgery, tachypnea, hypotension, S1Q3T3 pattern, RBB and T-wave inversion can be used to predict RVD in patients with PE in clinical practice.

P18

Pulmonary acute edema: analysis of morbid-mortality in the ICU

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Introduction In order to analyze morbidity and mortality associated with pulmonary acute edema, a protocol was established with a prospective data collection.

Materials and methods From October 2003 to October 2004, 2012 patients were admitted to the ICU of Santa Lucia Hospital and 705 (35%) to the cardiologic ICU. All patients were analyzed prospectively and 39 patients had pulmonary acute edema as the primary cause of admission.

Results Thirty-nine patients had pulmonary acute edema. The mean age was 72.9 years old, 21 were women and 18 were men. Thirty-one (88.6%) out of this group had a history of high blood pressure and 24 (61.5%) related previous admissions by cardiac diseases. Thirteen (34.2%) patients were admitted with systolic blood pressure (SBP) ≥ 200 mmHg and 11 (28.4%) had SBP between 160 and 199 mmHg. Thirteen patients used sodium nitroprusside. The most frequent symptoms were respiratory insufficiency, observed in 79.5%, and tachyarrhythmia (56.4%). Seventeen (43.6%) patients needed intubation and mechanical ventilation. Four were submitted to non-invasive mechanical ventilation (NIMV) and 15 patients needed vasoactive drugs. The mean ICU stay was 9.4 days. The mortality rate was 28.2%.

Conclusion The high mortality associated with the high number of patients that needed tracheal intubation and ventilatory prosthesis shows the severity of disease. NIMV becomes an important therapeutic option to avoid intubation in selected patients.

P19

Heart rate variability of patients with acute myocardial infarction submitted to a physiotherapy intervention 24 hours after the cardiac event: phase I of cardiac rehabilitation

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Purpose To evaluate the heart rate (HR) variability at rest, during the deep breathing test (DBT) and during an exercise protocol, in patients with acute myocardial infarction (AMI) submitted to a hospital physiotherapy intervention 24 hours after the cardiac event. Additionally, to evaluate the safety of the protocol applied.

Methods and results Eight male patients (mean age 50 ± 12 years), admitted to the Coronary Care Unit of the Irmandade Santa Casa de Misericórdia de São Carlos with noncomplicated AMI, were studied. All patients were hemodynamically stable and used conventional medications. The patients were submitted to the hospital physiotherapy intervention 24 hours after their admission. The instantaneous HR was acquired and monitored by an HR monitor (Polar®S810i) during 10 min at rest pre-exercise, 4 min of DBT, 5 min of exercise protocol (active hand and foot exercises, and active-assisted lower extremities exercises) and 10 min at rest post-exercise in the supine position. The blood pressure (BP) was

Table 1 (abstract P19)

	RMSSD (ms)	RMSM (ms)	LF/HF ratio	LF (nu)	HF (nu)	HR (beats/min)	SBP (mmHg)	DBP (mmHg)
Pre rest	20 ± 9	31 ± 14	0.8 ± 0.6	41 ± 16	58 ± 16	65 ± 6	104 ± 12	70 ± 6
DBT	49 ± 21*	58 ± 28†	1.8 ± 1.3	56 ± 24	44 ± 24	65 ± 6	–	–
Exercise	20 ± 12	36 ± 15	2.4 ± 1.6‡	66 ± 14‡	34 ± 14‡	72 ± 6‡	113 ± 15‡	74 ± 6
Post rest	24 ± 16	32 ± 17	1.0 ± 0.7	45 ± 16	55 ± 16	65 ± 6	104 ± 14	73 ± 7

* $P < 0.05$, DBT vs pre rest and post rest; † $P < 0.05$, DBT vs pre-rest; ‡ $P < 0.05$, exercise vs pre rest and post rest.

measured before, during and after the exercise protocol. The R–R intervals (ms) were analyzed by time domain (RMSSD and RMSM) and frequency domain methods, and the power spectral components were expressed as normalized units (nu) at low (LF) and high (HF) frequencies, and as the LF/HF ratio. Data are presented as the mean \pm standard deviation (Table 1). The statistical analysis was performed by ANOVA and the Tukey post-hoc test with the level of significance set at 5%.

Conclusion The physiotherapy intervention protocol appeared to be effective as it induced hemodynamic repercussion and modification of the autonomic control of HR, without any clinical intercurrentence.

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P20

The use of the SOFA score to analyze the profile and severity of organ dysfunction in patients with cardiovascular disorders

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Background Multiple organ dysfunction has become the leading cause of morbidity and mortality in intensive care, making it necessary to understand, test and validate evaluation systems for this syndrome.

Objective To evaluate the profile of clinical evolution and severity of cardiovascular patients using a dysfunction organ score (Sequential Organ Failure Assessment [SOFA]).

Design An observational cohort study.

Patients A total of 569 consecutive cardiovascular patients (326 men, 243 women) admitted to the cardiointensive unit (CIU) between July 2003 and December 2004. Patients with an ICU stay shorter than 12 hours were excluded.

Measurements and main results To assess the organ dysfunction, we collected data of assailed organ systems, individually, and the total maximum SOFA (TMS). We analyzed the association between basic cardiovascular pathology and admission diagnosis with higher dysfunction organ scores and their impact on mortality. The mean age was 61.1 years, and the length of CIU stay was 5.8 days, with CIU mortality of 13.3%. The median TMS was 3.86, significantly higher in non-survivors (12.0 vs 2.0, $P < 0.001$). The organ dysfunction, individually or in association, was correlated with higher mortality, and respiratory dysfunction was the highest prevalent (57.3%). With respect to cardiovascular pathology, although there was higher prevalence of ischemic, hypertensive and rheumatic pathology, just the dilated non-ischemic cardiomyopathy (24% non-survivors, $P = 0.046$) was correlated with higher mortality. Analyzing the admission diagnosis, the presence of cardiogenic shock (72.7% non-survivors, $P < 0.0001$), pulmonary infection (47.3%, $P < 0.0001$) and congestive heart failure (27.3%, $P = 0.12$) associated with higher scores of organ dysfunction and higher mortality. The acute coronary syndrome without ST-segment elevation and atrial arrhythmias, although of higher prevalence, were correlated with lower mortality.

Conclusion The SOFA score allowed a simple and effective evaluation of organ dysfunction severity profile in patients with heart disease, identifying high morbidity and mortality diseases and high-risk groups, that will enable earlier therapeutic measures and increased monitorization.

P21

ST-segment elevation myocardial infarction: analysis of consecutive series of patients and later follow-up

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Introduction Arteriosclerotic coronary disease is one of the leading causes of death worldwide. In order to analyze patients admitted with ST-segment elevation myocardial infarction (STEMI) diagnosis, a databank was established to collect information about the clinical condition and late follow-up.

Materials and methods One hundred and ninety-three patients with acute coronary syndromes (ACS) admitted to the ICU of Santa Lucia Hospital from October 2003 to October 2004 were analyzed. A total of 37.8% developed STEMI. The data were collected prospectively.

Results Seventy-three patients had STEMI. The mean age was 61.4 years, and 55 were men. The most common risk factor was hypertension (46/65.7%). Thirty-three patients (45.2%) showed previous history of ACS, and 14 out of this group had previous infarction. Nine patients had been submitted to coronary artery bypass graft (CABG) previously, and nine to angioplasty with stent implantation. The anterior descendent artery territory was the most common affected. Thirty-four patients (46.6%) were submitted to thrombolysis and 14 out of this group received this treatment in other hospitals. After thrombolysis, 17 patients realized rescue angioplasty and six realized CABG. Primary coronary angioplasty was made in 22 patients, and 77% of them had a stent placed immediately. The coronary arteriography was made in 93.2% of the patients admitted with STEMI. Patients were stratified by the TIMI score for STEMI, and 30.8% of them showed score ≥ 6 . This series has a 12.3% mortality rate. The follow-up was made by telephone contact with 89.3% of the patients more than 6 months from the event. Twenty-eight of them were readmitted by cardiac causes and there was no late mortality.

Conclusion The high TIMI score justifies the high mortality observed in this series. This occurs because Santa Lúcia Hospital is a reference center for cardiology in Brasília.

P22

Records of inhospital cardiopulmonary resuscitation in a medical cardiologic ICU

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Introduction New techniques have been used in cardiopulmonary resuscitation (CPR) since the introduction of closed cardiac massage in 1960. Despite this progress, there was no significant improvement in survival rates after inhospital cardiac arrest over the past 40 years. In a general hospital, survival rates at discharge, not considering specifically ICU patients, is around 15–20%. Few data are available considering survival in cardiologic critical care units.

Methods Between April 2004 and December 2004 we recorded and analysed all attempted cardiopulmonary resuscitation in a medical ICU of a teaching cardiologic hospital. The patients were

64 ± 20 years. Forty-four (62.8%) were male and 26 (37.2%) were female. Diagnosis at admission to the ICU were: cardiogenic and/or septic shock, 37.2%; heart failure (NYHA IV), 20%; acute coronary syndrome, 21.4%; acute respiratory failure, 10%; others, 11.4%. Associated diseases: acute renal failure, 68.5%; hypertension, 60%; diabetes mellitus, 37.2%; COPD, 10%; infection, 91.5%. Using an Utstein-based template, data were collected immediately after each resuscitation, by physicians who have performed CPR. They were previously certified in Advanced Cardiac Life Support.

Results Seventy cardiopulmonary arrests were recorded in 50 patients. Of these, 49% returned to spontaneous circulation and 4% had hospital discharge. Twelve patients had more than one event. The first pulse rhythm was divided as follows: VF/VT (14.08%), asystole (19.7%), PEA (66.22%). Predictive factors of return to spontaneous circulation in univariate analysis were: time from ICU admission to cardiopulmonary arrest ≤7 days ($P = 0.03$), age <75 years ($P = 0.003$), time of CPR <18 min ($P = 0.0001$). In multivariate analysis, only the time from admission to the ICU to cardiopulmonary arrest ≤7 days was predictive of return to spontaneous circulation ($P = 0.015$, odds ratio 1.19, 95% CI 0.6–5.9).

Conclusion Survival after CPR in cardiac patients is poor. Considering our population, it is lower than that observed in general hospital patients. These data could help physicians in attempting resuscitation, and patients and families in making end-of-life decisions.

P23

Correlation between B-type natriuretic peptide and N-terminal pro-brain natriuretic peptide in patients presenting to an emergency department with decompensated heart failure

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Background B-type natriuretic peptide (BNP) and N-terminal pro-brain natriuretic peptide (NT-proBNP) have been used to assess patients with heart failure. Few studies have compared both markers in patients who present to the emergency department (ED) with decompensated heart failure (HF).

Methods We studied 40 patients who presented to an ED with decompensated HF diagnosed by means of clinical judgement (Framingham criteria). The mean age was 80.3 ± 10.4 years, and 18 (45%) were male. Thirty-four (85%) patients were NYHA class III or IV. Ischemic HF was present in 25 (62.5%) patients. The mean ejection fraction was 46 ± 19.2%. Both BNP and NT-proBNP were measured at the moment of admission to the ED. The correlation between the two markers was assessed by the Pearson coefficient test.

Results Mean values for BNP and NT-proBNP were 943.2 ± 821.2 and 10,436.7 ± 14,721 pg/ml, respectively. A strong correlation was observed between the two markers ($r = 0.81$, $P < 0.001$). NT-proBNP values were much higher than BNP values in all patients but one, whose values were 165 pg/ml and 1620 pg/ml.

Conclusion A good correlation was observed between BNP and NT-proBNP. The ratio between NT-proBNP and BNP was much higher than usually reported in outpatient settings. This could reflect a proportionally greater reduction in renal elimination of NT-proBNP in this population with severe decompensated HF.

P24

B-type natriuretic peptide as a risk predictor of long-term outcomes in heart failure patients

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Background Hospitalization for decompensated heart failure (DHF) carries a poor prognosis, with frequent readmissions. The B-type natriuretic peptide (BNP) is secreted by an overloaded left ventricle, and the prognostic value of the admission BNP assay has not been established for patients with DHF.

Objective To determine the prognostic value of admission BNP in patients hospitalized due to DHF.

Methods We conducted a prospective observational cohort study in 63 consecutive patients admitted to the coronary care unit with DHF between January and December 2003. Clinical features and outcomes were recorded. BNP was measured on admission and correlated with the combined end point of death and readmission for DHF. Patients were followed up for at least 12 months.

Results Baseline characteristics and main outcomes of this cohort were: 50.8% of patients were male, mean age was 77.3 years and 85.7% of patients were in NYHA class IV. In-hospital mortality was 12.7%. Through ROC curve analyses a BNP cutoff level of 1160 pg/ml was defined, and on Kaplan–Meier curves it turned out to be strongly related to death or readmission ($P = 0.0076$).

Conclusion A high admission BNP level is a strong predictor of death or readmission in patients hospitalized for DHF.

P25

Is anemia a predictor of in-hospital complications and mortality in decompensated heart failure?

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Background Anemia is a common finding in decompensated heart failure (DHF) and is associated with high mortality rates. Mechanisms for association between these syndromes are unclear and are probably multifactorial.

Objective To identify contributing factors for anemia and its contribution for a worse prognosis in patients with DHF.

Methods From January 2003 to December 2004, we studied a cohort of 135 patients (54% male, mean age 76.5 ± 11.08 years, 79.6% NYHA class IV) admitted to the coronary care unit due to DHF. They were divided into three groups (G) according to admission hemoglobin (Hgb) (G1: Hgb >12 g/dl; G2: Hgb = 10–12 g/dl; G3: Hgb <10 g/dl), and baseline demographics, laboratory findings, need of blood transfusion, in-hospital complications and mortality were compared. Statistical analyses were performed with the Kruskal–Wallis test (laboratory findings) and Pearson's chi-square test (other variables).

Results Most of the patients were in G1 (54.1%) (G2 = 37.1%; G3 = 8.8%). Patients in G3 (male 66.6%, $P = 0.002$) had more previous history of renal dysfunction (41.7%, $P = 0.003$), higher levels of B-type natriuretic peptide ($P = 0.03$) and D-dimer ($P = 0.001$), needed more blood transfusions (66.7% of patients, $P < 0.0001$) and all patients had at least one complication ($P = 0.039$). Importantly, in-hospital mortality rates were

significantly different among groups (G1 = 4.1%, G2 = 3.8%, G3 = 33.3%, $P = 0.003$).

Conclusions In DHF, anemia is a strong predictor of in-hospital mortality and complications. Increased prevalence of renal dysfunction and necessity of blood transfusion observed in these patients may be related to the mechanisms of higher mortality.

P26

Correlation of B-type natriuretic peptide and electrocardiographic alteration at presentation and prognosis in patients with non-ST-segment elevation myocardial infarction

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Background Elevated levels of B-type natriuretic peptide (BNP) drawn at presentation and concomitant cardiac troponin I (cTnI) after coronary heart disease associated with electrocardiographic alterations for high mortality. Sparse data are available on its use at first presentation with non-ST-segment elevation myocardial infarction (NSTEMI).

Objectives We sought to evaluate BNP, alone and in comparison with cTnI and electrocardiography alterations, for risk assessment at initial presentation NSTEMI.

Methods We obtained samples from 50 patients presenting within 6 hours of NSTEMI admission to our coronary unit care with electrocardiography alterations, and measured BNP/troponin I at 0 hours and 6–12 hours after admission. All patients underwent coronary angiography for treatment of NSTEMI.

Results Of 50 patients, 42 were men. The mean age was 67.3 years. The median BNP was higher in patients who died (89 pg/ml, 25th–75th percentile: 40–192), compared with survivors (15 pg/ml, 25th–75th percentile: 8.8–32, $P < 0.0001$). Patients with BNP >80 pg/ml were at significantly higher risk of death (17.4% vs 1.8%, $P < 0.0001$). Cardiac troponin established a gradient of mortality between the highest and lowest quartile (7.9% vs 0%, $P = 0.007$). Patients with BNP >80 pg/ml were also more likely to have impaired coronary flow ($P = 0.049$) and more electrocardiography alterations of the ST segment ($P = 0.05$).

Conclusions Increased concentrations of BNP at initial presentation of patients with NSTEMI are associated with electrocardiography alterations and cTnI impaired reperfusion after coronary angiography and higher short-term risk of mortality. These data support the value of combining markers of hemodynamic stress with traditional approaches to risk assessment in non-ST elevation of myocardial infarction.

P27

Cardiac surgery in octogenarians

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Background Cardiovascular disease is the leading cause of morbidity and mortality among the elderly, and the rate of invasive cardiovascular procedures in this population is rising, including cardiac surgery (CS). The goal of this study was to analyze the clinical characteristics and outcomes of CS in octogenarians.

Methods An analysis of consecutive CS in a single-center tertiary hospital over a 30-month period.

Results Among 504 consecutive CS, 30 patients (6%) were older than 80 years (group O, age 83 ± 3). They were compared with a control group of 60 patients younger than 65 years (group Y, age 52 ± 10) whose demographic characteristics were paired 2:1. Eighty-three percent of group O were operated on because of an unstable clinical condition versus 28% of group Y ($P = 0.02$). Preoperative left ventricular dysfunction was present in 43% of group O and 30% of group Y ($P = 0.06$). CABG without extracorporeal circulation was performed in 21% of group O and 17% of group Y ($P = 0.70$). A pulmonary artery catheter, intra-aortic balloon pump, and pacemaker were utilized in 6%, 0%, and 2% of group Y, and in 20%, 7%, and 13% of group O, respectively ($P = 0.009$). Severe bleeding and intraoperative death occurred in 7% and 10% of cases in group O, and none in group Y ($P = 0.008$). The times of operation, extracorporeal circulation, anoxia, and time to extubation were all longer in group O ($P = 0.004$). Utilization of vasoactive drugs was necessary in 36% of group Y, and in 61% of group O ($P = 0.005$). Lengths of stay in the ICU, semi-intensive care, and hospitalization were all more prolonged in group O. Pulmonary edema, atrial fibrillation, vasoplegia, and need for dialysis were more common in group O.

Conclusions CS in octogenarians is usually performed because of an unstable clinical condition, in patients with left ventricular dysfunction. A significant number is performed without extracorporeal circulation. Hemodynamic support is frequently necessary. Although lengths of operation and of hospitalization are more prolonged and postoperative complications are more frequent, a favorable result can be expected in a significant number of patients.

P28

Comparison of monophasic versus biphasic cardioversion for atrial fibrillation

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Background Electrical cardioversion (CV) of patients with atrial fibrillation (AF) is a current practice. Recent data suggest that biphasic waveform shocks are more effective than monophasic ones for transthoracic CV, but the optimal protocol has not been defined.

Objective To determine the rate of CV success comparing biphasic versus monophasic waveform energies; which is more effective to achieve cardioversion at initial shock and to access the cumulative energy used by each waveform energy.

Methods We conducted a prospective, randomized study of 43 patients with atrial fibrillation during an 18-month period. Success rates of CV with a defibrillator using monophasic waveform energy with a sequential energy of 200 J–300 J–360 J (Group 1) and using biphasic waveform energy with a sequential energy of 120 J–150 J–200 J (Group 2) were randomly compared. If the maximum energy used by one group did not achieve CV success, a crossover to the maximum energy of the other group was performed.

Results The study population consisted of 22 patients in Group 1 and 21 patients in Group 2 with similar baseline characteristics. The rate of CV success was 95.5% in Group 1 and 85.5% in Group 2 ($P =$ not significant). Group 1 achieved success at initial shock in 95.5% and Group 2 in 57.1% ($P = 0.27$). The mean cumulative energy was 200 J in Group 1 and 203 ± 135 J in the biphasic waveform group ($P = 0.078$).

Conclusion In this study, AF cardioversion using biphasic waveform energy was less effective than a monophasic pulse. This result could be attributed to the initial energy of 200 J used by the monophasic group.

P29

Prognostic value of D-dimer in acute heart failure

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Background Several factors associated with the pathophysiology of heart failure (HF) contributed to the occurrence of thromboembolic events, such as vascular disease, hypercoagulability and venous stasis. Many studies showed elevation of coagulation markers, including D-dimer, in advanced stages of HF. The role of D-dimer is still unknown as a long-term prognostic marker in HF patients.

Objectives To evaluate the best value of D-dimer that can predict inhospital death. To determine the prognostic role of D-dimer after 1 year of follow-up in patients with decompensated HF.

Materials and methods A cohort of 70 patients with decompensated HF (85.7% in NYHA class IV) admitted to a coronary care unit during the year 2003. The D-dimer was measured in 53 patients (77.2 ± 10.2 years old, 54.7% male, 84.9% NYHA class IV) at hospital admission; and it was correlated with inhospital death and event-free survival (1 year of follow-up after baseline hospitalization). We used the ROC curve to establish the best cutoff for sensibility and specificity for inhospital death, followed by the chi-square test; and also the log rank test to analyze the Kaplan–Meier curve. We consider $P \leq 0.05$ statistically significant.

Results The best cutoff point of D-dimer in the ROC curve to predict inhospital death was 1433 mg/dl ($P = 0.03$), with sensibility = 80%, specificity = 69% and negative predictive value = 97%. After 1 year of follow-up we observed that patients with D-dimer ≥ 2000 mg/dl during initial hospitalization had the worst prognosis (event-free survival median = 295 days when D-dimer < 2000 mg/dl vs 70 days when D-dimer ≥ 2000 mg/dl, $P = 0.03$).

Conclusions An elevated D-dimer at hospital admission in patients with decompensated HF seems to have clinical importance, indicating a higher probability of inhospital death and worse event-free survival after 1 year.

P30

Impact of myeloperoxidase dosage in acute coronary syndrome

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Background The leukocyte enzyme myeloperoxidase has been linked to the development of lipid-laden soft plaque, the activation of protease cascades affecting the stability and thrombogenicity of plaque in acute coronary syndromes. A recent study showed its potential usefulness for risk stratification among patients who present with chest pain.

Objective To determine whether measurement of myeloperoxidase can predict acute myocardial infarction in patients admitted to a chest pain unit.

Methods From July to December 2004, we conducted a prospective observational cohort study in 140 patients presenting to the emergency department within 24 hours after the onset of chest pain of suspected cardiac origin. Subjects who were at least 21 years old and with no history or clinical evidence of inflammatory, immunological or neoplastic disease were eligible to participate. The demographics, clinical profile and outcomes were recorded. Admissional myeloperoxidase was measured and correlated with clinical outcome.

Results The study population consisted of 140 patients (54% male); mean age 63.7 ± 13.9 years, 62.8% with systemic hypertension and 27.8% were diabetics. Myocardial infarction was the final diagnoses in 9.3% of patients. A cutoff point of 100 pM was selected with the use of the C statistical method. This cutoff point showed a sensitivity of 92%, a negative predictive value of 98%, a negative likelihood ratio of 0.19 and an odds ratio of 8.1 ($P = 0.031$). By multiple regression including other conventional risk factors, this level of admission myeloperoxidase was identified as an independent predictor of myocardial infarction (odds ratio of 8.0; $P = 0.048$).

Conclusion Myeloperoxidase measured soon after admission due to chest pain is a new risk marker for acute coronary syndromes. Its usefulness as a strong independent predictor for acute myocardial infarction must be considered.

P31

Obesity and inhospital prognosis in acute heart failure

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Background Previous studies have defined that obesity is a risk factor for the development of heart failure. However, whether obesity influences inhospital mortality of patients with heart failure remains unknown.

Objectives To analyze the obesity impact, measured by the body mass index (BMI), on inhospital morbidity and mortality of the patients with heart failure, and to correlate them with other serum markers, like BNP and D-dimer.

Materials and methods A cohort study with 125 patients with heart failure (mean age = 54 years; 55.2% male, 79.2% NYHA functional class VI) admitted to the coronary care unit between January 2003 and December 2004. This sample was divided into three groups according to their BMI (weight:height²): group A – BMI < 25 , group B – BMI = 25–29.9, and group C – BMI ≥ 30 . The inhospital complications of incidence, mortality and admission serum D-dimer and BNP were compared. Risk factors, complications and inhospital mortality, were compared using the likelihood ratio chi-square test. The Kruskal–Wallis test was used to correlate the BMI with serum markers and ANOVA. Statistical significance was set at $P \leq 0.05$.

Results The sample was divided into three groups (group A – 56.8%, group B – 29.6% and group C – 13.6%). There was no difference in age between the two groups ($P = 0.14$). Diabetes was more frequent in group B (overweight). Obese patients (group C) had lower BNP levels ($P = 0.01$) and D-dimer ($P = 0.035$). There were no differences between the three groups related to complications and inhospital mortality.

Conclusions The elevation of the BMI is not a predictor of mortality or inhospital complications among patients with heart failure. We also observed its relation with lower levels of worse prognostic markers, like BNP and D-dimer.

P32

Use of anticoagulation and D-dimer levels in patients with acute heart failure

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Introduction Decompensated heart failure (DHF) is associated with several coagulation disturbances, including elevation of the circulating D-dimer levels, contributing to pathophysiology and thromboembolic events. The influence of oral anticoagulant on D-dimer levels in patients with HF has not been established.

Objective To verify whether oral anticoagulant treatment would influence D-dimer levels in patients with DHF.

Materials and methods A cohort study with 70 patients admitted with DHF (85.7% NYHA FC IV) to the coronary care unit during 1 year. Of this sample, 53 patients had a D-dimer dosage on admission and were divided into two groups: group A (GA = 8 patients) with oral anticoagulant; and group B (GB = 45 patients) without oral anticoagulant. The Student *t* test was performed for the analysis.

Results GA and GB were similar with respect to mean age (78.7 ± 11.8 vs 77.0 ± 10.1 years) and male gender (37.5% vs 57.7%). The mean INR (GA) was 4.09 ± 2.61 . There was no difference in admission D-dimer levels between GA and GB (GA = 1326.5 mg/dl vs GB = 1426.2 mg/dl, $P = 0.81$).

Conclusions This study indicated that oral anticoagulant therapy did not influence circulating D-dimer levels, despite adequate anticoagulation, suggesting that this therapy does not completely protect against all coagulation abnormalities observed in DHF.

P33

Prediction of heart failure by C-reactive protein in patients with acute myocardial infarction

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Introduction Inflammatory markers such as C-reactive protein (CRP) have shown a high prognostic value in the setting of coronary artery disease and heart failure (HF).

Hypothesis To correlate CRP levels in patients admitted with acute myocardial infarction (AMI) with MACE, presence of pulmonary congestion, ventricular function by echocardiogram, and inhospital (IH) mortality.

Methods A prospective cohort of 222 patients (72% male, 64 ± 13 years old) were admitted to a tertiary hospital coronary care unit after an AMI and were treated with primary percutaneous coronary intervention (PCI) between March 1999 and October 2003, and were followed for 31.5 ± 15.3 months. The door to balloon time (DB) was 322 ± 908 min, 70.2% underwent stent placement and 70.2% were Killip I class. CRP was measured in 91 patients at baseline (CRP1) and 24 hours after PCI (CRP2), and Delta PCRt was defined by CRP1 – CRP2. The Mann-Whitney

and Wilcoxon tests were performed and statistical significance was defined as $P \leq 0.05$.

Results Higher levels of CRP2 were correlated with higher DB ($P = 0.03$) and diabetes ($P = 0.037$). There was no correlation between the values of CRP-b and CRP-24 hours and MACE. Higher values of Delta PCRt were correlated with age, Killip class II/III and the presence of left ventricular dysfunction, as well as inhospital mortality. ROC curve analysis (AUC = 0.747; 95% CI = 0.602–0.691) correlated Delta CRP and inhospital mortality. The best Delta PCRt cutoff was 2.32 mg/dl to predict inhospital mortality.

Conclusion CRP variation in the first 24 hours seems to be a relevant method to predict HF in patients admitted with AMI.

P34

Unstable angina and non-ST-segment elevation myocardial infarction: analysis of consecutive series of patients and later follow-up

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Crit Care 2005, **9(Suppl 2)**:P34 (DOI 10.1186/cc3578)

Introduction According to world statistics, arteriosclerotic coronary disease has been growing worldwide, receiving special attention in ICUs.

Materials and methods One hundred and ninety-three patients with acute coronary syndromes (ACS) admitted to the ICU of Santa Lucia Hospital from October 2003 to October 2004 were analyzed prospectively. A total 62.2% developed unstable angina or non-ST-segment elevation myocardial infarction (NSTEMI). The data collection was made using interviews, chart reviews and other examinations.

Results One hundred and twenty patients had NSTEMI or unstable angina. The mean age was 66.3 years and 80 were men. The most common risk factor was hypertension (90/75.0%). Seventy-one (59.2%) patients showed previous history of ACS; 29 out of this group had previous myocardial infarction, and 28 patients had been submitted to coronary artery bypass graft (CABG) previously. Seventy-seven (64.2%) patients were submitted to coronary angiography; 23 of them were submitted to angioplasty with stent implantation and 21 to CABG. The mean ICU stay was 3.6 days. The mortality rate was 10%. The follow-up was made by telephone contact with 94.1% of the patients more than 6 months from the event. A total 33.3% of them were readmitted for cardiac causes, and late mortality was 5.9% of followed-up patients.

Conclusion The follow-up reached a high percentage of the population studied and showed a late mortality compatible with the medical literature.

P35

Validation of the ADHERE model for risk stratification in patients with acute heart failure admitted to the critical care unit

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Crit Care 2005, **9(Suppl 2)**:P35 (DOI 10.1186/cc3579)

Background Decompensated heart failure (DHF) is responsible for high morbidity and mortality. Estimation of the mortality risk in

patients admitted with DHF helps clinicians guiding care. Models for risk stratification of patients during admission for acute DHF are not well established. The Acute Decompensated Heart Failure National Registry (ADHERE) developed a tool for risk stratification for patients hospitalized with DHF.

Objective To validate the ADHERE risk stratification model in a cohort of patients with DHF.

Design, setting and patients A cohort study of 137 consecutive patients admitted to the coronary care unit with a primary diagnosis of DHF was conducted to determine the validity of the ADHERE risk stratification model. Demographics, clinical details, laboratory data and clinical outcome were recorded. The risk stratification model was applied and correlated with clinical outcomes.

Results Baseline characteristics and main outcomes of this cohort were: 54% of patients were male, mean age was 76.52 ± 11.08 years and 79.6% of patients were considered NYHA class IV. The inhospital mortality was 9.2%. Admission ADHERE risk stratification was performed and we identified 70.67% of patients as low risk and 20.3% in the intermediate-risk group. No one was classified in the high-risk group. There was no correlation between the ADHERE risk stratification model and inhospital mortality.

Conclusions In our small cohort of patients admitted due to DHF, the ADHERE risk stratification model did not accurately predict hospital mortality.

Hemodynamics/shock

P36

Volume expansion with hydroxymethylamide (voluven 6%) in the immediate postoperative period after heart surgery

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Objective To analyze the usage of hydroxymethylamide during volume reposition in the immediate postoperative period after heart surgery.

Materials and methods A prospective study in which patients submitted to heart surgery had volume expansion with voluven 6%. Only patients with total preserved renal and hepatic function were included. None of them had any clinical or laboratorial signs of coagulation disturbances or any occurrence during surgical procedure. Voluven 6% was used during the initial phase of the postoperative period (first 2 hours), with a maximum volume limit of 1000 ml per patient. Other aspects were studied such as signs of bleeding, anaphylactic reactions and time for achieving clinical stability.

Results A total of 192 patients were analyzed; 71.3% were male. Regarding the type of surgery, 77.08% were submitted to CABG, 15.10% to valve surgeries and 7.82% to other types of interventions (congenital heart disease, aortic aneurysm, etc.). The time necessary for hemodynamic stability during infusion was about 60 min and the total bleeding amount was considered acceptable (547 ml in 24 hours). Three patients (5.73%) evolved to bleeding related to coagulation disturbances caused by temporary CPB, which justified blood transfusions. There were no significant alterations in relation to hematocrit and hemoglobin levels, or to platelet counting. No pyrogenic or anaphylactic reactions were detected during the study.

Conclusion We believe the solution of hydroxymethylamide 6% is a safe and adequate volume expander for use during the recovery phase of patients submitted to heart surgery.

P37

Is intestinal tonometry a reliable method to detect histological changes after small bowel transplantation?

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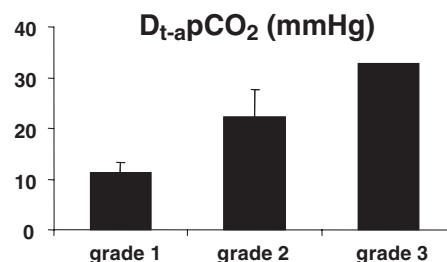
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Introduction Postoperative complications after intestinal transplantation can be attributed to hypothermic storage and reperfusion injury. In this study, we sought to obtain evidence that intestinal pCO_2 measurement can be a useful method for monitoring graft perfusion and early histological changes after small-bowel transplantation. Additionally, we evaluated the initial effects of isolated intestinal hypothermic perfusion (IHP) (at $4^\circ C$) on mucosal and serosal blood flow distribution, and we correlated these findings with other systemic and regional markers of mesenteric ischemia.

Methods Eight dogs (23.3 ± 1.1 kg) were submitted to *in situ* IHP for 30 min, followed by a 180-min reperfusion period. The cardiac output, mesenteric vein and intestinal serosal blood flows (SMVBF and SBF, ultrasonic flowprobe), intestinal mucosal-arterial pCO_2 gradient ($D_{t-a}pCO_2$, tonometry) and O_2 -derived variables were evaluated.

Results IHP induced a reduction in SMVBF (579 ± 53 to 321 ± 10 ml/min) and SBF (44.7 ± 3.2 to 29.1 ± 5.3 ml/min) and an increase in $D_{t-a}pCO_2$ (2 ± 2.8 to 20.5 ± 4.5 mmHg). No alterations on systemic metabolic or O_2 -derived variables were observed. The increase of the $D_{t-a}pCO_2$ correlated with the grade of mucosal injury (Fig. 1).

Figure 1



Conclusion IHP induces a proportional reduction on blood flow in all layers of the intestine, and none of the systemic markers of splanchnic ischemia predict the intestinal blood flow disturbances during the early phase of intestinal transplantation. In addition, intestinal pCO_2 measurement seems to be a useful way for monitoring graft perfusion and histological changes after hypothermic ischemia and reperfusion.

P38

Intestinal blood flow and pCO_2 gradients in arterial and venous mesenteric blood flow obstruction

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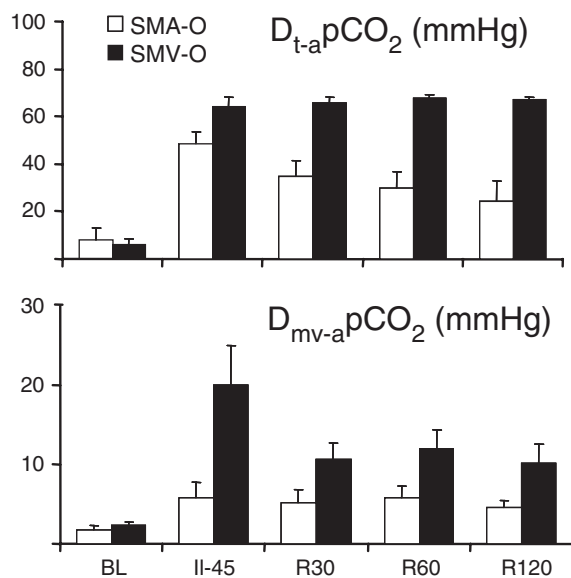
Introduction In this study, we evaluated the systemic and regional pCO_2 gradients changes induced by arterial and venous

mesenteric blood flow obstruction. In addition, we sought to obtain evidence that systemic markers of splanchnic hypoperfusion can detect the initial changes after intestinal ischemia induced by arterial or venous blood flow interruption.

Methods Fourteen dogs were subjected to 45 min of superior mesenteric artery (SMA-O, $n = 7$) or vein occlusion (SMV-O, $n = 7$). Systemic hemodynamic was evaluated through a Swan-Ganz catheter and arterial catheters, while gastrointestinal tract perfusion was evaluated by superior mesenteric vein and serosal blood flows (SMVBF and SBF, ultrasonic flowprobe). Intestinal O_2 -derived variables, mesenteric-arterial and tonometric-arterial pCO_2 gradients ($D_{mv-a}pCO_2$ and $D_{t-a}pCO_2$) were calculated.

Results A significant decrease in CO and MAP was detected in the SMV-O group; pCO_2 gradients presented a significant increase in both groups (Fig. 1). The histopathologic injury scores were 2.7 ± 0.5 and 4.8 ± 0.2 for the SMA-O and SMV-O groups, respectively.

Figure 1



Conclusion Temporary mesenteric congestion was associated with significant hemodynamic and metabolic disturbances. The $D_{t-a}pCO_2$ changes can be detected by systemic markers of splanchnic hypoperfusion after temporary SMV occlusion.

P39

Inhospital mortality of patients with submassive pulmonary embolism submitted to thrombolytic therapy in a multicenter study

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Purpose Thrombolytic therapy for submassive pulmonary embolism (SPE) remains controversial due to the lack of evidence for mortality reduction. We compared inhospital mortality of SPE patients submitted to r-TPA, unfractionated heparin (UFH) or low-

weight molecular heparin (LWMH) in a prospective multicenter study.

Methods A multicenter cohort included 625 patients, from January 1998 to May 2003, admitted with diagnosis of pulmonary embolism confirmed by: pulmonary angiography, helical computer tomography, magnetic resonance, echocardiography or lung scan. One hundred and thirty-three patients (49% males, 68 ± 15 years old) were considered having SPE after associated acute right ventricular dysfunction on a 2D echocardiogram and an absence of arterial hypotension. Syncope and chronic cor pulmonale were the exclusion criteria. Therapy (r-TPA, UFH or LWMH) was initiated after diagnosis, at the physician's discretion.

Results Overall inhospital mortality was 15.4%. Fifty eight patients received UFH, 35 patients had LWMH and 40 patients had r-TPA. The inhospital mortality was 19.3%, 17.6% and 10.8%, respectively ($P = 0.54$). In univariate analysis, a lower mortality was observed among patients with heart failure submitted to r-TPA ($P = 0.008$), which was non-significant in multivariate analysis ($P = 0.75$). There was no difference when comparing LMWH versus r-TPA ($P = 0.4$) and UFH versus r-TPA ($P = 0.27$).

Conclusion In this non-selected SPE population, no significant difference was found among patients submitted to thrombolytic therapy when compared with heparin for inhospital mortality.

P40

Clinical and hemodynamic characteristics of elderly patients with severe sepsis and septic shock

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Background The number of elderly patients admitted to ICUs is high; in this setting, infectious complications are frequent. Clinical and hemodynamic characteristics of elderly patients with severe sepsis and septic shock have not been systematically reviewed in recent series.

Objectives To analyze current clinical and hemodynamic characteristics of elderly patients with severe sepsis and septic shock admitted to the ICU.

Methods From a prospective cohort of 340 patients admitted to a general ICU of a tertiary teaching hospital we analyzed 83 cases of septic shock and severe sepsis from June 2003 to November 2004. The APACHE II score and the Sequential Organ Failure Assessment (SOFA) score were used as prognostic indexes. Differences were considered significant when $P < 0.05$.

Results Fifty-six (67.4%) patients were male and 27 (32.6%) were female; the mean age was 57.1 (16–88) years. The median for the APACHE II score was 25 (4–43). The mean ICU stay was 25 (1–171) days, and 52 (62.7%) patients died. In 40 (48.2%) cases septic shock/severe sepsis was the cause of ICU admission, and in 43 (51.8%) cases it was a complication during the ICU stay. Thirty-four (41%) patients were over 65 years old. As compared with younger patients, there was no difference regarding gender distribution, APACHE II score, SOFA score (initial, delta or maximum values), use of pulmonary artery catheter, need of mechanical ventilation, dialysis, duration of ICU stay or mortality. As for the hemodynamic parameters, however, elderly patients presented a lower cardiac index (4.6 ± 0.9 vs 3.2 ± 1.1 , $P = 0.01$), a lower DO_2 (575.6 ± 85.5 vs 430.4 ± 121.1 , $P = 0.01$) and a lower VO_2 (178.4 ± 65.7 vs 119.9 ± 39.6 , $P = 0.03$). There was a trend toward a lower heart rate among elderly patients (111.7 ± 19.4 vs 90.9 ± 25.5 , $P = 0.06$).

Conclusion In the present study, clinical variables were similar in both young and elderly patients with severe sepsis/septic shock. However, patients over 65 years old had different hemodynamic characteristics. This finding should be considered for the diagnosis and management of elderly patients with severe sepsis and septic shock.

P41

***In vivo* leukocyte–endothelium interactions in rat mesenteric microvessels after ischemia/reperfusion and sepsis**

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Objective A leukocyte–endothelium interaction is known to be a remarkable event at the beginning of systemic inflammatory response syndrome. The aim of this study was to evaluate leukocyte–endothelium interactions in superfused mesenteric postcapillary venules after hemorrhagic shock/reperfusion and cecal ligation and puncture in rats.

Methods Thirty-six Wistar rats (200–250 g) were submitted to the following interventions: 0 hours, anesthesia with sodium pentobarbital (50 mg/kg i.p.), hemorrhagic shock (MAP ~40 mmHg lasting 1 hour) and reperfusion with lactated Ringer’s solution (3 × shed blood) + 25% of the shed blood; 24 hours, anesthesia and cecal ligation and puncture; 48 hours, anesthesia, cecal resection and peritoneal lavage; and 72 hours, anesthesia and intravital microscopy of the mesentery (venule diameter, 15–25 µm).

Results Data of leukocyte–endothelium interactions in rat mesenteric microcirculation are presented as the mean ± standard deviation (Table 1).

Table 1

Leukocyte–endothelium interactions in rat mesenteric postcapillary venules

Group	n	Rolling cells/ 10 min	Adherent cells/ 100 µm venule length	Migrated cells/ 5000 µm ²
SHAM	4	100 ± 13	3 ± 1	2 ± 1
+ CLP	6	215 ± 25*	15 ± 1*	15 ± 1*
+ CLP + REL	3	106 ± 13	5 ± 1	5 ± 1
HS + 25%	4	215 ± 14*	14 ± 2*	16 ± 1*
+ CLP	5	219 ± 9*	20 ± 2*	16 ± 1*
+ CLP + REL	4	105 ± 12	8 ± 1	8 ± 1
HS + LR	3	175 ± 10*	12 ± 0*	13 ± 1*
+ CLP	3	207 ± 16*	16 ± 1*	16 ± 1*
+ CLP + REL	4	102 ± 12	4 ± 1	15 ± 1*

HS, hemorrhagic shock; 25%, reinfusion of 25% of the shed blood volume; LR, lactated Ringer’s solution; CLP, cecal ligation and puncture; REL, cecal resection and peritoneal lavage. * *P* < 0.01 compared with SHAM.

Conclusions The double-hit model (ischemia/reperfusion and sepsis) induced a severe inflammatory injury similar to sepsis alone. The inflammatory process was overcome by cecal resection and peritoneal lavage. Up to 72 hours of reperfusion with lactated Ringer’s solution and 25% of the shed blood volume, inflammation is still evidenced by the increased number of migrated cells in the perivascular tissue.

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P42

Mixed and central venous oxygen saturation in patients with septic shock: is there a difference?

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Introduction The mixed venous oxygen saturation (mSVO₂) is an important marker of global perfusion in patients with septic shock. There is some evidence that central venous oxygen saturation (cSVO₂) can replace mSVO₂. However, little is known about where it should be located: the superior vena cava (ccSVO₂) or the right atrium (acSVO₂). This study aimed at evaluating the differences between mSVO₂ and cSVO₂ (either from the cava or from the atrium) and the impact of them in patient management.

Methods We included patients admitted to a tertiary university ICU with septic shock that had a Swan–Ganz catheter and a central venous catheter in place. Each patient was submitted to three sets of hemodynamic and respiratory monitoring, with a minimal interval of 4 hours. Each set included a blood gas analysis of samples collected from the proximal (acSVO₂) and distal port of the Swan–Ganz catheter (mSVO₂) and also from the central line catheter (ccSVO₂). Each of these samples was analyzed by a blinded critical care physician who decided the hypothetical management for the patient. Statistical analysis was done using a paired Student *t* test. Results were considered significant if *P* ≤ 0.005.

Results We studied 22 sets of measures in seven patients (five female and two male) with a mean age of 60.57 ± 23.25 years. The mean values were 76.47 ± 8.02, 75.54 ± 11.96 and 70.90 ± 8.53 for ccSVO₂, acSVO₂ and mSVO₂, respectively. There was a significant difference between ccSVO₂ and mSVO₂ (*P* = 0.009) and acSVO₂ and mSVO₂ (*P* = 0.01), but not between ccSVO₂ and acSVO₂ (*P* = 0.60). The concordances in patient management were 63.2%, 68.2% and 78.9% between ccSVO₂ and mSVO₂, acSVO₂ and mSVO₂ and ccSVO₂ and acSVO₂. When only sets with a ccSVO₂ below 70 were considered, the concordance between ccSVO₂ and mSVO₂ was 75%.

Conclusion Our results suggest that blood samples derived from a central catheter, even if it is located in the right atrium, may be not accurate enough to be used as a measure of tissue oxygenation and may lead to improper management of the patient, mainly when the values are above 70%.

P43

Hemodynamic monitoring can be lifesaving in pediatric septic shock

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Background Pediatric septic shock is usually associated with multiple factors, including hypovolemia, myocardial depression, vascular failure, endocrine and metabolic disturbances. Eighty percent of the children with fluid refractory septic shock present with a low cardiac index. We emphasize the role of invasive and non-invasive monitoring for children with septic shock, leading to changes in treatment and prognosis.

Case A 5-year-old boy presenting with pneumonia, respiratory failure and severe sepsis. At admission, he was tachypneic and tachycardic, with inaudible blood pressure, prolonged capillary

refill time and weak pulses. The patient received 60 ml/kg normal saline in 60 min, without recovery. After placement of a central venous catheter, he was started on continuous dopamine, reaching 15 µg/kg/min. Again without significant improvement in arterial blood pressure and perfusion, epinephrine infusion was associated, starting with 0.1 µg/kg/min and increasing until 1.5 µg/kg/min. At this moment, he had low blood pressure, tachycardia, superior vena cava saturation (SVO₂) of 65%, oliguria and prolonged capillary refill time and, 2 hours later, presented with desaturation, hepatomegaly and acute pulmonary edema. An echocardiogram revealed a cardiac index of 1 l/min/m². Changing treatment strategy, he was started on milrinone infusion and monitoring with continuous SVO₂ and pulmonary artery catheter. Two hours later, he had normal urinary output, normal blood pressure, SVO₂ of 74% and cardiac index of 3 l/min/m². Treated with milrinone and low-dose epinephrine, he progressively improved arterial blood pressure, perfusion, pulse and mental status. The patient was weaned off vasoactive drugs and mechanical ventilation after 6 days.

Discussion Myocardial dysfunction is frequent in children with septic shock, and it persists even after correction of hypovolemia, acidosis and electrolyte disturbances. Most of the children with septic shock have a low cardiac index and increased systemic vascular resistance.

Conclusion Monitoring cardiac function, combining an echocardiogram with invasive methods, such as SVO₂ or pulmonary artery catheter, can be lifesaving in pediatric refractory septic shock.

P44

Comparison between values of central venous and arterial lactate and standard base excess in shocked patients

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Introduction Hemodynamic optimization based on tissue perfusion markers is a strategy considered adequate for the management of patients in shock in ICUs.

Objectives To evaluate the variability and correlation between venous and arterial standard base excess (SBE) and lactate samples.

Materials and methods The analysis of lactate levels was performed and the SBE obtained from the same blood of central venous and arterial samples of 115 patients. We compared these measurements (Wilcoxon signed rank test), and determined the correlation between these variables (Spearman rank order correlation).

Results There was a statistically significant difference between the value of venous SBE: -4.3 mEq/l (-7.4 to -0.9) as compared with the arterial value: -3.2 (-6.9 to 0), $P < 0.001$; but there was no difference between the venous lactate: 1.67 mmol/l (1.22-2.22) as compared with the arterial lactate: 1.56 (1.22-2.22), $P = 0.792$. The correlation coefficients were 0.929 to venous and arterial SBE (bias: 0.09) and 0.826 to lactate (bias: -0.024).

Discussion The agreement between venous and arterial samples permits one to use the central venous lactate level similar to the arterial level and their variations. For SBE, the module value was different between the measurements, otherwise their variation has good correlation. As these variations guide the clinical decision, we can use it as a goal of hemodynamic monitoring.

Conclusion It is possible to guide hemodynamic monitoring in shock patients using values of central venous lactate and variations of SBE.

P45

Bone marrow cellularity after hemorrhagic shock and fluid resuscitation with hypertonic saline or lactated Ringer's solution

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Introduction Qualitative alterations in the bone marrow morphology have been described after shock and fluid resuscitation. However, quantitative cellularity must also be addressed.

Objective To assess bone marrow cellularity after hemorrhagic shock and fluid resuscitation with hypertonic saline (HSS) and lactated Ringer's solution (LR).

Methods Wistar rats (250-300 g, $n = 22$), anesthetized with pentobarbital, were bled to a mean arterial pressure (MAP) of ± 40 mmHg over 10 min and were maintained at this level for 50 min. The animals were randomized into four groups: Sham (cannulation, no shock, no treatment), NT (shock, no treatment), LR (shock, followed by the infusion of LR, 3 x shed blood volume), and HSS (shock, followed by the infusion of 7.5% NaCl, 4 ml/kg). The shed blood was not reinfused. Animals were killed 72 hours after shock; the marrow cavity of the femur was washed with McCoy's Medium (2 ml), and total and differential leukocyte counts were performed in the perfusate. Blood samples for total and differential blood leukocyte counts were obtained from the cut tip of the tail of the animals.

Results Resuscitation with LR and HSS restored the MAP to the basal levels. Table 1 presents the bone marrow counts. There was no difference among groups concerning leukocyte blood counts.

Table 1

	Sham ($\times 10^7/ml$)	NT ($\times 10^7/ml$)	LR ($\times 10^7/ml$)	HSS ($\times 10^7/ml$)
Total	4.1 \pm 0.8	3.5 \pm 1.2	2.6 \pm 0.2*	4.9 \pm 0.7
Blasts	0.07 \pm 0.03	0.07 \pm 0.03	0.03 \pm 0.008	0.06 \pm 0.02
Neutrophils	2.0 \pm 0.4	1.7 \pm 0.2	0.9 \pm 0.01*	2.0 \pm 0.3
Eosinophiles	0.3 \pm 0.1	0.3 \pm 0.1	0.2 \pm 0.009*	0.5 \pm 0.1
Lymphoid	0.3 \pm 0.1	0.5 \pm 0.1	0.3 \pm 0.05	0.3 \pm 0.06
Erythroblast	1.3 \pm 0.3	1.5 \pm 0.2	0.9 \pm 0.1*	2.0 \pm 0.5
G/E relation	2.29 \pm 0.78	1.32 \pm 0.13	1.44 \pm 0.33	1.51 \pm 0.40
Hematocrit	47% \pm 0.9	33% \pm 0.9	36% \pm 1.4	35% \pm 0.7

* $P < 0.05$ (LR vs HSS), Mann-Whitney test.

Conclusion After hemorrhagic shock, the bone marrow total cellularity decreased both in animals resuscitated with LR and in those not resuscitated with fluids. After resuscitation with LR, the number of myeloid and erythroblast cells was lower than that observed in the resuscitation with HSS.

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P46

Cardiac output and pulse pressure respiratory variation in hemorrhagic shock

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Background Arterial pressure values frequently decline later after intravascular volume contraction, or when this hypovolemia becomes severe. On the other hand, cardiac output (CO) may decline early in hypovolemic states. CO is strongly coupled with systolic volume (SV). SV presents cyclic variations with intrathoracic pressure changes during mechanical ventilation, and pulse pressure variations (ΔPp) are SV dependent. Thereby, ΔPp has been recommended to guide fluid replacement.

Objective To test the hypothesis that ΔPp and CO alter with a similar precocity during intravascular volume contraction.

Methods In 12 ventilated and anesthetized dogs (19 ± 2.5 kg), the CO was measured with a Swan-Ganz catheter while the mean arterial pressure (MAP) and ΔPp were measured through an intra-arterial catheter. After baseline measurements (BL), a graded hemorrhage (20 ml/min) was promoted. Measurements were performed every 5 min during hemorrhage. Digital recordings of arterial pressure waves by multiparametric monitor (Datex-Ohmeda, Finland) were obtained. ΔPp was defined by the following formula: $\Delta Pp (\%) = 100 \times (Pp_{ins} - Pp_{exp}) / [(Pp_{ins} + Pp_{exp}) / 2]$. Pp_{ins} , inspiratory pulse pressure and Pp_{exp} , expiratory pulse pressure.

Results See Table 1. ΔPp amplification ($P = 0.006$) and CO decline ($P = 0.02$) occurred significantly at 10 min of hemorrhage ($15 \pm 2\%$ estimated volume contraction). The MAP drop occurred by 20 min.

Table 1 (abstract P46)

Time step	BL	5 min	10 min	15 min	20 min	30 min
Volume step (%)	BL	-10 ± 1	-15 ± 2	-20 ± 3	-35 ± 1	-45 ± 1
ΔPp (%)	12.6 ± 1.9	15.8 ± 2.7	19.7 ± 2.4^a	20.8 ± 2.6	21.9 ± 2.6	33.4 ± 4.5
MAP (mmHg)	123 ± 8.2	129 ± 7.0	116 ± 11.9	117 ± 12.2	86 ± 14.3^b	80 ± 12.3
CO (l/min)	2.4 ± 0.3	1.9 ± 0.3	1.5 ± 0.3^a	1.5 ± 0.3	1.3 ± 0.3	1.1 ± 0.3

^a ΔPp amplification and CO decline. ^bMAP drop.

Table 1 (abstract P47)

	Group	Baseline	T35	T65	T95
Mean arterial pressure (mmHg)	Halo	$97.3 \pm 4.6^{**}$	$78.1 \pm 7.6^{**}$	$73.6 \pm 7.6^{**}$	$88.3 \pm 4.0^{**}$
	Sevo	$114.7 \pm 3.9^{**}$	$104.4 \pm 5.1^{**}$	$96.0 \pm 5.7^{**}$	$99.0 \pm 5.0^{**}$
Cardiac index (l/min)	Halo	$3.6 \pm 0.26^{**}$	$1.16 \pm 0.24^{**}$	$1.3 \pm 0.13^{**}$	$2.7 \pm 0.16^{**}$
	Sevo	$4.4 \pm 0.30^{**}$	$2.4 \pm 0.26^{**}$	$2.4 \pm 0.24^{**}$	$3.6 \pm 0.31^{**}$
Arterial lactate (mmol/l)	Halo	1.69 ± 0.34	1.73 ± 0.34	1.57 ± 0.27	1.45 ± 0.35
	Sevo	1.27 ± 0.26	1.52 ± 0.27	1.36 ± 0.37	1.15 ± 0.32
Portal vein flow (ml/min)	Halo	584.7 ± 64.0	$270.3 \pm 23.0^*$	$203.1 \pm 26.5^*$	504.3 ± 41.4
	Sevo	534.2 ± 38.5	$311.2 \pm 28.5^*$	$270.2 \pm 29.5^*$	509.0 ± 35.8
PCO ₂ gap (mmHg)	Halo	5.11 ± 1.09	8.51 ± 1.93	$13.59 \pm 2.3^*$	6.06 ± 1.49
	Sevo	6.64 ± 0.75	8.23 ± 0.84	$12.37 \pm 1.81^*$	9.32 ± 1.19
Cocaine ($\mu\text{g/ml}$)	Halo	0	$11.3 \pm 0.55^*$	$6.50 \pm 0.68^*$	0.49 ± 0.11
	Sevo	0	$11.9 \pm 0.47^*$	$6.13 \pm 0.68^*$	0.40 ± 0.19

Conclusion We conclude that ΔPp and CO have the same precocity to detect intravascular volume depletion, and that arterial pressure decreases only in later phases of hypovolemia.

P47

Systemic and regional hemodynamic effects of a high intravenous dose of cocaine under halothane or sevoflurane anesthesia

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Background Cocaine abuse has been linked to penetrating and blunt trauma requiring surgical treatment. Although the cardiovascular effects of cocaine are well studied, particularly its association with arrhythmia, myocardial infarction and sudden death, little is known about the effects of cocaine abuse on splanchnic perfusion and the potential undesirable interaction with volatile anesthetics. We hypothesized that halothane would elicit more circulatory adverse effects than sevoflurane in an acute model of cocaine intoxication.

Methods Mechanically ventilated Beagle dogs ($n = 14$, 12.8 ± 0.3 kg) underwent anesthesia induction with intravenous propofol. They were then randomly assigned to two experimental groups: 1.5% halothane ($n = 7$, Halo) or 2.25% sevoflurane ($n = 7$, Sevo). After 30 min (Baseline), intravenous cocaine was infused as a bolus (12 mg/kg over 5 min), followed by 0.22 mg/kg/min during 30 min (BL-T35), and followed for 60 min thereafter (T35-T95). Systemic hemodynamics were determined by arterial and pulmonary artery catheters. Portal vein blood flow was measured by a transit time ultrasonic flowprobe. The PCO₂ gap (gas tonometry), blood gases, arterial lactate and cocaine levels were measured at each timepoint.

Results See Table 1.

Conclusions A high dose of cocaine in anesthetized animals induces a severe, but transient, hypodynamic state, which was more pronounced under halothane anesthesia. Regional hemodynamic derangement accompanied systemic hemodynamic variations and was completely reversible.

P48

Pulse pressure respiratory variation in experimental hemorrhage and resuscitation

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Background Pulse pressure (Pp) is strongly coupled with left ventricular stroke volume (SV). Therefore, pulse pressure respiratory variation (ΔPp) reflects SV variation during the respiratory cycle. ΔPp accentuation identifies hypovolemia, and this parameter is recommended to guide volume replacement. Recent reports alert to other clinical situations that accentuate ΔPp , such as pulmonary hypertension and right ventricular dysfunction. ΔPp during and after massive resuscitation has not been determined.

Objective To observe ΔPp alterations during aggressive volume resuscitation after experimental hemorrhage.

Methods In 12 ventilated and anesthetized dogs (19 ± 2.5 kg), the CO, MPAP and PAWP were measured by Swan-Ganz catheter; pulmonary resistance (PVR) was calculated using standard formulae. Arterial pressure traces were recorded by a multi-parametric monitor (Datex-Ohmeda, Finland) and ΔPp was calculated according to the following formula: $\Delta Pp (\%) = 100 \times (Pp_{ins} - Pp_{exp}) / [(Pp_{ins} + Pp_{exp}) / 2]$. Graded hemorrhage (20 ml/min) was produced to a MAP of 40 mmHg. The total shed blood volume was retransfused over 30 min at a rate of 50 ml/min (T10-T30).

Results During shock we observed the predicted MPAP and PAWP drop and ΔPp amplification, due to a decreased preload, and, consequently, cardiac output decreased. After total shed blood reinfusion and volume expansion (T30), ΔPp increased when compared with either BL ($P = 0.02$) or T20 ($P = 0.003$). This increase was associated with increased PVR ($P = 0.01$) and MPAP ($P = 0.05$), when compared with BL (Table 1).

Conclusion We conclude that ΔPp can increase after rapid volume infusion as in hypovolemic states. An acute increase in pulmonary pressure and resistance may be responsible for the observed increment in ΔPp .

Sepsis

P49

Association of the SOFA score and mortality in elderly patients with severe sepsis and septic shock

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Introduction The SOFA score is an excellent predictive marker of outcome in sepsis; however, there are very few studies that relate it to mortality in elderly patients with sepsis and septic shock.

Objective To assess the association of the SOFA score and other factors related to mortality in elderly patients with severe sepsis and septic shock.

Methods A 3-month prospective cohort study of 30 patients aged ≥ 65 showing severe sepsis or septic shock [1]. Arterial hypotension (systolic arterial pressure < 90 mmHg) corresponded to the 'time-zero' of the study. The variables used were: the SOFA score on days 1, 3, 5, 7, 14, and 28, (Δ)SOFA (variation of the SOFA score on days 1 and 3), APACHE II score, troponin I dosage, BNP and PCR, plasma glucose levels, organ failures [2], the presence of previous cardiovascular disease, assessment of dependence and cognitive deficit [3,4], length of ICU stay, and need for mechanical ventilation. We used Student's *t* test and the Fischer exact test for a statistical analysis. We considered the significance level of 5%.

Results The mean age of patients, of whom 60% were female, was 82 ± 9 years (minimum = 65 years, maximum = 99 years). The predominant diagnosis was septic shock in 67% of the cases, while 33% of the patients developed severe sepsis. On days 1, 3, 5, 7, 14, and 28, the SOFA score presented mean values of 7, 6, 4, 3, 2, and 2, respectively (minimum = 2 and maximum = 15), thus evidencing a significant relationship between the SOFA score on day 1 ($P = 0.0001$) and day 3 ($P = 0.001$), including (Δ)SOFA score ($P = 0.043$), and mortality. The number of failures was also associated with mortality when two or more organ failures ($P = 0.001$) were present. The age, gender, APACHE II score, length of ICU stay, dependence level, presence of cognitive deficit and/or previous cardiovascular diseases, plasma glucose levels, troponin I, BNP and PCR were not associated with mortality.

Conclusion A mean SOFA average above 5 as well as SOFA variation within the first 72 hours proved to be good predictive markers in elderly patients with septic shock and severe sepsis. The same occurred in the presence of two or more organ failures during the course of sepsis.

Table 1 (abstract P48)

	BL	Shock ^a	T10	T20	T30
PAM (mmHg)	123 \pm 8.2	40 \pm 4.4	106 \pm 5.8	114 \pm 7.8	121 \pm 5.3
PAPm (mmHg)	18 \pm 1.6	11 \pm 1.4	26 \pm 2.9	27 \pm 2.9	24 \pm 3.1
PAwP (mmHg)	8 \pm 1.3	4 \pm 0.9	7 \pm 1.3	6 \pm 1.1	6 \pm 1.1
CO (l/min)	2.4 \pm 0.3	0.5 \pm 0.1	2.3 \pm 0.3	2.9 \pm 0.4	2.4 \pm 0.3
PVR (dyn.seg/cm ⁵)	333 \pm 80	1166 \pm 751	656 \pm 451	581 \pm 349	600 \pm 486
ΔPp (%)	13 \pm 1.9	23 \pm 3.8	16 \pm 2.6	13 \pm 1.0	17 \pm 1.0

^aGraded hemorrhage (20 ml/min) was produced to a MAP of 40 mmHg.

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P50

The gut mesenteric lymph during bacterial translocation carries factor(s) related to mortality in sepsis

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Introduction Experimental and clinical studies have shown that bacterial translocation (BT) has been implicated in the pathogenesis of sepsis and multiple organ dysfunction syndrome (MODS). In this study we examined the role of the intestinal lymph during the BT process on the clinical outcome in a pre-established sepsis state.

Methods Adult female Wistar rats (200–250 g) were submitted to the combination of induction of BT plus sepsis (S), with and without mesenteric lymph flow into the systemic circulation, and were monitored in terms of bacterial quantification per compartments and mortality ($n = 20$ /each group). Groups: sepsis group (inoculation of 10^7 , 10^9 or 10^{10} CFU/ml/100 g body weight of *Enterobacter cloacae* 89 into the portal vein); BT group (5 ml *Escherichia coli* R-6 10^{10} CFU/ml/100 g body weight confined to the small intestine for 2 hours); BT with lymphadenectomy group; and combination group (sepsis 10^7 or 10^9 plus BT- 10^{10}) with and without lymphadenectomy. The interruption of the lymph flow was achieved by mesenteric lymph node resection 5 days prior to the experiments, which is not a sufficient time for the re-canalization of the lymph ducts. The observation period for mortality was of 30 days in all groups.

Results The BT groups and S- 10^7 group did not show any mortality; however, the combination of S- 10^7 or S- 10^9 with BT without lymphadenectomy significantly increased the mortality (50% within 32 hours and 100% within 13 hours, respectively) as compared with BT (0%), S- 10^7 (0%) and S- 10^9 (85% within 26 hours) alone. However, the combination group (S- 10^7 + BT- 10^{10}) with lymphadenectomy prevented death in all animals. In addition, the bacterial recovery in varying compartments of the combination groups was similar to the recovery of each group alone.

Conclusion Overall data demonstrated significant deleterious synergistic effects of BT in combination with sepsis, suggesting that translocation of bacteria through the gut-associated lymphoid system might be the main factor for the aggravation of the host proinflammatory response. The BT process can thus be responsible for the installment of the MODS; moreover, this phenomena seems to not be related to the amount of translocated bacteria.

P51

Previous bacterial translocation challenge enhances peripheral blood bacterial clearance in the subsequent sepsis

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Introduction A bacterial translocation (BT) event has been strongly related to the pathogenesis of sepsis as well as to the sepsis progression to the state of multiple organ failure, and increasing scientific findings have pointed out the beneficial role of BT by building a gut immune defense repertoire. In a previous study, we have demonstrated that a previous BT challenge reduces significantly the translocation index at the second BT challenge with the same bacterial strain. Thereby, in this study we sought to evaluate the effect of previous BT challenge on experimentally induced sepsis, examining the bacterial clearance index from the systemic blood circulation, in order to evaluate its influence on the host's immunological defense response.

Methods Adult female Wistar rats (200–250 g) were submitted to BT (5 ml *Escherichia coli* R-6 10^{10} CFU/ml/100 g body weight confined to the small intestine for 2 hours) and after 2 weeks were submitted to semi-lethal and lethal sepsis induction (inoculation of 10^9 or 10^{10} CFU/ml/100 g body weight *E. coli* R-6 into the portal vein, respectively), and serial hemocultures were monitored at 0, 15, 30, 60 and 120 min. The BT control group received saline only ($n = 8$ /group). In the other group ($n = 6$), we evaluated the BT capacity of inducing anti-*E. coli* R6 O-antigen antibody production after 14 days.

Results Animals submitted to previous BT in combination with semi-lethal sepsis demonstrated a significantly faster bacterial clearance index when compared with animals that were not submitted to previous BT. Also, specific antibody against *E. coli* R6 was detected in 4/6 animals submitted to BT only 14 days before, suggesting that BT challenge can induce a specific immune response and play a protective role against further second bacterial challenge. However, when animals were submitted to a high concentration of bacteria (lethal sepsis, DL₁₀₀), previous BT challenge could not play its beneficial role.

Conclusion BT is able to build a host's specific immune response, although it is dependent on the sepsis severity.

P52

The exclusion of the mesenteric lymph during a bacterial translocation process substantially diminishes the microcirculation injuries

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Introduction Bacterial translocation (BT) has been attributed as the causal hypothesis in the development of the multi-organ failure syndrome induced by sepsis, which has been known as 'the gut hypothesis of sepsis'. Such a process is believed to occur by lymphatic and/or hematological routes. In this study we evaluated the role of the lymphatic route in the genesis of microcirculation injury.

Methods Adult female Wistar rats (200–250 g) underwent BT induction (BT), and BT induction 5 days (BT5) and 30 days (BT30) post-mesenteric lymphadenectomy, which provoked a complete

obstruction of efferent mesenteric lymph flow and re-canalization of the lymph duct, respectively. In the other group, following 30 days post-lymphadenectomy, animals were submitted to the same BT process with exclusion of the efferent lymph duct performed by catheterization (BT30E) ($n = 5/\text{group}$). In these conditions, all animals were submitted to mesenteric microcirculation study by an intravital microscope method from 2 hours of BT up to 4 hours.

Results Animals submitted to BT showed significant injuries. Always, the first lesion was leukocyte adhesion followed by capillary and small venula obstructions and hemorrhage of low flow capillaries and venules 2 hours following the BT process. The BT5 group showed only leukocyte adhesion and the BT30E group showed similar lesions as BT-group alterations, although were much milder even after 4 hours of the BT process. The lesions in the BT30 group initiated around 3 hours of the BT process, basically with leukocyte adhesion followed by few capillary obstructions and rare hemorrhages.

Conclusion This study demonstrates that the lymphatic route might carry factor(s) related to the microcirculation injuries induced by gut-associated lymphoid tissue during the BT process.

P53

Base excess and arterial lactate as early prognostic markers in severe sepsis patients

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Introduction The development of therapeutic goals depends on accurate evaluation of the supply of oxygen to organs and tissues. But tissular oxygenation and perfusion are difficult to measure and have a labile behavior. This study has an objective to evaluate the clinical utility of base excess (BE) and arterial lactate (AL) as early markers of morbidity and mortality in patients with severe sepsis assisted in the emergency department.

Methods A contemporary cohort study involving adult patients with severe sepsis attending the emergency department in a tertiary hospital. We use the criteria of the SCCM/ACCP consensus conference to standardize the diagnosis of severe sepsis.

Results A total 203 patients were enrolled, with mean age 74 ± 13.6 years; 51.7% of these patients were male. The hospital mortality rate was 65%. The mean AL was 3.0 ± 2.2 and the mean BE was -5.8 ± 6.8 . Comparing survivors and non-survivors, the discriminative variables were age, APACHE II score and SOFA score, number of organ dysfunctions, $AL \geq 5$ mmol/l, $BE \leq -4$ mmol/l, lungs as site of infection, plus systolic and mean arterial pressure. The correlation between AL and BE using Pearson's coefficient of correlation showed an R^2 value of 0.40 ($P < 0.0001$). The Kaplan–Meier curve for $AL \geq 5$ mmol/l was discriminative (log rank 0.002), but the same did not occur with $BE \leq -4$ mmol/l (log rank 0.126). Logistic regression has shown that the variables considered as independent risk factors were age ($P < 0.0001$; OR 1.059 and 95% CI 1.028–1.091) and the number of organic dysfunctions ($P < 0.0001$; OR 2.115 and 95% CI 1.448–3.090).

Conclusion $AL \geq 5$ mmol/l and $BE \leq -4$ mmol/l could discriminate survivors from non-survivors. Only the Kaplan–Meier curve from AL has reached statistical significance and the correlation between AL and BE was weak. Neither of these variables (AL and BE) were considered independent risk factors for death in this population of severe sepsis patients.

P54

Simple model for prediction of mortality in elderly patients with septic shock

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Introduction The number of elderly patients with septic shock has increased in past years, making it important to investigate the existence of prognostic factors in this population. This study aimed to develop a simple prognostic model of mortality in elderly patients with septic shock hospitalized in a medical ICU.

Methods A prospective cohort of 67 elderly consecutive patients (age over 65 years), within a 32-month period, having their pulmonary artery monitored due to septic shock. The logistic regression model employed death as the dependent variable, and as independent variables those with P values highly significant in the univariate analysis: APACHE II score, the presence of previous cardiovascular diseases (systemic arterial hypertension, diabetes mellitus, stroke and chronic coronary insufficiency), positive troponin I, the need for noradrenalin in doses from 0.5 $\mu\text{g}/\text{kg}/\text{min}$ and above and the number of organic failures according to Le Gall's criteria. Variables were dichotomized and added one by one to the model. Only APACHE II score and previous cardiovascular diseases remained in the end. The statistical package SPSS 10 was employed with a significance level of 5%.

Results The patients presenting previous cardiovascular disease and APACHE II score from 20 and above had 85% probability of death, and those presenting previous cardiovascular disease and APACHE II score below 20 had 74% probability of death during hospitalization in the ICU. Those with APACHE II score below 20 and with no previous cardiovascular disease had only 5% probability of death.

Conclusion The presence of previous cardiovascular disease should be included in the models to predict the probability of death in elderly patients with septic shock. This simple model shall be expanded and applied to a similar cohort for validation thereof.

P55

Total homocysteine plasmatic levels as a marker of clinical severity in septic patients

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Introduction Homocysteine (Hcy) is a sulfur-containing amino acid formed during methionine metabolism that has been appointed as a marker of cardiovascular disease. The mechanisms involved are unclear, but include an increase in oxidative stress, excessive thrombogenesis, mitotic alterations in smooth muscular cells and endothelial dysfunction. Some of these mechanisms are present in septic patients, suggesting that total homocysteine (tHcy) levels might be implicated in the pathogenesis of organ dysfunction. The objective of this study is to correlate tHcy levels and the severity of septic process, evaluated by the SOFA score.

Methods In this prospective clinical trial, patients admitted to a tertiary universital ICU with severe sepsis were included, before 48 hours of organ dysfunction diagnosis. Patients with acute renal

failure were excluded. Blood samples were collected after 8 hours of starvation, together with SOFA parameters, on days 1, 3, 7 and 14 after inclusion. Statistical analysis was performed using the Spearman correlation ratio relating SOFA and Hcy during each moment of evaluation.

Results We studied 60 samples of tHcy in 21 patients (10 female and 11 male), mean age 44.05 ± 19.42 years with a mean APACHE score of 22 (minimum 2, maximum 35). The mean tHcy values for each day studied were $9.479 \pm 6.520 \mu\text{mol/l}$ ($n = 21$), $8.025 \pm 4.592 \mu\text{mol/l}$ ($n = 19$), $8.637 \pm 4.620 \mu\text{mol/l}$ ($n = 15$), $6.897 \pm 3.704 \mu\text{mol/l}$ ($n = 5$), and mean SOFA scores were 7.62 ± 3.72 ($n = 21$), 5.63 ± 3.05 ($n = 19$), 4.6 ± 2.5 ($n = 15$), 2.8 ± 1.92 ($n = 5$), respectively, for days 1, 3, 7 and 14.

Conclusion Our results suggest that Hcy levels could not be related to organ dysfunction, measured through the SOFA score, in this septic patient population.

P56

Use of the modified MODS score in septic patients in the emergency department

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Introduction The Multiple Organic Dysfunction Index was developed in a sample of surgical patients, and since then has been shown as a good predictive method in patients with septic shock. Six organic systems were chosen and quantified from zero to four, using the greater value from 24 hours. The calculation of the cardiovascular variable using the pressure-adjusted heart rate leads to a lack of simplicity in the utilization of this index at the bedside. In an attempt to make the calculation of the cardiovascular component easier, the same group that has developed the MODS index has shown a modification in this cardiovascular element in which there was no need for central venous pressure measurement and in which was included the evaluation of vasopressor use and lactate level. The objective of this study was to evaluate the discriminatory capacity of MODS for septic patients in the emergency room.

Materials and methods A contemporary cohort study in adult patients with severe sepsis during a 6-month period in the emergency department (ED) of a tertiary hospital. We use the definitions of the SCCM/ACCP consensus conference for the diagnosis of severe sepsis.

Results There were 342 patients included with a hospital mortality rate of 64%. The mean age was 73.7 ± 13.6 years. The mean values of modified MODS, SOFA and APACHE II scores were 4.9 ± 3.0 , 5.4 ± 2.9 and 20.5 ± 7.1 , respectively. There was a good correlation between modified MODS and SOFA scores using the Pearson's correlation coefficient ($R^2 = 0.80$; $P < 0.0001$). The areas under the ROC curve for modified MODS, SOFA and APACHE II scores were 0.71, 0.71 and 0.75, respectively. The optimal cut point to modified MODS was 4 (sensitivity [S] 71.6%, specificity [P] 58.5%, positive predictive value [PPV] 75.4% and negative predictive value [NPV] 46.2%), being 5 to SOFA (S 68.0%, P 63.4%, PPV 76.8% and NPV 47.2%) and being 18 to APACHE II (S 76.7%, P 60.2%, PPV 77.4% and NPV 41.0%).

Conclusion The modified MODS score presents a good correlation with the SOFA score and a good discriminatory capacity in patients with severe sepsis in the ED.

P57

Metabolic acid-base status of critically ill septic patients: a quantitative longitudinal study

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Background Septic patients frequently present with severe acid-base alterations, and the nature is not completely elucidated. The use of Stewart's approach may bring new light to this field.

Objectives The aim of this study is to understand the nature of acid-base disturbance of early phase septic patients. Specifically, we have proposed to identify the components of strong ion difference (SID) that account for its variation in this clinical scenario.

Methods This study took place in a mixed 14-bed ICU of a university hospital. Patients who had severe sepsis with recently diagnosed (<24 hours) organ dysfunction were considered eligible for the study. We prospectively collected plasma Na^+ , K^+ , Cl^- , ionic Ca^{2+} , Mg^{2+} , phosphate, albumin, lactate, arterial pH and pCO_2 for five consecutive days. Standard base excess (SBE) was calculated according to the Van-Slyke equation. SID effective (SIDe), SID apparent (SIDa) and strong ion gap (SIG) values were calculated using a computer program. The Pearson correlation index was used and $P < 0.05$ was considered statistically significant.

Results From September 2004 to December 2004, 20 patients were enrolled. The observed SIDe value for a neutral SBE was 33.4, lower than the 'normal' SID (approximately 40) due to the low albumin serum level seen in our patients (2.34 ± 0.48 g/dl). The median SBE value increased from -6.56 (-16.05 to -0.27) on the first day to -3.15 (-14.71 to 6.93) on the fifth day of observation. This increase was strongly correlated with the median SIDa daily level ($R^2 = 0.84$) that increased from 33.41 (coincident with the observed 'neutral' SIDe value) to 35.16. However, the median daily SBE did not show good correlation with SIG levels, which were kept almost constant during the study period (4.9 ± 2.7). On the fifth study day, metabolic acidosis had disappeared in 11 (55%) patients but persisted in nine (45%) of them. This was strongly dependent on their final SIDa value ($R^2 = 0.90$) and specifically on the serum Cl level ($R^2 = 0.66$).

Conclusion During the first days of severe sepsis a moderate-degree metabolic acidosis is caused by unmeasured anions. The SID apparent value can be considered neutral on the first day and becomes more positive during the next few days. This could be the first compensatory mechanism for restoration of a normal metabolic acid-base status.

P58

Bacterial translocation aggravates mesenteric microcirculation changes induced by sepsis

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Introduction Considering that systemically exacerbated or impaired inflammatory response with alteration of the microcirculation flow is a universal feature related to septic shock, regarding the current theory of sepsis that considers bacterial

translocation (BT) as the main etiological factor for the induction of systemic infection, we sought to examine the additional effect of BT in pre-established sepsis, evaluating intestinal microcirculation injury by intravital microscopy.

Methods Adult female Wistar rats (200–250 g) were submitted to the combination induction of sepsis plus BT, and mesenteric microcirculation of the small bowel was monitored for up to 2 hours by intravital microscope under general anesthesia ($n = 5$ /each group). Non-lethal, semi-lethal and lethal sepsis were induced by jugular vein inoculation of 10^7 , 10^9 or 10^{10} CFU/ml/100 g body weight of *Escherichia coli* R-6, respectively. The BT process was induced soon after sepsis induction by oroduodenal inoculation of 5 ml *E. coli* R-6 10^{10} CFU/ml/100 g body weight confined to the small intestine. In control groups, animals were submitted to BT or sepsis alone.

Results BT alone was able to provoke capillary hemorrhages and obstruction of capillaries and venules of low flow, from 30 min after inoculation, which worsened up to 2 hours. In the sepsis group, although hemorrhagic lesions were not seen, obstruction of venules extended to even high-flow venules, and the severity of microcirculation obstructions were directly proportional to the intensity of sepsis. Only lethal sepsis showed arteriolar obstruction. Most sepsis-related alterations initiated 25 min after inoculation and worsened up to 2 hours of the observation period. When the BT process was added to the sepsis, non-lethal sepsis microcirculation injuries were as intense as semi-lethal sepsis lesions, and the semi-lethal sepsis microcirculation injuries became as the lethal sepsis microcirculation injuries.

Conclusion The BT process, when associated with the pre-existing sepsis, augments significantly the mesenteric microcirculation injuries, showing that BT can be the additional triggering factor for the installment of multiple organ failure in sepsis shock.

P59

Acute portal hypertension without liver dysfunction enhances bacterial translocation to the lung

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Introduction Based on current knowledge, patients with cirrhosis have a higher risk of infection and are more likely to die as a result of those infections. Also, increasing evidence has attributed the bacterial translocation (BT) phenomenon as the most possible etiology of sepsis and MODS. Thus, in this study we examined the isolated portal hypertension (PH) role, without liver dysfunction, in an experimental BT model at a very acute phase of PH, in order to evaluate whether the infection in cirrhotic patients might be related only to the increased portal blood pressure factor with its consequential intestinal venous congestion.

Methods Adult female Wistar rats (200–250 g) were submitted to PH induction by partial portal ligation (decrease of 50% of portal flow) or PH-sham surgery, and 2 days later were subject to a BT experiment (5 ml *Escherichia coli* R-6 10^{10} CFU/ml/100 g body weight confined to the small intestine) or a BT-sham experiment (saline only) under general anesthesia. Following 2 hours of the BT process, samples of the mesenteric lymph node, liver, spleen and lung were collected for culture and the animals were sacrificed.

Groups: G1 (PH-Sham + BT-Sham), G2 (PH + BT-sham), G3 (PH-Sham + BT with inoculum) and G4 (PH + BT with inoculum) ($n = 8$ /group).

Results All cultures of G1 were negative; however, when PH factor was added (G2), the native Gram-negative intestinal bacteria translocated significantly to extraintestinal sites with exception of the lung: MLN (5/8, 62.5% positive); liver (2/8, 25% positive); spleen (1/8, 12.5% positive) and lung (0/8, 0%). In the conventional BT experiment, all samples were 100% positive with exception of the lung (3/8, 37% positive). Again, when PH factor was added (G4), even the lung was 100% positive, showing that PH factor is a significant factor related to BT even for native microflora. Also, the increased BT index to the lung might be related to the portal blood shunt to the systemic circulation by bypassing the bacterial clearance role of the liver and reaching directly the lung microcirculation, even at the early phase of PH. This fact can be related to the high incidence of pulmonary insufficiency in cirrhotic patients.

Conclusion PH factor increases native flora BT and promotes a higher index of BT to the lung when intestinal bacterial overgrowth factor is present in the rat model of BT.

P60

Can bacterial translocation be a beneficial event?

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Introduction Bacterial migration to extraintestinal sites has been attributed as the central component of the gut hypothesis of sepsis. However, some studies have pointed out the beneficial effect of bacterial translocation (BT) on the host's acquired immune system. In this study we evaluated the role of previous BT on the subsequent BT challenge, examining the BT index to organs, changes in WBC count at the mesenteric lymph and blood, and clinical outcome.

Methods Wistar rats ($n = 60$) were distributed into: BT group ($n = 20$), inoculation of 10 ml of 10^{10} CFU/ml *Escherichia coli* R-6 confined to the small intestine; BT1-14 group ($n = 20$), submitted to the BT procedure on days 1 and 14; S1-BT14 group ($n = 20$), received 10 ml saline on day 1 and the BT procedure on day 14. One-half of animals were killed 2 hours following the BT procedure. Samples from different compartments were collected for culture, mesenteric lymph and peripheral blood for WBC count. The other half were subjected to the clinical outcome evaluation concerning weight gain and mortality.

Results Animals submitted to double BT presented a significantly lower index of bacterial recovery (liver, spleen and blood) as compared with animals submitted to a single BT ($P < 0.05$). The WBC count of mesenteric lymph cells post double BT was similar to naïve animals, and it was significantly lower when compared with single BT ($P < 0.05$). The clinical outcome was unchanged in double BT as compared with other groups.

Conclusion A previous BT challenge was efficient in generating a host defense mechanism against a second episode of BT induced by intestinal overgrowth with the same bacterial strain.

P61

Comparison between intravital microscopy and laser Doppler microcirculation monitoring methods in experimental sepsis: preliminary results

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Introduction Sepsis (S) produces regional perfusion abnormalities by causing vasodilatation and blood flow redistribution, and this process mostly affects the mesenteric circulation. In addition, gut mucosal hypoperfusion can perpetuate the inflammatory process and contributes to the multiple organ failure. Thus, following experimental sepsis induction we examined gut blood flow by intravital microscopy and the gut tissue perfusion by laser Doppler, in order to detect the onset of the intestinal microcirculation changes at the acute phase of sepsis.

Methods Adult female Wistar rats (200–250 g) were submitted to sublethal sepsis (DL₉₅ 27 hours) by inoculation of 10⁹ CFU/ml/100 g body weight of *Escherichia coli* R-6 into the jugular vein and were monitored at 3 hours (*n* = 4) and 6 hours (*n* = 5) periods, examining 50 villi mucosal blood flow at the distal ileum by intravital microscope and external and internal mucosal surface tissue perfusion by laser Doppler using a type-S probe (3 hours, *n* = 4 and 6 hours, *n* = 3). Saline was used in control groups and all procedures were realized under general anesthesia.

Results Intravital analysis showed more than 90% of normal villi microcirculation in all S groups at all time periods, similar to the control groups (100% normal). Concerning tissue perfusion analysis with laser Doppler at the gut external surface, no significant statistical difference could be seen among all groups. Nevertheless, there was a statistical difference at the mucosal surface between the sham and 6 hours S groups, showing that signs of gut hypoperfusion at the mucosal site were not detectable by the intravital microscopy method although they were detectable by laser Doppler at only the late period. These data highlight that intestinal microcirculation is quite stable even during severe sepsis conditions, in contrary to the concept of fragile gut microcirculation related to sepsis shock.

Conclusion The laser Doppler mucosal tissue perfusion method can be a useful tool for the detection of microcirculation changes in sepsis. Ongoing studies are being performed to better evaluate microcirculation-measuring tools in sepsis.

P62

Iron-deficiency anemia increases intestinal bacterial translocation in rats

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Introduction Bacterial translocation has been related as the main causal event in the genesis of the systemic infection. Particularly in pediatric patients, worse prognosis of systemic infection has been related to malnourishment, impaired immune response and other debilitating diseases. In this study we therefore decided to examine the effect of iron-deficiency anemia in bacterial translocation (BT).

Methods Male Wistar rats, 21 days of age, were distributed into the control group (diet containing 50 mg/kg elemental iron, *n* = 12) and the anemic group (diet containing less than 5 mg/kg elemental

iron, *n* = 12). The animals were housed in metabolic cages and received deionized water and diet *ad libitum* for 6 weeks, and were submitted to BT experiments. Rats were fasted for 24 hours prior to midline laparotomy under general anesthesia. Initially, the distal ileum was ligated and 10 ml saline containing *Escherichia coli* R-6 (10¹⁰ CFU/ml) was inoculated by oro-duodenal catheterization, and confined in the entire small bowel by duodenal ligature. Afterwards, the abdomen wall was closed by suture. After 2 hours of the BT process, the mesenteric lymph nodes, liver, spleen, lung and blood were collected for culture under anesthesia and were sacrificed soon after.

Results At the experimental day, the weight of the anemic group (187 ± 20 g) did not show a statistical difference (*P* = 0.863) in relation to the control group (193 ± 19 g). However, the hemoglobin (5.6 ± 1.1 g/dl) and hepatic iron (89 ± 15 µg/g) were statistically lower (*P* < 0.001) than the control group (14.8 ± 0.8 g/dl and 374 ± 60 µg/g, respectively). The median number of *E. coli* R-6 recovered in mesenteric lymph nodes in the anemic group (26.5 × 10⁷ CFU/g) was higher than that of the control group (33.0 × 10⁴; *P* = 0.049). The number of bacteria recovered in the liver, spleen, lung and blood were not statistically different between two groups, although there was a higher recovery in anemic group.

Conclusion Iron-deficiency anemia increases intestinal bacterial translocation in rats.

P63

Costs of sepsis treatment between survivors and nonsurvivors in Brazilian ICUs: does it matter?

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Introduction Sepsis has been considered a major healthcare problem, upheld by the resources consumed to care for patients with this disease and its high incidence and associated mortality rate. Although we are aware of the high total hospital costs associated with sepsis treatment, even post discharge, the difference in costs of sepsis treatment between survivors and nonsurvivors is an economic analysis that can provide more reliable and interchangeable data. Literature addressing the costs of sepsis management is scant.

Objectives To assess direct costs of sepsis treatment in Brazilian ICUs, comparing survivors and nonsurvivors until ICU discharge.

Design An observational cohort study.

Setting Twenty-one ICUs of private and public hospitals.

Patients and methods Patients admitted with sepsis, severe sepsis or septic shock were enrolled to the study. During 6 months, patients meeting these criteria underwent clinical and epidemiological evaluation. Hospital costs related to ICU stay were also estimated. Standard values were based on the Brazilian Medical Association (AMB) price index for medical procedures and the BRASINDICE price index for medications, solutions and hospital materials. The concept of direct costs was established considering clinical support services (pharmacy, physiotherapy, radiology and laboratory service), consumables (drugs, fluids, nutrition, blood and blood products), and staff (medical staff, technicians and nursing staff). The Kruskal-Wallis test was performed to test for differences in the medians of cost among groups defined according to quartiles of length of stay or tertiles of SOFA score. Simultaneous multiple pair-wise comparisons among groups were performed with the Conover-Inman test. All hypothesis testing was two-tailed; *P* < 0.05 was considered statistically significant.

Measurements and main results A total of 524 patients were enrolled. The mean age was 60.5 years and 58% were male. The overall mortality was 43.8% and the median SOFA score was 7.6. Considering the length of stay, survivors and nonsurvivors had similar (median 13 and 10, respectively, $P = 0.097$). Costs did not differ significantly (\$9352 for survivors vs \$9116 for nonsurvivors; $P = 0.763$). However when comparing costs between survivors and nonsurvivors, dividing the length of stay into quartiles, we found a statistically significant difference between both groups ($P < 0.0001$), even considering the SOFA score when divided into tertiles, mainly comparing SOFA survivors < 7 ($P < 0.05$).

Conclusions This century appears set to become the century of biotechnological advance in healthcare. Unfortunately, the general restrictions on resources make the introduction of new interventions difficult, even if it will not have any cost analysis. Our data reveal an expected reality, that we have differences in costs between survivors and nonsurvivors, mainly comparing length of stay. Moreover, we still have to access the specific areas that have more impact in these direct costs to apply strategies that should offer a better outcome in septic patients.

Infection

P64

Validation of a semi-quantitative bedside procalcitonin measurement in intensive care patients

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Introduction and objective Elevation in the serum concentration of procalcitonin (PCT) has been proposed as a marker of disease severity and is associated with systemic infection [1]. This association has led to the proposed use of PCT as a novel biomarker of bacterial sepsis [2-4]. We sought to evaluate the PCT measurement with a semi-quantitative bedside method (PCTQ).

Methods From April to July 2003 we evaluated 48 blood samples from 30 patients (14 males with median age 76.64 ± 13.66 years and 16 females with median age 82.06 ± 10.5 years) with sepsis or SIRS in the ICU. PCT levels were measured and grouped into four intervals (< 0.5 ng/ml, 0.5–2 ng/ml, 2.0–10 ng/ml and > 10 ng/ml) by a quick bedside semi-quantitative method (BRAHMS PCTQ), and the results compared with measurements performed by a quantitative luminometry method (PCTL) (BRAHMS LUMITEST PCT, Germany).

Results The Kruskal–Wallis ANOVA analysis found a positive and reasonable correlation between the PCTQ and the PCTL for PCT levels > 10 ng/ml. There was no significant difference between the other three intervals (< 0.5 ng/ml, 0.5–2 ng/ml and 2.0–10 ng/ml) measured by the PCTQ.

Conclusion This preliminary analysis suggested that the PCTQ can be used to accurately measure PCT levels above 10 ng/ml. Other studies with more samples are necessary to provide more information about levels below 10 ng/ml.

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P65

Multiple brain abscesses due to *Penicillium* spp. infection

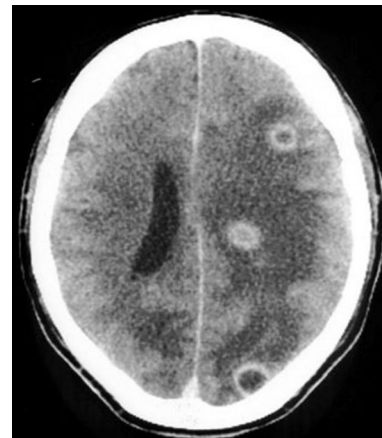
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Introduction A 41-year-old man, with chronic liver disease caused by long-term HBV infection (Child–Pugh C), presented to the Emergency Department complaining of bilateral loss of visual fields and dysphasia for 3 days. CT scan and MRI revealed multiple brain abscesses. Stereothacic biopsies revealed fungal infection and amphotericin B treatment was begun with initial improvement. The patient died a few days later as a consequence of massive gastrointestinal bleeding due to ruptured esophageal varices. The final microbiologic analyses disclosed infection by *Penicillium* spp.

Discussion Approximately 225 species of *Penicillium* have already been described. Systemic penicilliosis is a fungal infection caused by the dimorphic fungi *Penicillium marneffeii*, a pathogenic species of the *Penicillium* genera. Segretain initially isolated this species in captive bamboo rats (*Rhysomys sinensis*) at the Pasteur Institute in 1956. Few cases have been described since then, until the emergence of a widespread AIDS epidemic in the Southern Asia, when it became an endemic infection among AIDS patients. Systemic penicilliosis is an extremely rare disease in the non-immunocompromised host. In the HIV-infected patients it is predominantly a late occurrence, with CD4 count normally around 50 cells/mm. Fever and weight loss are the most common first clinical manifestations, present in up to 95% of cases. The respiratory system is the most common organ affected. Cutaneous manifestations are frequent (up to 75% of cases) and are very important clues to the clinical diagnosis of penicilliosis. Over the past 50 years, according to a recent review, a total of 34 cases of invasive infection have been described in the literature, most of them associated with non-immunocompromised hosts. Regarding CNS infection, only three cases had already been reported, two of them in non-immunocompromised patients [1].

Figure 1



Conclusion To our knowledge, this is the fourth documented case of CNS infection by a member of the *Penicillium* genera in the world, and the first one in Brazil.

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P66

Impact of empirical antibiotic therapy and mortality in the elderly with septic shock

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Background There are still questions on early implementation of correct empirical antibiotic therapy and its association with mortality reduction in septic shock (SS).

Objective To evaluate the impact of the use of empirical antibiotics on elderly mortality with SS in the ICU.

Methods A prospective cohort of 67 patients over 65 years old followed-up during 32 months and with pulmonary artery monitoring due to SS. Cultures were achieved in the first 24 hours. Ventilator and hemodynamic support, volume resuscitation and empirical antibiotic support with large spectrum were also employed. The choice of the antibiotics was based upon a probable community-acquired or hospital infection, and it was considered adequate when at least one effective drug had been included. Previous diseases, organic failures, and APACHE II scores were also evaluated. As for the statistical analysis, the *t* test, the chi-square test and Kaplan–Meier survival curve analyses were applied, considering 5% as the significance level.

Results The average ranges were: for age (80 ± 7), for APACHE (19 ± 5), for ICU stay (18 ± 9 days), where 51% were women. Among the previous diseases one can point out systemic arterial hypertension in 40%, ischemic heart disease in 31%, stroke in 21% and the COPD in 30% of the cases. Pulmonary SS alone occurred in 70% of the cases, and in association with urinary SS in 27%. The blood cultures were positive in 10% of the samples. The Gram-negative pathogens were responsible for 79% of the infections, where 36% were due to *Pseudomonas*. The multidrug-resistant microorganisms represented 8% of the cultures. Thirty-nine deaths occurred during the stay in the ICU. The antibiotics used in the empirical form were correct in 87% of the patients and they were modified in around 72 hours when clinical worsening or inadequate antimicrobial susceptibility patterns result took place. There was no association between age ($P = 0.22$) or adequate empirical antibiotic therapy and mortality, but mortality was associated with APACHE score ($P < 0.001$) and organic failures ($P = 0.006$). The ICU length of stay was not correlated with the use of adequate empirical antibiotics ($P = 0.66$).

Conclusion The adequate and early empirical antibiotic therapy was not associated with mortality or with the ICU stay of the elderly with SS. Possibly, the high level of correct choices of the antibiotic scheme and its modification due to clinical failure and inadequate antimicrobial susceptibility patterns have contributed to the results.

P67

Clinical impact of positive blood cultures in intensive care patients

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Background Infectious complications are frequent in patients admitted to ICUs, and great effort is made in order to identify possible infecting microorganisms. In this setting, multiple blood cultures are usually collected, although their true value is still to be ascertained.

Objective To ascertain the clinical impact of positive blood cultures in patients admitted to the ICU.

Methods We carried out a prospective cohort study in 340 patients in a general ICU of a tertiary hospital from June 2003 to November 2004. Clinical characteristics and blood cultures from all patients were reviewed. Differences were considered significant when $P < 0.05$.

Results One hundred and eighty-one (53.2%) patients were male, and the mean age was 51.9 (12–88) years. The initial diagnosis was respiratory failure in 115 (33.8%), cardiovascular failure in 97 (28.5%), neurological in 41 (12.1%), diabetic ketoacidosis in 27 (7.9%), postoperative status in 21 (6.2%) and other conditions in 39 (11.5%). The median APACHE score was 17 (range 2–45) and 107 patients (31.5%) died in the ICU. Four hundred and eighty-eight blood cultures were drawn from 201 patients; 156 (31.9%) cultures were positive in 93 (46.2%) patients. Gram-positive cocci were found in 44 (21.9%) patients and Gram-negative bacilli in 25 (12.4%) patients. As compared with patients with negative blood cultures, patients with positive blood culture had a longer ICU stay (32.5 ± 50.5 vs 12 ± 12.3 days, $P < 0.001$), a higher initial SOFA score (7.2 ± 1.9 vs 5.6 ± 4.4 , $P = 0.01$), a higher total SOFA score (152.2 ± 119.8 vs 62.8 ± 76.5 , $P < 0.001$), a higher maximum SOFA score (11.1 ± 4.1 vs 8.3 ± 5.7 , $P < 0.001$), a higher frequency of central venous catheterization (90.3% vs 71.3%, $P = 0.002$), urinary catheterization (86% vs 6.8%, $P = 0.001$), invasive blood pressure monitoring (44.1% vs 27.8%, $P = 0.06$) and a higher frequency of mechanical ventilation (80.6% vs 50.9%, $P < 0.001$). Mortality was increased in patients with positive blood cultures (50.5% vs 32.4%, $P = 0.009$).

Conclusion Patients admitted to the ICU that develop positive blood cultures are more severely ill than patients with negative blood cultures. The finding of an infecting microorganism in the blood of intensive care patients does not warrant a better prognosis.

P68

Procalcitonin in a semi-quantitative test and C-reactive protein in the evaluation of postoperative patients admitted to a critical care unit

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Introduction Procalcitonin and C-reactive protein (CRP) are acute phase proteins produced by stimulation to infectious and inflammatory factors, and are greatly used because they present more clinical applicability with practicality and fast detection. The objective of this study is to evaluate which of these markers shows better capacity to predict the evolution of postoperative patients during their stay in the ICU.

Materials and methods An observational study, performed between February and March 2004 in an ICU of a tertiary hospital. Postoperative patients with more than 24 hours of stay in the ICU and older than 18 years were included in the sample. A semi-quantitative test of procalcitonin (BRAHMS Laboratory) was performed after the patient enrollment.

Results Twenty-six patients were included, 31% submitted to urgent surgery and 69% to elective surgery. The mean age was 71.5 ± 10.6 years and 53% were female. The mean APACHE II score and SOFA score were 19.2 ± 4.9 and 5.8 ± 2.5 , respectively. Every patient presented two or more criteria for systemic inflammatory response syndrome, and the rate of ICU mortality was 30.8%. Among the survivors none presented a procalcitonin test ≥ 2 ng/ml, against 57.1% of non-survivors ($P = 0.02$). The mean value of CRP was 13.0 ± 6.2 between survivors and was 15.4 ± 7.3 among non-survivors ($P = 0.34$). The predictive capacity of these variables, as evaluated by the area under the ROC curve, was 0.835 for procalcitonin and 0.634 for CRP.

Conclusion The semi-quantitative test of procalcitonin was superior to the CRP dosage as a predictor of worse evaluation in this population. This information would be of utility if provided early at the bedside in the identification of patients with potentially unfavorable outcome.

P69

Analysis of central venous catheter-related bloodstream infections in a teaching medical ICU: 2 years of follow-up

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Introduction Central venous catheters (CVCs) are frequently used in the ICU. Infection, the most frequent complication of CVC use, is associated with increased morbidity and mortality.

Hypothesis The purpose of this study is to describe the epidemiology and to determine infection rates related to CVC use, the causative agents and its influence in ICU stay.

Methods We evaluated prospectively (NNISS-CDC/Atlanta) all laboratory-confirmed CVC-related bloodstream infections (LBSI) in an 18-bed medical ICU of a university centre between January 2002 and June 2004. Catheter insertion was performed by cardiology residents. Data collected: number of LBSI, device utilization (DU), time of ICU stay, demographic data (sex, age), causative agents and rates of infection/1000 CVC days.

Results A total 174 episodes of LBSI were studied. They represented 28% of all diagnosed ICU infections. The lethality was 47% in 30 days (medium ICU mortality was 28%). Ninety-seven (55.7%) episodes occurred in men and 77 (44.3%) in women ($P =$ not significant). Sixty percent of the episodes occurred in patients 60–90 years old. A total 20.6% occurred in the first week and 37% after 28 days. The ICU stay of these patients was 26 days (ICU general medium stay was 12 days). The percentage incidences of the main infective agents in 2002, 2003 and 2004 were, respectively: *S. aureus* – 19%, 16.5%, 2.5%; *S. epidermidis* – 22%, 31%, 34%; *E. faecalis* – 4%, 5%, 7.3%; *K. pneumoniae* – 21%, 16.5%, 14.6%; *P. aeruginosa* – 13%, 10.5%, 7.3%; other Gram-negatives – 19.4%, 19.4%, 24.5%; *Candida* sp. – 0.8%, 0%, 9.8%.

Conclusions BSI remains an important problem increasing the ICU stay and costs. The biphasic incidence calls attention to the need for better selection for admitting patients from other hospitals and to improve adherence to standardized infection control practices.

P70

Renal function profile in patients using polymixin for treatment of multiresistant *Pseudomonas* sp. in an ICU

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Crit Care 2005, **9(Suppl 2)**:P70 (DOI 10.1186/cc3614)

Introduction Multidrug-resistant *Pseudomonas* sp. (MDR-PS) is one of the most frequently isolated microorganisms causing hospital-acquired infections. Polimixin has been the only therapeutic option in many such cases. Nephrotoxicity is always a concern when this antibiotic is being used.

Objective The purpose of this study is to describe the impact of Polimixin use in the renal function of a number of patients.

Materials and methods A retrospective series of cases of patients with infection caused by MDR-PS, after 3 days or more of Polimixin use, admitted from December 2002 to August 2004 to the medical-surgical ICU of a tertiary hospital. The renal function was evaluated using the mean of the serum urea and creatinine obtained before and during the Polimixin use. A total of 31 cases were analyzed. For data analysis, measures of frequency and central tendency were used; the Wilcoxon test for comparison of the means before and during treatment.

Results The mean age of the patients was 66.52 ± 17.86 years, 67.7% of male gender. The observed co-morbidities were: arterial hypertension 54.8%, malignant neoplasm 35.4%, diabetes mellitus 29.3%, and chronic renal failure (CRF) 19.3%. The length of stay in the ICU was 33.7 ± 28.7 (median 23) days and the average days of Polimixin use was 15.19 ± 10.37 (median 14) days. Eleven patients (35.5%) were on dialysis during the Polimixin use, five cases started the dialysis during the treatment, three of these had CRF. Among the patients not on dialysis, only 18 had urea and creatinine values available for analysis prior to and during the treatment. The total mean for urea prior to and during the treatment was 68.64 ± 49.39 and 69.64 ± 31.90 ($P = 0.57$) and the total mean for creatinine before and during treatment was 1.57 ± 1.6 and 2.24 ± 3.5 ($P = 0.32$), respectively.

Conclusions In this small sample of critically ill patients, the use of Polimixin did not demonstrate a significant impact in renal function as observed by following the urea and creatinine levels.

P71

Vancomycin-resistant enterococci in a general ICU of a teaching hospital in São Paulo

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Objective To evaluate the colonization rate and risk factors associated with vancomycin-resistant enterococci (VRE) in patients in a general ICU in a teaching hospital.

Methods Rectal swabs were collected from June 2003 to November 2004, according to current recommendations of the infection control committee of our institution. Data from 94 patients were reviewed for analysis. The variables analyzed were age, time elapsed until ICU admission, length of ICU stay, Acute Physiology and Chronic Health Evaluation (APACHE) II score and ICU outcome. The presence of intravascular catheters, urinary catheter, need of invasive mechanical ventilation (IMV) and dialysis were determined. Antimicrobial therapy (vancomycin, imipenem-cilastatin,

cefepime and ceftriaxone) was also evaluated. Data analysis was performed with SPSS 12.0 and differences were considered significant when $P < 0.05$.

Results From the 94 patients, 34 (36.17%) had positive VRE samples, all isolates being *Enterococcus faecalis*. Age, APACHE II score, time elapsed until ICU admission and mortality rate (26.5% vs 35%) were not related to VRE colonization. However, patients with positive samples had a longer ICU stay (38.24 days VRE-positive and 16.82 days non-VRE, $P = 0.038$). Neither the insertion of intravascular and urinary catheters nor the need for IMV and dialysis was associated with VRE colonization. In 57 patients who received vancomycin, 47.4% turned out to be VRE-positive.

Conclusion A longer ICU length of stay predisposed to VRE colonization in a tertiary hospital. Clinical variables related to patient characteristics did not predispose to VRE colonization. The quality of medical and nursing care provided probably had greater influence, as could be expected in a teaching hospital.

P72

Comparison of antimicrobial resistance rates in an ICU in Rio de Janeiro, Brazil and the United States

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Introduction Antimicrobial resistance has been the major problem for treating patients in the ICU. Most international guidelines are based on antimicrobial resistance rates observed in the USA. For an empirical antimicrobial decision strategy it is important to know the differences between local and imported data.

Objective To compare local ICU antimicrobial resistance rates (RJ-ICU) with USA-ICU antimicrobial resistance rates (USA-ICU).

Methods A prospective analysis of antimicrobial resistance rates in a seven-bed medical-surgical ICU in Rio de Janeiro, Brazil and comparison with ICARE (CDC-USA) rates. All isolates were responsible for hospital-acquired infections. The National Committee for Clinical Laboratory Standards were used for the minimum inhibitory concentration, or zone diameter testing standards reporting susceptible, intermediate, or resistant organisms.

Results The rates of antimicrobial resistance were: methicillin-resistant *S. aureus*, 50% RJ-ICU vs 68% USA-ICU ($P = 0.165$); quinolone-resistant *P. aeruginosa*, 80% RJ-ICU vs 52% USA-ICU ($P < 0.0001$); imipenem-resistant *P. aeruginosa*, 49% RJ-ICU vs

38% USA-ICU; ceftazidime-resistant *P. aeruginosa*, 32% RJ-ICU vs 24% USA-ICU ($P = 0.15$); third cephalosporin-resistant *Enterobacter* spp., 60% RJ-ICU vs 47% USA-ICU ($P = 0.412$); and third cephalosporin-resistant *K. pneumoniae*, 30% RJ-ICU vs 21% EUA-ICU ($P = 0.329$).

Conclusion Quinolone-resistant *P. aeruginosa* was significantly higher in the RJ-ICU than in the USA-ICU. We speculate that this difference could be related to different antimicrobial use or patient severity.

Nephrology

P73

Protein losses in continuous renal replacement therapies

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Introduction Continuous renal replacement therapies (CRRT) readily allow for the nutritional support of these high catabolic states, but also contribute to the nitrogen loss through filtration of free amino acids and small peptides across the hemofilters. Amino acid clearances and calculated losses in adults on continuous venovenous hemofiltration (CVVHD) have been reported in the range of 2–11% of dietary intake.

Objective To analyse protein losses from CRRT treatments in critically ill patients.

Materials and methods Paired samples from serum, venous and dialysate/ultrafiltrate were obtained during CRRT procedures from 41 patients in a 27-bed ICU from July 2002 to May 2003. Paired samples were collected from 1, 6, 12, 24, 36 and 48 hours of continuous hemodialysis, a total of six samples of serum, venous and dialysate. PAN 650 filters were used in all patients. Blood flow was 150 ml/min in all patients and the dialysate flow during CVVHD was 16.6 ml/min. Five patients received no diet. Four patients received an oligomeric diet, one patient hyperalimentation intravenously, and the others received polymeric diets. The protein given was 1.3–1.7 g/kg. Total calorie intake was 22–25 kcal/kg. The amino acid assays, using high-pressure liquid chromatography serum, venous and dialysate, were performed by laboratory CTN and Pardini.

Results The average patient age was 73.08 years (43–88 years) and the APACHE II score was 18.37 (11–28). Serum, venous and dialysate amino acids were obtained in 41 patients and analysed 23 amino acids. Analyses were performed on the average of amino acids. Statistical calculations were by analysis of variance, linear, nonlinear and logarithmic regression.

Conclusion The losses of amino acids are more evident with amino acids that are more elevated in the plasma such as glutamine, alanine, glycine, glutamic acid. It seems that dialysis does not modify the behaviour of plasma amino acids.

P74

Severely ill patients in acute renal failure and prognostic indexes

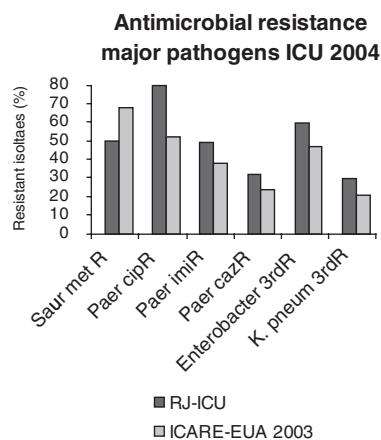
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Background Several predictive scores have been developed to estimate the mortality risk in acute renal failure (ARF). Yet the

Figure 1



accuracy of scores has been shown to vary when applied to foreign populations, and locally developed indexes may become better predictors. The aim of this study was to compare the performances of three working scores – one locally developed.

Patients and methods A total of 194 consecutive patients with ARF under intensive care were enrolled at initiation of renal replacement therapy maintained beyond 24 hours. Liaño's index (ATN-ISS), Mehta's index (PICARD), and a locally tested index (IRA-PUC) were properly applied. The discrimination and calibration of the indexes were evaluated (area under the ROC curves, goodness of fit and linear regression analysis), and were compared.

Results The population's observed mortality was high (87.0%), with a median of four (95% CI: 3–4) failing organs at inclusion. Predicted mean mortalities were 86.8, 84.9 and 87.9 (ATN-ISS, PICARD and IRA-PUC, respectively). The areas under the ROC curves were 0.702, 0.695 and 0.755 (ATN-ISS, PICARD and IRA-PUC, respectively). Goodness-of-fit determination was acceptable for all, and the linear regression analysis R^2 value was 0.954, 0.448 and 0.947 ($P = 0.015$; $P = 0.088$; $P = 0.001$) for ATN-ISS, PICARD and IRA-PUC, respectively. Discrimination was less adequate than previously stated for all tested indexes. Contrasting with ATN-ISS and IRA-PUC, PICARD was not so well calibrated.

Conclusion Discrepancies in characteristics and in mortality rates among populations at risk and the original one may decrease the accuracy of ARF predictive indexes, precluding their extensive use.

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P75

Prognostic significance of serum creatinine in patients with acute coronary syndromes for prediction of in-hospital mortality

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Context Patients with renal dysfunction are at an increased risk for cardiovascular disease.

Objective To evaluate the prognostic significance of serum creatinine for in-hospital mortality in patients with acute coronary syndromes.

Design An observational study.

Patients and methods Included were consecutive patients with acute coronary syndromes admitted alive to the coronary care unit from February 2004 to January 2005. The patients were initially classified into three groups on the basis of serum creatinine concentration measured on admittance. Normal renal function and mild and severe renal dysfunction were defined as serum creatinine concentrations of <1.2 mg/dl, ≥ 1.2 but <2.0 mg/dl, and ≥ 2.0 mg/dl, respectively. Patients receiving regular hemodialysis were excluded from the study. Univariate and multivariate relative risks (RRs) were calculated for three renal risk quartiles using the serum creatinine concentration on presentation.

Results This study included 227 patients. The mean age was greater in the severe renal dysfunction group ($P = 0.031$). Of the analysed variables – age, sex, diabetes, hypertension, dyslipidemia, previous myocardial infarction, previous coronary angioplasty and coronary artery bypass graft – only the creatinine level was an independent predictor of greater in-hospital mortality. The in-hospital mortalities of mild and severe renal dysfunction patients were greater (7.9% and 31.6%, respectively) than that of patients without renal dysfunction (2.8%), $P = 0.000$, with an increased risk of 10 times.

Conclusion In this study, we showed that the creatinine level at admission is an independent predictor of in-hospital mortality in patients with acute coronary syndromes.

P76

Impact of renal scintigraphy in severe patients with acute renal failure

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Introduction Acute renal failure (ARF) is frequent in severe patients, producing a poor outcome in the face of its multiple insults that are individually determined [1,2]. Technetium 99m ethylenedicycysteine scintigraphy (Tc-EC) has a very low plasma protein binding and a large volume of distribution. Tc-EC is a good agent for renal function evaluation, providing an index of tubular function and yielding high-quality images [3-5].

Objective To evaluate the clinical impact of renal scintigraphy (RC) in the management of ARF.

Materials and methods We evaluate all patients in ICUs of a general, private hospital, submitted to RC in the period of January 2003 to January 2004.

Results Thirty-four patients (18 male), 79.56 ± 16.26 years old, with an APACHE II score of 16.94 ± 6.34 (expected mortality 25%) were studied. The observed mortality was 29.41%. Seventy-three percent of the patients were anuric for 55.36 ± 13.43 days. Dialyses were used in 85.29% of the population and RC always carried through after 30 days. Seventy-four percent of the patients were mechanically ventilated during RC with no transport accident. RC changed the nephrology prescription, interrupted the method or indicated long-term access confection. The radiotracer most used was Tc-EC in 64.70% of the patients. Twenty percent of the patients continued in chronic dialysis and 17.64% had recovered renal function.

Conclusion RC, mainly with Tc-EC, influenced and modified the clinical impression, nephrological decision, and medical care of severe ARF patients. RC seems to be a good cost-benefit with simple accomplishment method to evaluate glomerular filtration and tubular function with an important impact especially in anuric patients.

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P77

Influence of renal dysfunction on in-hospital morbidity and mortality of patients with decompensated heart failure

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Crit Care 2005, **9(Suppl 2)**:P77 (DOI 10.1186/cc3621)

Background Renal dysfunction (RD) is a clinical condition associated with worse in-hospital prognosis for patients admitted due to decompensated heart failure (DHF).

Objectives To evaluate the impact of RD in patients admitted due to DHF, and its relationship with clinical features and laboratory data, length of stay (LOS), and in-hospital complications and mortality.

Methods From January 2003 to December 2004, we studied a cohort of 137 patients admitted to the coronary care unit due to DHF (79.6% NYHA class IV). The mean age was 76.5 ± 11.08 years, 54% male, 29.9% diabetes mellitus, 74.5% systemic hypertension, 64% ischemic cardiomyopathy and the mean LOS was 14.2 ± 34.6 days. RD was defined as an estimated (Cockcroft) creatinine clearance less than 60 ml/min on admission. Baseline demographics, laboratory findings, LOS and complications (cardiac arrhythmias, hemorrhage, need of blood transfusions, hemodynamic instability and infections) and mortality rates were compared. The Mann-Whitney test (laboratory findings and LOS), the Student *t* test (age) and Pearson's chi-square test (other variables) were used.

Results A total of 73.4% of the patients with DHF were considered to have RD. They were older (79.7 ± 9.5 vs 67.1 ± 10.4 years, $P < 0.0001$), with paradoxically less diabetes (18.1% vs 55.9%, $P < 0.0001$). On admission, B-type natriuretic peptide ($P = 0.021$), D-dimer ($P = 0.024$), hematocrit ($36.2 \pm 5.6\%$ vs $38.2 \pm 4.4\%$, $P = 0.029$) and hemoglobin (12.1 ± 1.89 vs 12.9 ± 2.08 g/dl, $P = 0.057$) were smaller. The need for blood transfusion (21.2% vs 5.9%, $P = 0.041$), and a significant increase of LOS was observed in the RD group (16.3 ± 41.2 vs 8.4 ± 5.7 days, $P = 0.013$), and higher in-hospital mortality (9.57% vs 5.88%, $P =$ not significant) was observed in the RD group.

Conclusions RD is highly prevalent in patients admitted due to severe heart failure, with a clinical impact on blood transfusion, length of stay, and determining a trend to higher mortality.

P78

Analysis of two groups of patients with acute renal failure in the critical care setting

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Introduction Acute renal (ARF) failure has a notable prevalence in the ICU. When patients are identified by small alterations in the creatinine levels, the percentage of ARF may reach 25% in the critically ill.

Objective To evaluate ARF in two groups of patients: Group A (GA), patients with ARF at admission to the ICU; Group B (GB), patients developing ARF during the ICU stay.

Materials and methods A prospective survey, carried out between July 2004 and February 2005 in a tertiary care private hospital. The sample was composed of two groups. GA: patients with ARF at admission, creatinine >2.0 mg/dl and normal renal function prior to the admission. GB: patients with normal renal function, with a 0.5 mg/dl increase in the serum creatinine during the ICU stay or if presented with chronic renal failure, defined as serum creatinine >2 and <4.9 mg/dl, an increase of 1.0 mg/dl in serum creatinine levels. Patients with serum creatinine level >5 mg/dl, history of ARF in another hospital or kidney transplant were excluded.

Results Six hundred and eighty patients were admitted to the ICU during the study period. Sixty-five patients had ARF, 14 in GA and 51 in GB. The mean age was 62.79 years and 69.4 years, respectively. The causes of ARF in GA were hypoperfusion (28.6%) and sepsis (21.4%), whereas in GB they were hypoperfusion (35.3%), septic shock (29.4%) and sepsis (19.6%). The prevalence of contrast-induced ARF was 7.1% in GA, and

2.0% in GB ($P < 0.05$). The mean serum creatinine level was 4.2 mg/dl in GA and 2.7 mg/dl in GB ($P < 0.05$). The mean urine output measured 24 hours before the diagnosis of ARF was 551.08 ml in GA and 713.37 ml in GB. The APACHE II score was 33.94 in GA and 41.76 in GB. The mortality in GA was 28.6% (four patients) and was 58.8% in group B (30 patients) ($P < 0.05$). The mortality for the ICU in general was 13.2% (90 patients). Twenty-three patients went for dialysis: GA 35.7% (five patients) and GB 35.29% (18 patients). The mean number of sessions was 4.78 in GA and 3.2 in GB. Four patients in GA (80%) and 15 (83.3%) in GB died in the dialysis group.

Conclusions The ARF mortality remains high despite the advances in technology, notably in patients on dialysis. In some cases the ARF diagnosis was delayed, as demonstrated by the serum creatinine levels in GA.

Pneumology

P79

Cuff pressure control of the tracheal tube: a prospective study in a general ICU

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Introduction High pressures of the tracheal tube cuffs can impair damage for restriction of the air flow.

Objectives To demonstrate the prevalence of high pressures of the tracheal cuff in orotracheal tubes (OTTs) and tracheotomies (TCT). To verify the impact of cuff pressure control on further cuff volume adjustment.

Methods This is a transversal study, which evaluated every tracheally intubated (OTT or TCT) patient in a general or neurosurgery ICU. Daily we have measured cuff pressures with a mercury manometer. The pressure goal was 20 mmHg (27.2 cmH₂O).

Results One hundred and six patients were evaluated, 75 (71%) male. Their age ranged from 16 to 92 years (mode 85 years). Forty-two (39%) patients had undergone TCT and 64 (61%) had undergone OTT. The first-day APACHE II score ranged from 4 to 39 (mode 22) and the average mortality risk was 27.5%. The length of time of OTT ranged from 1 to 16 days (mode 8 days) and that for TCT from 5 to 70 days (mode 5 days). The initial pressures ranged from <20 mmHg to 140 mmHg (mode <20 mmHg). After initial reduction of the cuff volumes, the range of the pressures decreased (from <20 mmHg to 80 mmHg).

Conclusion Increased prevalence of high pressures of the cuff in tracheal tubes justifies frequent monitoring of this parameter, aiming at brightening up the deleterious effect of the drawn-out use of these tubes.

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P80**A new integrative weaning index of discontinuation from mechanical ventilation****SN Nemer, CSV Barbas, JB Caldeira, LM Azeredo, S Machado, R Gago, T Clipes, PR Filho, PCP Souza***Hospital de Clínicas de Niterói, Rio de Janeiro, Brazil*
Crit Care 2005, **9(Suppl 2)**:P80 (DOI 10.1186/cc3624)

Background and objectives Indexes predicting the weaning outcome are frequently inaccurate. With the present study, we aim to evaluate the predictive performance of a new index for predicting the weaning outcome, which we called the integrative weaning index (IWI).

Methods Two hundred and fifty patients of several etiologies in the weaning process that remained up to 24 hours in mechanical ventilation were evaluated (all with $\text{PaO}_2 \geq 60$ mmHg with $\text{FiO}_2 \leq 0.4$ and $\text{PEEP} \leq 8$ cmH₂O). All patients were submitted to a 2-hour trial of spontaneous breathing. Those who sustained 2 hours of spontaneous breathing without return to mechanical ventilation in the following 24 hours were considered weaned, while those who could not sustain 2 hours of spontaneous breathing or returned to mechanical ventilation in the following 24 hours were considered not weaned. The frequency/tidal volume ratio (f/Vt ratio), the airway occlusion pressure at 0.1 s after the onset of inspiratory effort (P 0.1), the product of P 0.1 and f/Vt (P 0.1 × f/Vt), the respiratory rate (RR), the quasi-static compliance of the respiratory system (Cqst,rs), the $\text{PaO}_2/\text{FiO}_2$ ratio and the new integrative weaning index ($\text{IWI} = \text{Cqst,rs} \times \text{SaO}_2 / \text{f/Vt ratio}$) were evaluated in all patients. Arterial blood gas was collected with FiO_2 in 0.35. The sensitivity, specificity, positive predictive value, negative predictive value and the receiver operating characteristic (ROC) curves were calculated in order to evaluate the predictive performance of each index. The nonparametric method of Hanley and McNeil was used to compare the area under the ROC curves of each index.

Results Two hundred and eighteen patients were weaned, while 32 patients were not weaned. The IWI presented the larger area under the ROC curves (0.97), followed by the f/Vt ratio (0.90), Cqst,rs (0.89), f/Vt × P 0.1 (0.85), RR (0.80), P 0.1 (0.70) and finally by the $\text{PaO}_2/\text{FiO}_2$ ratio (0.60). The area under the ROC curves of the IWI was larger than those for f/Vt ratio ($P < 0.0001$) and also larger than those for the other indexes ($P < 0.0001$).

Conclusion In our study, even compared with other essential indexes in the literature, the IWI showed the best criteria for predicting the weaning outcome. With the obtained results we believe that with the use of the IWI in other countries we may further prove its accuracy.

P81**A comparative study of inspiratory muscle strength, neuromuscular drive to breath and its ratio in weaning outcome****SN Nemer, CSV Barbas, M Andrade, C Geraldo, L Tabajaras, C Coimbra, C Cadilhe, J Dias, PCP Souza***Hospital de Clínicas de Niterói, Rio de Janeiro, Brazil; University of São Paulo, Brazil*
Crit Care 2005, **9(Suppl 2)**:P81 (DOI 10.1186/cc3625)

Background and objectives The inspiratory muscle strength and the neuromuscular drive to breath, evaluated by the maximal inspiratory pressure (MIP) and airway occlusion pressure (P 0.1), respectively, are important factors in weaning. The aim of this study is to evaluate the MIP, the P 0.1 and its ratio (P 0.1/MIP) in weaning outcome.

Methods Seventy consecutive patients of several etiologies in the weaning process that remained up to 24 hours in mechanical ventilation were evaluated (all with $\text{PaO}_2 \geq 60$ mmHg with $\text{FiO}_2 \leq 0.4$ and $\text{PEEP} \leq 8$ cmH₂O). All patients were submitted to a 2-hour trial of spontaneous breathing. Those who sustained 2 hours of spontaneous breathing without return to mechanical ventilation in the following 24 hours were considered weaned, while those who could not sustain 2 hours of spontaneous breathing or returned to mechanical ventilation in the following 24 hours were considered not weaned. $\text{MIP} < -25$ cmH₂O, $\text{P 0.1} < 4.2$ cmH₂O and $\text{P 0.1/MIP} < 0.14$ cmH₂O were used to predict the success in weaning outcome. The predictive performance of each index was evaluated through the sensibility, specificity, positive predictive value, negative predictive value and diagnostic accuracy. The results were also evaluated by the area under the receiver operating characteristic (ROC) curves.

Results MIP presented an area under the ROC curves smaller than those for P 0.1 (0.52 ± 0.08 vs 0.76 ± 0.06 , respectively; $P = 0.004$) and also smaller than those for P 0.1/MIP (0.52 ± 0.08 vs 0.78 ± 0.06 , respectively; $P = 0.0006$). P 0.1/MIP presented excellent predictive performance in weaned patients, with sensibility of 98.08, but with the area under the ROC curves only slightly larger than those for P 0.1 (0.78 ± 0.06 vs 0.76 ± 0.06 , respectively; $P = 0.69$).

Conclusion In our study, Pi max was the criterion with the worst predictive performance. P 0.1 was shown to be a very important criterion to evaluate the respiratory center output, although with limitations in evaluating weaning failure. Patients with P 0.1/Pi max ratio > 0.14 are not always associated with weaning failure, but values < 0.14 were highly associated with success in weaning outcome.

P82**A comparison of two alveolar recruitment maneuver approaches in patients with acute respiratory distress syndrome and hemorrhagic stroke with Glasgow Coma Scale ≤ 8** **SN Nemer, CSV Barbas, J Caldeiras, L Caldeiras, J Goulart, M Cabral, M Rocha, JM Garcia, PCP Souza***Hospital de Clínicas de Niterói, Rio de Janeiro, Brazil*
Crit Care 2005, **9(Suppl 2)**:P82 (DOI 10.1186/cc3626)

Background and objectives Alveolar recruitment maneuvers (ARM) are generally not used in acute respiratory distress syndrome (ARDS) patients in an acute phase of brain injury, aiming to avoid increasing the intracranial pressure (ICP).

Methods Sixteen patients with ARDS and hemorrhagic stroke were evaluated. Criteria for admission were: acute onset, bilateral chest radiographic infiltrates, pulmonary-capillary wedge pressure ≤ 18 mmHg, $\text{PaO}_2/\text{FiO}_2$ ratio < 200 and Glasgow Coma Scale ≤ 8 with ICP monitoring. Patients were randomized into two similar groups. One group received ARM with CPAP of 35 cmH₂O for 40 s, and the other group received pressure control ventilation (PCV) with a positive end expiratory pressure (PEEP) of 15 cmH₂O and pressure control above a PEEP of 35 cmH₂O for 2 min (tidal recruitment). The ICP, cerebral perfusion pressure (CPP) and oxygen pulse saturation (SpO_2) were similar in both groups before the randomization. The fraction of inspired oxygen (FiO_2) was kept to 1.0 during the study. The ICP, CPP and SpO_2 were measured before and after ARM and were compared by Student's *t* test. Mortality was compared by Fisher's test.

Results Initial values of the ICP, CPP and SpO_2 were, respectively: 13.38 ± 4.53 mmHg (CPAP group) vs 13.25 ± 3.45 (tidal recruitment group), $P = 0.95$; 82.75 ± 10.37 (CPAP group) vs 84.25 ± 10.37 mmHg (tidal recruitment group), $P = 0.73$; and

95.75 ± 1.04 (CPAP group) vs 95.0 ± 1.51% (tidal recruitment group), $P = 0.26$. After ARM, the ICP was higher in the CPAP group (20.50 ± 4.75 mmHg vs 13.13 ± 3.56 mmHg; $P = 0.003$), the CPP was lower in the CPAP group (62.38 ± 9.81 vs 79.60 ± 6.80 mmHg; $P = 0.001$) and the SpO₂ was lower in the CPAP group (96.58 ± 1.50 vs 98.25 ± 1.83%; $P = 0.045$). Mortality was lower in the tidal recruitment group, but was not statistically different (37.5% vs 50%; $P = 0.50$)

Conclusion Tidal recruitment with a PEEP of 15 cmH₂O and pressure control above a PEEP of 35 cmH₂O did not affect the ICP and decreased the CPP, but at safe levels, besides improving oxygenation, it can be done safely in patients with ARDS and brain injury. On the other hand, ARM with a CPAP of 35 cmH₂O for 40 s can worsen the ICP and CPP, and should be avoided in these patients.

P83

Early extubation after heart surgery

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Crit Care 2005, **9(Suppl 2)**:P83 (DOI 10.1186/cc3627)

Objective To analyze early extubation of patients submitted to heart surgery while in the ICU.

Materials and methods Aleatory and prospective analysis of patients submitted to heart surgery and early extubation immediately post operation, with other aspects being studied such as: clinical evolution, cardiopulmonary complications, time of stay in the ICU and complications related to early extubation. As criteria for inclusion, the main determining factors were hemodynamic stability, consciousness level (Ramsay >3), motor function preservation, normal radiologic pattern and PO₂/FiO₂ ratio >250. After 1 hour of ICU arrival, patients were submitted to superficialization of the consciousness level with an antagonist of benzodiazepinics, and then nebulization with a 'T' piece for 30 min, following extubation, and then intermittent noninvasive ventilation support (CPAP). All of the patients were monitored with pulse oximetry, series of gas analysis, clinical evaluation and radiologic control.

Results Out of the total number of patients analyzed ($n = 100$), 72% were male. Regarding the type of surgery, there was a higher prevalence of patients submitted to CABG (83%); other types such as valve surgeries and congenital corrections totaled 17%. The average time for extubation was 2 hours (ICU arrival until extubation), and the average period of nebulization was 30 min. In this group, 4% went through reintubation because of somnolence. There were no deaths among the patients studied.

Conclusion The determination of specific protocols for early extubation facilitates a satisfactory evolution with less morbidity among patients submitted to heart surgery.

P84

The influence of positive airway pressure associated with physiotherapy intervention in phase I of cardiac rehabilitation

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Crit Care 2005, **9(Suppl 2)**:P84 (DOI 10.1186/cc3628)

Objective The objective of this study was to evaluate the effects of positive expiratory airway pressure and physiotherapy intervention

(PI) in phase I of cardiac rehabilitation (PP1) on the behavior of pulmonary function (PF) and inspiratory muscle strength (IMS) in the postoperative (PO) period of cardiac surgery (CS).

Method Twenty-four patients were randomly assigned into two groups: GEP ($n = 8$) performed respiratory exercises with positive expiratory pressure (EPAP) associated with PP1; and GP1 ($n = 16$) performed PP1 only. The PF was measured by spirometry preoperatively and at the fifth PO (5PO), and the IMS was measured by the maximal inspiratory pressure (P_{lmax}) preoperatively, at the first PO (1PO) and at 5PO.

Results For spirometric variables, as a percentage of predicted, significant reductions were observed when the preoperative was compared with 1PO for GP1, but for GEP only a difference to the vital capacity was observed ($P > 0.05$). In relation to the differences between the treatments, smaller values were observed in GP1 for peak flow (PF) at 5PO. We found significant reductions of P_{lmax} preoperatively to 1PO in both groups. However, P_{lmax} showed a reduction of the preoperative to 5PO situation only in GPI ($P < 0.05$).

Conclusion These data suggest that CS produces reductions of IMS and PF, and that EPAP associated with PP1 was more effective in the reduction of respiratory changes than PP1 isolated. However, the PF did not wholly reverse until 5PO, the continuance of treatments being necessary after this hospital period.

P85

Acute effects of the application of bi-level positive airway pressure on heart rate variability in healthy young men

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Objective To evaluate the acute effects of noninvasive ventilation through bi-level positive airway pressure (BiPAP) on heart rate variability (HRV) in young and healthy men.

Methods Eleven young and healthy men, aged 22 ± 2 years, were studied. The heart rate and R-R intervals (ms) were collected on a beat-to-beat basis from an electrocardiogram recording in the CM5 derivation with an electrocardiography monitor (Ecafex TC500). The signal was converted by an analogical/digital conversor (Lab.PC+; National Instruments) and processed by a specific routine. The record was collected in two situations: 10 min at rest in the sitting position during spontaneous breathing; and 10 min at the same position with BiPAP (BiPAP®; Tranquility Respironics) application through a nasal mask. The BiPAP pressures slowly increased the inspiratory pressure up to 15 cmH₂O and the expiratory pressure to 8 cmH₂O, allowing voluntary adaptation. The heart rate and its variability were analyzed by the time domain (TD), through RMSSD (ms) and RMSM (ms) indexes, and by the frequency domain (FD), which was expressed as normalized units of low frequency (LF), high frequency (HF) and the LF/HF ratio. In addition, the respiratory rate (RR), the arterial oxygen saturation (oxymeter Emai OX-P-10), the end-tidal carbon dioxide (capnometer BCI-1050) and the blood pressure (indirect auscultatory methods) were measured. The statistical analysis was performed by the Wilcoxon test with $P < 0.05$.

Results In the TD the RMSSD index was significantly lower during BiPAP application when compared with the situation without the ventilatory support. In the FD, only the LF/HF ratio increased significantly during BiPAP application. In relation to physiologic variables, lower end-tidal carbon dioxide values ($P = 0.001$) and higher SaO₂ ($P = 0.04$) were observed during BiPAP application.

Conclusion The results suggest that the acute application of positive pressure in the airway can promote a decrease of HRV and change the autonomic balance, with predominance of the sympathetic system over the parasympathetic system on heart rate modulation.

Acknowledgement This study was approved by the Ethical Committee of Universidade Federal de São Carlos.

P86

Utility of alveolar 'dead space' in the risk stratification of pulmonary embolism in patients who present to the emergency room with acute dyspnea

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Crit Care 2005, 9(Suppl 2):P86 (DOI 10.1186/cc3630)*

Background Previous studies have suggested that normal results of D-dimer and alveolar dead space are highly predictive tools to determine pulmonary embolism in patients with acute dyspnea.

Objective To assess the utility of a protocol to monitor the alveolar dead space fraction associated with D-dimer in the prediction of pulmonary embolism in patients with acute dyspnea.

Methods A prospective study where a protocol was used to assess alveolar dead space and D-dimer in Q patients who presented to the emergency department with dyspnea. The enrollment was performed from September through October 2003.

Results Seven (77.7%) patients were female and the mean age was 77.1 ± 13 years. Nine (100%) patients underwent Doppler ultrasonography of the venous lower extremities; four (44.4%) underwent CT scan of the thorax, three (33.3%) had high dead space alveolar fraction; six (66.6%) had a high D-dimer, and three (33.3%) had an ultimate diagnostic of pulmonary embolism.

Conclusion A normal alveolar fraction of dead space and normal D-dimer were associated with low prevalence of pulmonary embolism in patients admitted to the emergency department with acute dyspnea.

P87

Heart rate variability in the elderly with chronic obstructive pulmonary disease submitted to acute application of bi-level positive airway pressure

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Objective To evaluate the acute effects of noninvasive ventilation, through bi-level positive airway pressure (BiPAP), on heart rate

variability in elderly subjects with chronic obstructive pulmonary disease (COPD), and to compare the heart rate variability (HRV) in healthy elderly men with COPD patients.

Methods Eighteen men (nine healthy men, aged 66 ± 4 years [control]; and nine men with COPD, aged 71 ± 7 years [G2]) were studied. The heart rate and R-R intervals (ms) were collected on a beat-to-beat basis from an electrocardiogram recording in the CM5 derivation with an electrocardiography monitor (Ecafex TC500). The signal was converted by an analogical/digital converter (Lab.PC+; National Instruments) and was processed by a specific routine. The record was collected in two conditions: 10 min at rest in the sitting position during spontaneous breathing, and 10 min during the same position with biBiPAP (BiPAP® S; Resprionics) application through a nasal mask. The BiPAP pressures slowly increased the inspiratory pressure up to 14–16 cmH₂O and expiratory pressure up to 6 cmH₂O, allowing voluntary adaptation. The BiPAP application was realized only in COPD. The heart rate and its variability were analyzed by the time domain (TD), through RMSSD (ms) and RMSM (ms) indexes, and the frequency domain (FD), which was expressed as normalized units of low frequency (LF), high frequency (HF) and the LF/HF ratio. The intra-group comparison was performed by the Wilcoxon test and the inter-group comparison by the Mann-Whitney test, with $P < 0.05$.

Results See Table 1.

Conclusions Our results suggest that the patients with COPD present modifications of sympathetic-vagal balance, with parasympathetic predominance over sympathetic in the sinoatrial node when compared with healthy elderly men. Moreover, the BiPAP application in this study reduced the HRV by DT analysis in COPD patients.

Acknowledgement This study was approved by the Ethical Committee of Universidade Federal de São Carlos.

P88

Respiratory insufficiency: a proposal of a databank

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Introduction Respiratory insufficiency is a common cause of ICU admission. In order to evaluate causes and mortality, a consecutive series of 44 patients were studied at the ICU of Santa Lucia Hospital, according to a protocol applied to collect data.

Materials and methods From 6 November 2004 to 11 January 2005, 44 consecutive patients were admitted to the ICU of Santa Lucia Hospital with respiratory insufficiency. Data were collected prospectively through a specific protocol for all patients that needed invasive or non-invasive ventilatory support.

Table 1 (abstract P87)

Heart rate variability during the sitting position in spontaneous breathing with and without bi-level positive airway pressure (BiPAP) application between control and chronic obstructive pulmonary disease (COPD) patients

		Control	COPD with BiPAP	COPD without BiPAP
Time domain	RMSSD (ms)	15.04 ± 5.72	14.16 ± 9.47	$10.74 \pm 9.18^{\dagger}$
	RMSM (ms)	27.36 ± 12.61	18.98 ± 14.41	15.10 ± 10.16
Frequency domain	BFun	48.22 ± 13.45	$30.46 \pm 13.23^*$	42.88 ± 20.68
	AFun	51.80 ± 13.44	$69.54 \pm 13.23^*$	57.12 ± 20.68
	BF/AF	1.04 ± 0.51	$0.49 \pm 0.35^*$	1.04 ± 0.92

Values presented as means \pm standard deviation. * Control versus COPD without BiPAP, $P < 5\%$; † COPD without BiPAP versus with BiPAP, $P < 5\%$.

Results The mean age was 69.6 years, and 25 (56.8%) were women. The mean body mass index was 26.7 kg/m². The most common causes were lack of consciousness (25%) and pneumonia (20.4%). The clinical symptoms most observed were low pulse oxymetry (75%) and dyspnea (65.9%). A total 65.1% needed tracheal intubation (TI) and mechanical ventilation on admission. Another 31.8% used non-invasive mechanical ventilation (NIMV). As regards ventilatory mode used, 67.4% had the assisted/controlled mode. Twenty-five percent of the patients developed pneumonia after mechanical ventilation. The mechanical ventilation mean time was 164.7 hours. Eight subjects needed a tracheostomy with an average 8.5 days of TI. The mean ICU stay was 10.3 days. The mortality rate was 45.4%.

Conclusion Respiratory insufficiency is a very serious and frequent clinical condition in the ICU, with a high mortality rate. NIMV avoided tracheal intubation in 31.8% of patients.

P89

Influence of bi-level non-invasive ventilation in exercise tolerance and respiratory muscle strength in chronic obstructive pulmonary disease patients

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Objective To evaluate the effects of bi-level ventilation (BiPAP[®]) on respiratory muscle strength and exercise tolerance in COPD patients.

Method Ten patients with clinical and spirometric diagnoses of COPD, with FEV₁ 45 ± 8% and 69 ± 9 years old, clinically stable, were submitted to non-invasive ventilation (BiPAP[®]) by nasal mask, while comfortably seated. Patients attended three sessions per week, during 12 weeks, 30 min each session. The positive inspiratory pressure varied between 12 and 14 cmH₂O, and the positive expiratory pressure between 4 and 6 cmH₂O, according to patient's comfort. Patients underwent clinical and physiotherapy evaluation pre and post treatment. The respiratory muscle strength was evaluated by maximal inspiratory pressure (P_Imax) and by expiratory pressure (P_Emax), measured by residual volume and total pulmonary capacity, respectively. Three maximum efforts were performed in equipment graduated in cmH₂O (Ger Ar, SP, Brazil), and the maximum value considered for analysis. Exercise tolerance was evaluated with the incremental test (IT) symptoms limited. The IT was performed in a treadmill (Imbramed model Milenium ATL RS, Brazil), with progressive speed, beginning with 2.0 km/hour, during 2 min, increasing 0.5 km/hour every 2 min. The perception of dyspnea (Borg Scale), systolic blood pressure (SBP), diastolic blood pressure (DBP), oxygen peripheral saturation (SpO₂), heart rate (HR) and walking distance were measured every 2 min. Statistical analysis was by the Wilcoxon test, with *P* < 0.05.

Results Statistically significant differences were observed for P_Imax (from 54 ± 17 to 77 ± 19; with *P* < 0.007), P_Emax (from 75 ± 20 to 109 ± 36; with *P* < 0.007), SpO₂ (from 88 ± 5 to 91 ± 4; with *P* < 0.02), SBP (from 168 ± 24 to 146 ± 14; with *P* < 0.02), dyspnea (from 3 ± 3 to 0.6 ± 1; with *P* < 0.01) and walking distance (from 466 ± 341 to 723 ± 300; with *P* < 0.015). However, significant differences in HR and DBP were not seen.

Conclusion According to these results, it is possible to conclude that BiPAP[®], promoting respiratory muscle rest, permitted better conditions in respiratory muscle strength development. Moreover, BiPAP[®] improved oxygenation and reduced the symptoms of dyspnea, and was able to improve exercise tolerance in patients with COPD.

P90

Congenital lobar pulmonary emphysema mimicking contralateral pulmonary hypoplasia

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Background Congenital lobar pulmonary emphysema (CLPE) is a rare condition, and it is characterized by overdistension of the affected lobe and compression and displacement of adjacent normal lung tissue and mediastinum.

Case A 2-month-old boy was admitted to the ICU with respiratory failure. At admission, he presented with bilateral pneumonia and respiratory failure, requiring mechanical ventilation and antibiotics. Despite the initial treatment, he persisted with desaturation and marked hypercapnia. Chest X-rays revealed hyperinflation of the left lung, with significant reduction of the right lung area. The first CT scan showed extensive consolidation of the right lung and atelectasis. Bronchoscopy revealed reduction of the right bronchus caliber and was diagnosed as right lung hypoplasia. The child continued to have desaturation and it was not possible to wean him off mechanical ventilation. Fifteen days later he had another CT scan showing overdistension of the left lung apex, suggesting the diagnosis of congenital lobar emphysema. After the second CT scan, we performed a selective intubation to the right, trying to inflate the collapsed right lung, and there was a marked improvement on saturation; a chest X-ray showed aeration of the right lung. The child was submitted to superior left lobe lobectomy, and after the surgery he improved in pulmonary function and it was possible to wean him off mechanical ventilation. The patient was discharged from the ICU 20 days later.

Discussion CLPE is characterized by postnatal overdistension of one or more pulmonary lobes, the left lobe being the most frequently affected. One-half of the cases have unknown causes. When a marked overdistension is present, lung herniation and collapse of the contralateral lung can occur. In the first instance, we considered the hypothesis of right lung hypoplasia, following bronchoscopy findings. CLPE was confirmed after a second CT scan.

Conclusion CLPE is a rare pulmonary condition, usually diagnosed before 6 months of age; it must be considered a differential diagnosis in cases of suspected contralateral lung hypoplasia.

P91

Pulmonary toxicity induced by bleomycin in a patient with Hodgkin lymphoma

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Background Hodgkin lymphoma usually presents before adolescence and adulthood. Patients with stage IV disease must receive chemotherapy and radiotherapy. Most of the chemotherapy drugs have several adverse effects, mainly when used in combination with other chemotherapy agents. Last year's study on Hodgkin lymphoma and pulmonary toxicity revealed that bleomycin was the drug most frequently associated with pulmonary toxicity.

Case A 5-year-old boy with mixed-cell Hodgkin lymphoma. He was admitted for the first time to the ICU with respiratory failure, pleural and pericardial effusions, renal failure, cholestasis and cardiac failure, caused by lymph node extrinsic compression against the renal arteries, biliary tract and left atrium. Initially treated with

cyclosporine, he improved after regression of the lymph nodes and was transferred to the floor. Without cholestasis symptoms, the child started treatment with adriamycin, bleomycin, vinblastine and dacarbazine (AVBD). Before starting on the new treatment, he was receiving 0.50 inspired oxygen fraction, and had minimal pleural effusion on the chest X-ray, similarly to the previous radiographs. One hour after receiving bleomycin (6 mg), he developed marked desaturation and generalized seizure, requiring intubation and mechanical ventilation; a chest X-ray at this moment revealed bilateral infiltrate. He persisted with hemodynamic instability, worsening respiratory failure despite high-frequency oscillatory ventilation, and died 13 days after bleomycin infusion. Necropsy revealed organizing diffuse alveolar damage, acute cor pulmonale, passive liver congestion, and lymphomatous infiltration of the liver, spleen and bone marrow.

Discussion Bleomycin's main adverse effect is pulmonary toxicity, with incidences from 3% to 10%. Histologically it can present with bronchiolitis obliterans organizing pneumonia, diffuse alveolar damage and interstitial pneumonitis, progressing or not to lung fibrosis.

Conclusion Bleomycin administration is a potential cause of pulmonary toxicity and can be associated with acute respiratory distress syndrome in children with Hodgkin lymphoma.

P92

Treatment of acute respiratory distress syndrome using the recommendations of the Brazilian Consensus of Sepsis in an ICU of a teaching hospital

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Introduction The acute respiratory distress syndrome (ARDS) is a clinical syndrome that affects both medical and surgical patients. Despite improvements in respiratory support, ARDS in critically ill patients is associated with mortality rates of between 40% and 65%. The Brazilian Consensus of Sepsis has recently proposed ventilation strategies that include low tidal volumes, high PEEP levels and recruitment maneuvers to increase the homogeneity of inflation of the lung.

Objective To determine the frequency of ARDS and to describe the outcome adopting the recommendations of the Brazilian Consensus of Sepsis.

Methods All patients in the early phase of ARDS, defined according to the criteria of the American-European Consensus Conference, admitted from January 2004 to December 2004 were evaluated from a database that includes demographic data, APACHE II score, ICU and hospital length of stay, and ICU and hospital mortality. All patients were ventilated according to the recommendations of the Brazilian Consensus of Sepsis.

Results From 938 admissions during the study period, 26 patients developed ARDS (2.77%). The mean age of this group of patients was 50 ± 22 years, and their mean APACHE II score was 20 ± 6 with a predicted mortality of 35.4%. The length of stay and mortality in the ICU were 17 ± 3 days and 61.5%, respectively, and the length of stay and mortality in hospital were 22 ± 13 days and 73.1%, respectively. The main cause of death was multiple organ dysfunction syndrome.

Conclusions The frequency of ARDS was 2.77% in the study population. The hospital length of stay of these patients tended to be long. The hospital mortality of this group of patients was 73.1%.

P93

Mechanical ventilation in geriatric patients who underwent orthopaedic surgery: a prospective study

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Objective Our hypothesis is that older patients more often receive mechanical ventilation than their younger counterparts.

Methods During a 4-year period (2001–2004), we collected data on 1410 patients admitted to an ICU of an orthopedic surgery hospital. We analyzed the use of mechanical ventilation.

Results The percentage of patients that needed at least 1 day of mechanical ventilation progressively increases from patients in their sixties to those in their nineties ($r = 0.97$): <65 years, 3.5%; 65–69 years, 1.2%; 70–79 years, 3.7%; 80–89 years, 16.1%; 90 years or more, 25.8%.

Conclusions In geriatric patients there is a positive correlation between age and need of mechanical ventilation in the postoperative period of orthopedic surgery.

Neurology

P94

Effect of intra-arterial nimodipine in patients with subarachnoid hemorrhage and refractory vasospasm: a pilot study

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Crit Care 2005, **9(Suppl 2)**:P94 (DOI 10.1186/cc3638)

Background Vasospasm following subarachnoid hemorrhage (SAH) after rupture of a cerebral aneurysm is a major complication. If left untreated it leads to death or permanent deficits in over 20% of patients. Treatment includes triple H therapy and nimodipine given by the enteral route. In severe cases, angioplasty and superselective intra-arterial injection of vasodilators may be effective.

Objective To evaluate the effect on transcranial Doppler (TCD) velocities of the treatment of moderate to severe refractory vasospasm with intra-arterial nimodipine.

Methods Three patients with Fischer IV SAH after aneurysm rupture were treated with coil embolization in the first 3 days after the hemorrhagic event, and enteral nimodipine (360 mg/day) developed moderate to severe vasospasm on the middle cerebral artery (detected by TCD) refractory to triple H therapy. They were treated with superselective injection of intra-arterial nimodipine, infused during a period of 30 min–1 hour, and were evaluated after 12–24 hours by a new TCD.

Results All three patients showed a reduction of mean flow velocity greater than 30% and a Lindergaard ratio lower than 3.

Conclusions This is a small series of patients but it suggests that treatment with intra-arterial nimodipine may be effective in reducing the severity of vasospasm refractory to clinical therapy. We intend to increase our cohort and correlate these effects with the development of ischemia and neurological outcome.

P95

Cerebrovascular autoregulation, CO₂ reactivity and outcome in patients with severe traumatic brain injury: a pilot study

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Background Impaired cerebral autoregulation is frequent after severe traumatic head injury, and impaired CO₂ reactivity may be associated with poor outcome.

Objective To evaluate the incidence, asymmetry and relation to outcome of impaired autoregulation and CO₂ reactivity.

Methods Five patients with severe head injury were prospectively assessed in the first 24 hours after trauma for the presence of impaired autoregulation and CO₂ reactivity. Four patients were monitored for invasive arterial blood pressure (ABP), intracranial pressure, cerebral perfusion pressure (CPP), jugular bulb oxymetry and transcranial Doppler (TCD) flow velocities and pulsatility index. One patient was monitored only for ABP and TCD parameters. Autoregulation was evaluated by flow velocity response to CPP and ABP changes induced by noradrenaline infusion. The CO₂ reactivity was assessed by flow velocity response to ventilator manipulation of the minute volume. Outcome was assessed with Glasgow Outcome Scale at discharge from hospital and after 3 months.

Results Autoregulation was globally impaired in three of the five patients and impaired in one hemisphere in one patient. CO₂ reactivity was globally impaired in one patient and impaired in one hemisphere in one patient. Three patients died, two of them probably associated with the severity of brain injury and one of septic shock. The two other patients are still in the hospital.

Conclusion We present here a small series of patients, but the results suggest that impaired autoregulation is indeed common in these patients, which may have implications in therapy. We intend to increase our cohort and to correlate autoregulation and CO₂ reactivity with outcome soon.

P96

Protein S-100b as a screening tool for the need of head CT scan after minor head trauma

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Introduction Systematic use of head CT scan after minor head trauma may lead to a high incidence of negative examinations and high costs. On the other hand, undetected intracranial lesions may be life threatening. Neuronal protein S-100b into the circulation has been suggested as a specific indication of neuronal damage. We tested the hypothesis that protein S-100b is a useful and cost-effective screening tool for the management of minor head traumas.

Methods Fifty consecutive patients sustaining isolated minor head trauma were prospectively evaluated in the emergency room by routine head CT scan and blood sampling for protein S-100b measurement, using an immunoluminescence test kit. Seventeen normal healthy individuals served as negative controls. Data are presented as the median and 25th–75th percentiles.

Results Patients reached the emergency room 45 min (30–62 min) after minor head trauma. Six patients had relevant

post-traumatic lesions at the initial head CT (12%) and were thereby counted as positive (CT+). The median systemic concentration of S-100b in those patients was 0.75 µg/l (0.61–6.5 µg/l), which was significantly different (U-test, $P=0.011$) from the median concentration, 0.26 µg/l (0.12–0.65 µg/l), of those without post-traumatic lesions in the initial head CT scan (CT–). A sensitivity of 100%, a specificity of 20%, a positive predictive value of 15% and a negative predictive value of 100% were detected.

Conclusions Protein S-100b has a very high sensitivity and negative predictive value, and could have an important role in ruling out the need for CT scan after minor head trauma. This may be of clinical relevance, particularly in countries in which trauma is epidemic and medical resources are limited, such as in Brazil.

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Nutrition/metabolism

P97

The effects of enteral feeding with eicosapentaenoic acid, gamma-linolenic acid and antioxidants in patients with sepsis

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Introduction Nutritional support with diets containing eicosapentaenoic acid (EPA), gamma-linolenic acid (GLA) and antioxidants can improve lung microvascular permeability, oxygenation and cardiopulmonary function, by modulating proinflammatory eicosanoid (leukotriene B₄, prostaglandin E, thromboxane B₂) production from arachidonic acid [1]. This diet can improve gas exchange and clinical outcomes in comparison with a standard control diet in patients with ARDS [2]. This study investigates whether an EPA + GLA + antioxidant enriched enteral diet can improve outcomes and reduce mortality in patients with sepsis.

Materials and methods This are the preliminary results of a prospective, randomized, controlled trial. Thirty patients with clinical diagnosis of either sepsis, severe sepsis or septic shock and under mechanical ventilation were enrolled in this study and were randomized for a high-fat, low-carbohydrate enteral nutrition formula or an enteral diet enriched with EPA + LGA + antioxidants (Oxepa; Abbott Laboratories). In association with sepsis standards of care, patients received enteral formula during mechanical ventilation. In all patients included in this study, enteral feeding was delivered at a constant rate to achieve a minimum of 50% of Basal Energy Expenditure (BEE) (Harris–Benedict equation) × 1.3 within the first 24 hours and, if tolerated, a minimum of 75% of BEE × 1.3 within 72 hours of initiation of enteral feeding until complete weaning from the ventilator.

Results Septic patients fed EPA + GLA + antioxidants maintained higher oxygenation status ($P=0.001$), more ventilator-free days ($P=0.001$), more ICU-free days ($P=0.02$) and lower mortality rates ($P=0.03$).

Conclusion This study suggests that an enteral diet containing EPA, GLA and elevated antioxidants helps to downregulate the synthesis of proinflammatory mediators and contributes to restore homeostasis of the septic patient. The beneficial effects of this diet suggest that this enteral nutrition formula would be a useful adjuvant therapy in the clinical management of sepsis.

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P98**How long does it takes to begin nutrition support in the ICU?****C Belo, MG Rodrigues***Quinta D'or Hospital, Rio de Janeiro, Brazil**Crit Care* 2005, **9(Suppl 2)**:P98 (DOI 10.1186/cc3642)

Introduction Nutritional support is very important in critically ill patients and many studies have been performed trying to optimize the nutritional therapy and to minimize the muscular catabolism of this group of patients.

Objective The present study demonstrated how long it takes to begin and to complete nutritional support in critically ill patients in the ICU, compared with clinical and surgical patients, and analyzed the complications and the causes of discontinuation of nutritional support in the ICU.

Materials and methods A prospective analysis of 85 patients (32 women and 53 men), 68 clinical and 17 surgical diagnoses, admitted to a 41-bed ICU from July 2004 to February 2005. The present study analyzed the time to begin and to complete nutritional support, the reason for discontinuation, the complications and the position of the catheter to provide the nutritional support.

Results The patient APACHE II score was 16.6 and 17 for surgical and clinical patients, respectively. The time to begin nutrition support was 3.52 and 2.1 days for surgical and clinical patients, respectively. The clinical patients had a gastric catheter in 51 patients and a catheter in the jejune position in 17 patients. The diet used was polymeric in 60 patients and oligomeric in eight patients; discontinuation of nutrition occurred in nine cases (13.4%) (four mesenteric ischemia, three hemodynamic instability, one oral nutrition and one gastrointestinal hemorrhage), and diarrhea occurred in 20 patients (29.41%), but it was auto limited and the average was 1.61 episodes/day. Gastroparesis occurred in 14 patients (20.6%) but all of them except one resolved in 1 day without needing a change of the catheter position and without relation to the catheter position. Eighteen patients died (26.47%). The surgical patients had a gastric catheter in 10 patients and a catheter in the jejune position in seven patients; discontinuation of nutrition occurred in three cases (17.64%) (two mesenteric ischemia, one hemodynamic instability), and diarrhea occurred in eight patients (47%), but it was auto limited and the average was 3.05 episodes/day. Gastroparesis occurred in four patients (23.5%) but all of them resolved in 1 day without needing to change the catheter position; all of them were related to hemodynamic instability. Four patients died (23.5%).

Conclusion The time to beginning nutrition support was shorter in the clinical group compared with the surgical group in spite of complete nutritional support in surgical patients being shorter. We did not observe too many complications and the majority received the nutritional support proposed. Diarrhea was more prevalent in the surgical group but was not involved in discontinuation of nutrition. The mortality was similar in both groups.

P99**Plasma amino acids in critically ill patients****MG Rodrigues, F Ruzany, DR Salgado, E Rocha, CF Valente, E Maccariello, RNA Paiva***Hospital Universitário Pedro Ernesto/Hospital Barra D'or, Brazil**Crit Care* 2005, **9(Suppl 2)**:P99 (DOI 10.1186/cc3643)

Introduction Stress states, sepsis and trauma markedly increase protein catabolism in skeletal muscle, gut, and connective tissue.

Catabolism is potentiated by a sepsis-induced decrease in amino acid uptake in skeletal muscle. One-third of the total amino acid output from skeletal muscle is glutamine and one-third is alanine.

Objective To demonstrate the concentration of plasma amino acids in critically ill patients.

Materials and methods A prospective analysis of 41 patients (17 women and 24 men) admitted to a 27-bed ICU from July 2002 to May 2003. Twenty-three amino acids were analysed in each patient up to 24 hours of admission in the ICU. The amino acid assays, using high-pressure liquid chromatography, were performed by laboratory CTN and Pardini.

Results The average patient age was 73.08 years (43–88 years) and the APACHE II score was 18.37 (11–28). Plasma amino acids were obtained in 41 patients and 23 amino acids were analysed ($\mu\text{mol/l}$). The total value of plasma amino acids was 4257.475 $\mu\text{mol/l}$ (average). The doses of plasma amino acids were: aspartic acid 75.95, glutamic acid 384.45, alanine 587.1, arginine 84.45, asparagine 78.5, cystine 497.55, phenylalanine 179.2, glycine 497.55, glutamine 413.25, hydroxyproline 58.25, histidine 84.55, isoleucine 90.325, leucine 195.5, lysine 190.05, methionine 48.85, ornithine 118.65, proline 201.5, serine 156.75, taurine 167.25, tyrosine 127.85, threonine 167, tryptophan 51.925, and valine 278.975.

Conclusion The concentrations of alanine, glutamic acid, aspartic acid, phenylalanine and arginine were more elevated than the other amino acids. Glutamine was demonstrated to be decreased, probably, as an essential amino acid in sepsis or catabolic patients, greatly consumed.

P100**Amino acid adherence in continuous renal replacement therapies****MG Rodrigues, F Ruzany, DR Salgado, E Rocha, CF Valente, E Maccariello, RNA Paiva***Hospital Universitário Pedro Ernesto/Hospital Barra D'or, Brazil**Crit Care* 2005, **9(Suppl 2)**:P100 (DOI 10.1186/cc3644)

Introduction Continuous renal replacement therapies (CRRT) readily allow for the nutritional support of these high catabolic states, but also contribute to the nitrogen loss through filtration of free amino acids and small peptides across the hemofilters, and possible adherence of amino acids.

Objective To evaluate amino acid adherence in CRRT.

Materials and methods Paired samples from serum, venous and dialysate/ultrafiltrate were obtained during CRRT procedures from 41 patients in a 27-bed ICU from July 2002 to May 2003. Paired samples were collected from 1, 6, 12, 24, 36 and 48 hours of continuous hemodialysis, a total of six samples of serum, venous and dialysate. PAN 650 filters were used in all patients. The blood flow was 150 ml/min in all patients and the dialysate flow during CVVHD was 16.6 ml/min.

Amino acid assays, using high-pressure liquid chromatography serum, venous and dialysate, were performed by laboratory CTN and Pardini. Adherence was calculated as: clearance hemodialysis (CH) / serum clearance (SC); $\text{CH} = (16.6 \times \text{dialysis}) / \text{serum amino acids}$; $\text{SC} = 150 \times (\text{serum amino acids} - \text{venous amino acids}) / \text{dialysis amino acids}$.

Results The average patient age was 73.08 years (43–88 years) and the APACHE II score was 18.37 (11–28). Serum, venous and dialysate amino acids were obtained in 41 patients and 23 amino acids were analysed ($\mu\text{mol/l}$): aspartic acid, glutamic acid, alanine,

arginine, asparagine, cystine, phenylalanine, glycine, glutamine, hydroxyproline, histidine, isoleucine, leucine, lysine, methionine, ornithine, proline, serine, taurine, tyrosine, threonine, tryptophan, valine. Analyses were performed on the average of the amino acids. Adherence was not statistically significant, and did not correlate with time of hemodialysis or with serum amino acids. Statistical calculations were made by analysis of variance, linear, nonlinear and logarithmic regression: glutamine ($R^2 = 0.978691062$), alanine ($R^2 = 0.575243703$), taurine ($R^2 = 0.612666425$), valine ($R^2 = 0.743575525$).

Conclusion We should not estimate the protein necessity in a septic or trauma patient on CHVVD based exclusively on the amino acid loss. Other factors, such as the adsorption of amino acids, may contribute to the continuous catabolism seen in these critically ill patients.

P101

Glutamine serum, adherence and losses in continuous renal replacement therapies in critically ill patients

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Introduction Continuous renal replacement therapies (CRRT) readily allow for the nutritional support of these high catabolic states, but also contribute to the nitrogen loss through filtration of free amino acids and small peptides across the hemofilters. Amino acid clearances and calculated losses in adults on continuous venovenous hemofiltration (CVVHD) have been reported in the range of 2–11% of dietary intake. Glutamine is an very important amino acid in critically ill patients.

Objective To analyse glutamine serum, losses and adherence from CRRT treatments in critically ill patients.

Materials and methods Paired samples from serum, venous and dialysate/ultrafiltrate were obtained during CRRT procedures from 41 patients in a 27-bed ICU from July 2002 to May 2003. Paired samples were collected from 1, 6, 12, 24, 36 and 48 hours of continuous hemodialysis, a total of six samples of serum, venous and dialysate. PAN 650 filters were used in all patients. The blood flows was 150 ml/min in all patients and the dialysate flow during CVVHD was 16.6 ml/min. Amino acid assays, using high-pressure liquid chromatography serum, venous and dialysate, were performed by laboratory CTN and Pardini.

Results The average patient age was 73.08 years (43–88 years) and the APACHE II score was 18.37 (11–28). Serum, venous and dialysate amino acids were obtained in 41 patients and glutamine was analysed ($\mu\text{mol/l}$). Analyses were performed on the average of amino acids. Statistical calculations were made by analysis of variance, linear, nonlinear and logarithmic regression.

Conclusion Glutamine is very important in critically ill patients. Glutamine was demonstrated to be decreased, probably, as an essential amino acid in sepsis or catabolic patients, greatly consumed. We should not estimate the protein necessity in a septic or trauma patient on CHVVD based exclusively on the amino acid loss. Other factors, such as the adsorption of amino acids, may contribute to the continuous catabolism seen in these critically ill patients.

P102

Results of an intensive insulin infusion protocol in diabetic and nondiabetic critically ill patients

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Introduction The implementation of an intensive insulin infusion protocol (IIIP) has recently been shown to improve results in the critically ill.

Methods We retrospectively reviewed the clinical charts and specific nutritional records from the Nutrition Support Team of all the patients admitted to the ICU and submitted to an IIIP during 1 year (1 January–31 December 2004). On all patients we collected: demographics (age, sex), maximum SOFA score, clinical characteristics (diabetes mellitus, glucose levels above 130 mg/dl or below 60 mg/dl) and risk factors to hyperglycemia (drugs, infection).

Results Over the study period, 37 patients received IIIP. All these patients presented infection and were submitted to mechanical ventilation. Twelve patients were diabetic and 25 were nondiabetic. A total of 10,239 glucose estimations were performed during 444 days. The demographics were well matched. The maximum SOFA score was bigger in the diabetic group (10 ± 2 vs 8 ± 3). We found 32% of hyperglycemic levels and 0.28% of hypoglycemia in the whole population. In the diabetic group, the incidence of hyperglycemia and hypoglycemia were, respectively, 37% and 0.44%, while in the nondiabetic group they were 29% and 0.21%.

Discussion The literature provides similar trends in the safety profile of IIIP in the critically ill. It seems necessary to observe the differences between diabetic and nondiabetic patients.

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P103

Enteral nutrition in septic shock in the elderly: do the waiting time to start and the achieved basal energy expenditure interfere with mortality?

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Background The earliest starting point of enteral nutrition (EN), as well as the basal energy expenditure (BEE), achieved within as short a waiting time as possible seems to benefit quite a large number of critical patients.

Objectives To analyze when to start EN and the BEE achieved in the elderly hospitalized with a septic shock diagnosis, and to verify its association with mortality in these patients.

Methods A prospective cohort conducted within 32 months and with 67 patients over 65 years old in the ICU with septic shock, where 59 of these patients had EN. The APACHE II score was determined in every patient. The following variables were analyzed in this group: the time taken to start the NE, the BEE (achieved or not), and the time to reach the BEE in those who had it. These variables were correlated with death and it was still observed whether there was correlation between the starting time point of

EN and the achieved BEE. The statistical tests used were the *t* test and the chi-square test, considering 5% as the significance level.

Results The average age was 80 ± 7 (minimum = 66, maximum = 96) years, the APACHE II average score was 18 ± 5 (minimum = 8, maximum = 28), and the time average to start EN was 80 ± 53 hours (minimum of 12 hours and maximum of 240 hours). The achieved BEE occurred in 69.5% ($n = 41$) of the patients and the time average to reach it was 115 ± 56 hours (minimum of 72 hours and maximum of 360 hours). Death was associated with time to start EN ($P = 0.001$) and with the non-achieved BEE ($P < 0.001$). However, there was no correlation with time to reach BEE ($P = 0.22$). The time to start EN did not show association with the achieved BEE ($P = 0.08$).

Conclusions Initiating EN as soon as possible and the BEE when achieved in this group of patients showed some benefit. The time to achieve the BEE does not seem to have correlation with mortality in these patients. The time to start NE did not have association with the BEE achieved in this sample.

Nursing

P104

Peripherally inserted central catheter in critically ill patients

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Crit Care 2005, **9(Suppl 2)**:P104 (DOI 10.1186/cc3648)

Introduction The use of the vascular catheters is one of the most important and required interventions in ICUs. One of these options is the peripherally inserted central catheter (PICC), which is inserted by habilitated nurses in patients who are in these conditions in the ICU.

Background and objectives To evaluate the use of this type of catheter in an adult ICU in the city of São Paulo, to check indication, insertion, maintenance and its complication rate.

Methods A prospective and descriptive study performed during 1 year from March 2003 to March 2004. From 89 evaluations, 40 PICC were inserted.

Results The main indication for the use of PICC was the administration of antibiotics, followed by difficulty in venous access and the administration of medications that act in the vascular system. Eighty-five percent of the catheters were used in the Semi-ICU. The great majority of patients were taken off the catheter just after the completion of the treatment (85%). There were two cases of phlebitis, three cases in which the catheter was accidentally removed and one case of obstruction.

Conclusions The PICC has importance and application in intensive therapy, being one more therapeutic option, with a low range of mechanical and infectious complications. It is necessary for institutional training to have adequate maintenance and manipulation.

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P105

Nasoenteral feeding tube placement: indications and nurse skills

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Introduction Nutrition therapy (NT) is a powerful tool to assist the patients' nutritional needs mainly in the ICU, where the patients usually have high energy expenditures. The route mostly used for NT is the nasoenteral feeding tube (NFT), being easier and with lower costs. It can be accomplished by the nursing staff under direct vision by the nasal route (after training) or through endoscopy. The nasoenteral insertion is not free from complications, and these can be classified as: mechanics (obstruction of the probe, accidental exit, migration of the tube), infectious and psychological (anxiety, depression). The NFT is suitable for small and medium periods of NT (about 6 weeks).

Objectives To classify the indication of the NFT in the ICU; to identify the complications and the professional that accomplished the insertion.

Results During the period from January 2005 to 23 February 2005 we studied 83 patients receiving NT, 49% of them male. Successful first introduction was achieved in 35 patients (42%). The indication of NFT was NT in 98% of cases: 58% of them were replaced, and the reasons were 16 obstructions of the tube (33%), 17 accidental exits (35%) and 15 migrations (32%). The nursing staff accomplished the tube insertion 80% of times. There were 5% with complications; all of them were nasal bleeding, considered a minor complication.

Conclusion The main reason for NFT insertion was NT initiation. Nursing staff have great capability for tube placement and we identify clear requests for improvement interventions to avoid a large number of tube replacements.

Epidemiology/quality of life/administration

P106

Electrocardiographic analysis for telemedicine based on a low-cost software approach

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Introduction Trends in telemedicine applied for clinical cardiology involve techniques such as the transmission of Holter monitoring recordings, as well as of electrocardiographic (ECG) measurements in the ICU. Both techniques enable more efficient clinical procedures, especially in the case of acute myocardial infarction [1]. However, this transmission is a complex task, since different file formats must be handled by the system, thus requiring conversion from one format to the other.

Objective To propose a low-cost software tool for the analysis of ECG recordings of different file formats, which enable processing of data measured in the ICU or arising from telemedicine systems.

Materials and methods Twenty ECG recordings, taken from acute myocardial infarction patients by a telemedicine system, were stored as .pdf files. We have considered just the derivations

Avf, II and III. In the following, they were analysed by our software tool to estimate the variation of the area of the ST segment. First, the .pdf files were converted to eight-bit .bmp files, as images with 2000 × 1600 pixel resolution, in a grey scale. Axes are defined in the image to extract a data file, which may be converted into any desired format. This data file was processed by two different methods, in order to estimate the variation of the ST-segment area. The first method employs vertical axis scanning whereas the second method carries out standard integration, based on a finite-interval technique.

Results The two methods presented the following average errors for the estimation: 1.80% for derivation Avf, 1.27% for derivation II and 1.38% for derivation III. Average variances were 7000 for method 1 (axis scanning) and 7200 for method 2 (standard integration).

Conclusion Simple and cost-effective methods for the analysis of ECG recordings arising from a telemedicine system, which may be used in current computer configurations in the ICU, were successfully employed to estimate the variation of the ST-segment area for myocardial infarction patients. Method 1 presents the lowest variance.

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P107

Resuscitative status of patients during their stay in the ICU: changing decision-making to end-of-life care

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Objective To verify whether the status of treatment in terms of resuscitative effort changes during the stay of critical patients in intensive care.

Methods We retrospectively analyzed 2108 patients admitted to the ICU from 1 January 2003 to 31 December 2003. During this period, the resuscitative status (no limitation of care, do not resuscitate and comfort care) at the moment of admission and in the morning medical visit on the day of death were recorded and compared. Numerical variables were compared using the Student *t* test and categorical variables with the chi-square test. A level of significance of 5% was required to consider some difference as significant.

Results Death occurred in 204 (9.7%) patients and dead patients were older (69.2 ± 17.6 vs 63.1 ± 18.5 years, $P < 0.001$) and had a longer stay in the ICU (45 ± 13.8 vs 4 ± 8.3 days, $P < 0,001$) than the total admission patients. The APACHE score was not different (20.1 vs 21.2 , $P = 0.06$). The resuscitative status is presented in Table 1.

Table 1

Resuscitative status at admission and on the day of death

Resuscitative status	Admission (n = 2108)	Death (n = 204)	P
No limitation of care	2094 (99.3%)	103 (50.5%)	<0.001
Do not resuscitate	2 (0.1%)	12 (5.9%)	
Comfort care	12 (0.6%)	89 (43.6%)	

Conclusion The change of the resuscitative status from admission to the day of death may reflect a change in the medical decision, involving the families, to end-of-life care, limiting measures that prolong life after failure of intensive support.

P108

Analysis of the stressful factors in an ICU

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Background The hospital atmosphere, notably in the ICU, submits the patient to psychological experiences that frequently influence them after ICU discharge. It is important to identify the stressful factors contributing to the development of this phenomenon.

Objectives To identify and to stratify the stressful factors, in the patient's perspective, their relatives and the health care professionals, at an ICU.

Methods A descriptive cross-sectional survey, carried out between June and November 2004 in a general ICU of a private hospital. The sample was composed of three groups: group 1 (G1) was formed by patients, group 2 (G2) by patient's relatives and group 3 (G3) by ICU health care personnel responsible for the included patients. In order to identify and stratify the stressful factors, we used the Intensive Care Unit Environmental Stressor Scale (ICUESS), composed of 40 assigned items scaled 1 (not stressful) to 4 (very stressful). The three groups answered in agreement with their perception of stressful factors for the patient. For each individual, a Total Stress Score (TSS) was calculated from the sum of all the answers of the scale.

Results Thirty individuals were included in each group. The mean age of the three groups was: 57.30 ± 17.61 years for G1; 41.43 ± 12.19 for G2; and 40.82 ± 20.20 for G3. The mean TSS was 62.63 ± 14.01 for the patients; 91.10 ± 30.91 for the relatives; and 99.30 ± 21.60 for the health care professionals. A larger TSS was associated with patients without religion, that have more expensive health insurance and those that had attended university. Among the relatives, the parents had larger values of TSS. The respiratory therapists were the professionals that obtained a larger TSS and the smallest average was found among the doctors. The average of the patients' TSS was lower than that of the relatives and that of the health care professionals. There was no statistically difference between the latter two groups (family and professionals).

Conclusion The perception of the main stressful factors was different among the three groups, especially when patients were compared with the relatives and health care professionals. These groups (family and professionals) believe that some factors are more stressful for the patient than the patient himself would have stated.

P109

Intensive care medicine teaching in a Brazilian medical school: the student's perspective

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Introduction Several medical schools do not have a specific discipline for the teaching of intensive care medicine (ICM) topics

in their curriculum. As a result, students often seek exposure to ICM in extracurricular activities.

Objective To analyze the interest and contact with ICM among students of a Brazilian public medical school.

Methods This is a descriptive study. We applied a questionnaire to enroll students between the sixth and the final semesters.

Results We studied 216 students. The mean age was 22.8 ± 1.7 years, and 61.7% ($n = 129$) were men. Most of them (56.5%, $n = 122$) had never frequented an ICU despite classifying the usefulness of an apprenticeship in this area as high (average of 4.3 ± 0.9 , in a scale from 1 to 5). The main reason for not frequenting an ICU was lack of opportunity to do so (80.9%, $n = 93$). Among students that had already frequented an ICU, 81.9% did so exclusively as part of extracurricular activities; the main reason for seeking this exposure was interest in ICM as a future specialty (37.7%, $n = 26$). Almost all students (98.6%, $n = 212$) thought that ICM topics should be more explored at their university. The main causes for students' dissatisfaction with ICM teaching at their university were: disinterest of the manager (65.5%, $n = 135$), disinterest of the teachers (24.3%, $n = 50$) and lack of qualified teachers (14.4%, $n = 31$). Although most students (55.3%, $n = 119$) had already participated in a discussion to send a patient to the ICU, 32.4% ($n = 36$) thought they were not capable of identifying a patient with the need for intensive care. On a scale from 1 to 5, the mean interest in ICM was 3.6 ± 1.0 . The most popular topics were: shock (4.74 ± 0.60), cardiopulmonary resuscitation (4.73 ± 0.64), and SIRS/sepsis (4.63 ± 0.66). The procedures that more students had contact with were: peripheral venous access (40.9%, $n = 88$); cardiopulmonary resuscitation (28.4%, $n = 61$); and passage of a vesical probe (25.6%, $n = 55$).

Conclusions This study revealed a high interest in ICM topics among medical students. However, the majority of the population studied had not frequented an ICU before. Moreover, of those who had already frequented an ICU, most had done so in units outside the academic atmosphere.

P110

Radiologic assessment of volemic status: vascular pedicle width

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Objectives Portable, supine chest roentgenograms (CXR) are the most commonly used noninvasive method to identify pulmonary edema in the ICU. We conduct a study to evaluate the influence of cardiomegaly, pulmonary edema and vascular pedicle width (VPW) on diagnosing hypervolemia using digital CXRs.

Methods A radiologist selected eight CXRs to assure equal proportions of: cardiothoracic ratio (CTR) >0.55 ; presence of Kerley's lines and VPW >70 mm. Assuming that VPW >70 mm is indicative of hypervolemia, two groups of 10 intensivists (≤ 10 years and >10 years of activity) were enrolled without any additional clinical information.

Results See Table 1.

Conclusions The overall agreement of VPW and the diagnostic of hypervolemia is poor among young and older intensivists. Older intensivists are prone to admit hypervolemia even in the absence of cardiomegaly or pulmonary congestion.

Table 1 (abstract P110)

Evaluation of the agreement, vascular pedicle width >70 mm and hypervolemia

	PPV	NPV	Sensitivity	Specificity	Accuracy
Total					
≤ 10 years	0.25	0.85	0.63	0.53	0.55
>10 years	0.58	0.75	0.70	0.64	0.66
CTR >0.55					
≤ 10 years	0.35	0.95	0.88	0.59	0.65
>10 years	0.60	0.70	0.67	0.64	0.65
CTR ≤ 0.55					
≤ 10 years	0.15	0.75	0.38	0.47	0.45
>10 years	0.55	0.80	0.73	0.64	0.68
Kerley's lines (+)					
≤ 10 years	0.30	0.70	0.50	0.50	0.50
>10 years	0.40	0.65	0.53	0.52	0.53
Kerley's lines (-)					
≤ 10 years	0.20	1.00	1.00	0.56	0.60
>10 years	0.75	0.85	0.83	0.77	0.80

PPV, positive predictive value; NPV, negative predictive value.

P111

Dexmedetomidine as a sedative agent for more than 24 hours in acutely ill patients

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Objective To retrospectively review dexmedetomidine infusion for more than 24 hours in acutely ill patients and to evaluate its safety profile.

Design and setting A retrospective observational study in a tertiary general hospital, mixed ICU.

Patients Fifty-seven patients who were assigned to dexmedetomidine use for more than 24 hours over a 12-month period.

Results From January to December 2004, 57 patients were included. Most patients were male (71.9%) and the mean age was 55.6 years (19–93 years); the mean APACHE II score was 17.5 (6–41). The mean ICU and hospital lengths of stay were 15.4 and 43.5 days, respectively. There were 32 medical patients and 25 emergency and elective postoperative care admissions. The mean duration of drug infusion was 82.2 hours (25–408 hours), and 100% of the patients were on coadjuvant sedative agents when dexmedetomidine was started. Hypotension episodes occurred in five patients (8.7%) receiving the drug for more than 24 hours, and no bradycardia episodes were noted. Six patients (10.9%) died during the hospital stay, but they were not timely related to the dexmedetomidine infusion.

Conclusions The safety profile of dexmedetomidine use, as a coadjuvant sedative agent, for more than 24 hours in the ICU setting is comparable with its use for less than 24 hours. No clinically relevant side effects directly related to the study drug were observed after a 24-hour infusion period.

P112

What are the direct costs of sepsis treatment in Brazilian ICUs?

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Introduction Severe sepsis and septic shock are characterized by a high incidence, mortality and cost. Actually, sepsis is a major healthcare problem, upheld by the resources consumed to care for patients with this disease. Although we are aware of the high total hospital costs associated with sepsis treatment, even post discharge, the heterogeneity of the health care system (private or public hospitals) makes any estimate of costs directly attributable to sepsis a real challenge. Besides direct and indirect costs, 'hidden costs' like education, staff training and comorbidity-related issues can be significant in a major disease. Direct costs are defined mainly by the physicians and nursing fees, medicines, blood products and equipments used for monitoring and organ dysfunction support in sepsis. This simplified type of economic analysis can provide more reliable and interchangeable data.

Objective To assess the direct costs of sepsis treatment in Brazilian ICUs, comparing private and public hospitals.

Design An observational cohort study.

Setting Twenty-one ICUs of private and public hospitals.

Patients Patients admitted to one of the ICUs with sepsis, severe sepsis or septic shock, according to SCCM/ACCP Consensus Conference criteria, were enrolled to the study. During 6 months (1 October 2003 to 30 March 2004) the collected data were analyzed. Patients meeting these criteria underwent clinical and epidemiological evaluation. Hospital costs related to ICU stay were also estimated. Indirect cost estimates like administrative issues, electrical energy, depressed state of the equipment and facility maintenance were not included in the economic analysis. The TISS (Simplified Therapeutic Intervention Scoring System) score was also used for cost estimation. To compare the groups (public and private) we used the Mann-Whitney test and the Student *t* test. Standard values were based on the Brazilian Medical Association (AMB) price index for medical procedures and the BRASÍNDICE price index for medications, solutions and hospital materials.

Measurements and main results For the 619 patients included, only 85% were enrolled, considering 37.6% from private institutions and 62.4% from public institutions. From these data, 58% were male, the mean age was 60.5 years and the overall mortality was 43.8%. For public and private hospitals we found a median SOFA score of 7.5 and 7.1, and the mortality rate was 49.1% and 36.7%, respectively. Public and private hospitals had similar lengths of stay (median 10 and 9, respectively, *P* = 0.091). The total direct costs did not differ significantly (\$9260 for public hospital vs \$8776 for private hospital, *P* = 0.328).

Conclusions Sepsis remains a major world health problem. Our data have not shown a significant difference in direct costs

between public and private hospitals, perhaps our length of stay was also comparable. An accurate estimate of the cost of hospital care for septic patients would be essential to encourage physicians and healthcare managers to develop and implement evidence-based strategies to improve quality of care and to reduce costs in the ICU.

Surgery/trauma

P113

Thrombotic thrombocytopenic purpura after an episode of acute pancreatitis

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Thrombotic thrombocytopenic purpura and hemolytic uremic syndrome are uncommon diseases that frequently overlap their features, together having an incidence of three to seven cases per million. Pancreatitis may be, in some cases, part of both clinical presentations. The onset of pancreatitis followed by manifestations of these diseases has few reports in the literature.

We report the case of a 27-year-old man who presented to the emergency department of our hospital with 2 days of epigastric pain associated with nausea and vomiting, mild jaundice and moderate dehydration. He had no fever and his physical examination was unremarkable except for a light tenderness of the epigastric area and abdominal distention. An initial amylase level of 612 U/l, lipase of 2678 U/l together with a leukocyte count of 12,000 were the only altered laboratory data. The abdominal sonography showed a heterogeneous pancreas, with a slight increase in its size, and a lightly distended gallbladder without any signs of gallstones. We also performed an abdominal CT, where there was an undefined and irregular contour of the pancreas, increased density of adjacent plans, a few liquid collections within and bilateral pleural effusion. A diagnosis of pancreatitis was made and 2 days after his admission the patient had complete clinical relapse and was about to start an oral diet again. Nevertheless his laboratory data showed progressive thrombocytopenia with a fall from 333,000 to 9000 platelets and a rise on LDH from 363 to 5711, together with a progressive loss of renal function (peak creatinine, 3.8 mg/dl). He became oliguric but had no need for renal replacement therapy; he also presented light drowsiness and confusion. After the confirmation of erythrocyte fragmentation in a peripheral blood smear, we established a diagnosis of thrombotic thrombocytopenic purpura and started plasmapheresis daily for 6 days until his platelets reached 150,000. After that he had four more sessions on alternate days and was discharged from hospital with a platelet count of 269,000, without any neurologic or renal impairment. He has been followed in the hematologic department of our hospital and has so far maintained remission (3 months).

Table 1 (abstract P113)

Evolution of laboratory data								
Laboratory value/day	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 8	Day 30
Amylase (U/l)	2949	1062	485	351	100	129	72	63
Platelets (mm ³)	332,000	24,000	9000	23,000	31,000	75,000	196,000	413,000
Hemoglobin (g/dl)	15.5	11	7.7	5.9	6.1	8.3	7.7	15.1
Urea (mg/dl)	37	134	139	167	178	164	150	31
Creatinine (mg/dl)	1.1	2.7	3.6	3.7	3.9	3.4	3.1	0.9

P114**Abdominal hypertension and compartmental syndrome in intensive care medicine**

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Introduction and objectives The objective of this trial was to compare abdominal hypertension and abdominal compartmental syndrome (ACS) in patients under risk for these pathologies in the ICU.

Methods Eighty-nine patients with monitoring indications for intra-abdominal pressure (IAP) based on clinical or surgical admission diagnosis in the ICU were included. Measurements via an indirect method through the vesical catheter were made at three distinct timepoints: at admission, and at 6 hours and 12 hours.

Results The incidence of ACS was 14.6% (13 patients); in the total sample, the male sex prevailed at 63% (56 patients). The patients had been distributed into two groups: with ACS and without ACS. Gastric surgery diagnosis predominated in both groups (84.6%/57.9%; $P < 0.067$). Global mortality was 30.3% (27 patients): 53.8% (seven patients) in the group with ACS and 26.3% (20 patients) in the group without ACS; $P < 0.046$. Table 1 describes the sample.

Table 1

Compartmental syndrome	Present ($n = 13$), average/standard	Absent ($n = 76$), average/standard	P value
Weight	78.3/10.4	79.4/25	0.876
Height	1.66/0.04	1.67/0.09	0.696
APACHE	16.1/7.6	16.5/8.1	0.869
IAP admission	28.2/6	15.6/6.3	<0.0001
IAP 6 hours	27.8/9.2	15.8/6.3	<0.0001
IAP 12 hours	29.6/9.4	15.9/6.2	<0.0001
IAP Average	28.5/6.6	15.7/5.8	<0.0001

Conclusion Abdominal hypertension and ACS are frequent diagnostics in intensive care medicine; superior average values of the IAP at admission, at 6 hours and at 12 hours to 28 mmHg are correlated with the biggest incidence of ACS and greater mortality.

P115**Outcome of bariatric surgical patients admitted to the ICU**

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Background The problem of obesity has reached epidemic proportions and the number of bariatric procedures is increasing. There are few data regarding the outcome of these patients in the intensive care environment.

Objective The aim of this study was to evaluate the outcome of bariatric surgical patients admitted to the ICU.

Setting An eight-bed surgical ICU in a 50-bed private hospital.

Methods From April 2003 to February 2005 we prospectively followed bariatric surgical patients admitted to the ICU. The outcome and ICU resource utilization were recorded. The

APACHE II score was calculated (QuaTI System software database; Dixtal, SP, Brazil).

Results There were 304 patients (240 female) in 313 consecutive ICU admissions. The mean age was 36.9 ± 10.9 years. The mean BMI was 44.10 ± 5.2 kg/m². Of these patients, 302 (99.3%) were admitted in the immediate postoperative period for a primary procedure. A total of 252 patients (82.9%) underwent Roux-en-Y gastric bypass (16 laparoscopic) and 52 patients (17.1%) underwent biliopancreatic diversion (two laparoscopic). In 20 (6.4%) of 313 admissions, the length of stay was >24 hours. The APACHE II score was 10.0 ± 9.2 . The mean LOS was 7.8 ± 16.8 days. The main reasons for unplanned ICU admissions ($n = 11$) were bowel occlusion ($n = 2$), anastomotic leakage ($n = 2$), gastrointestinal bleeding ($n = 2$), wound infection ($n = 1$), pulmonary embolism ($n = 1$), acute pulmonary edema ($n = 1$), massive atelectasis ($n = 1$) and perforated bowel ($n = 1$). There was need for mechanical ventilation in 22 (7.0%) admissions, a pulmonary artery catheter in two (0.6%), dialysis therapy in one (0.3%) and parenteral nutrition in one (0.3%). Only three patients have developed complications (anaphylactic reaction, respiratory acidosis, cetoacidosis) during the immediate postoperative period for a primary procedure (<48 hours) and only one patient has never been discharged from the ICU. The 28-day ICU mortality rate was 0.65% ($n = 2$) and the overall ICU mortality rate was 0.98% ($n = 3$).

Conclusions Based on these preliminary results, we conclude that bariatric surgical patients in the immediate postoperative period for a primary procedure are very low risk ICU patients.

P116**Dexmedetomidine for short-term and long-term sedation: amplifying its applicability**

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Background The α_2 -agonist dexmedetomidine (DEX) it is an effective agent for the management of sedation and analgesia after cardiac, general, orthopedic, head and neck, oncologic and vascular surgery in the ICU. DEX is currently approved as a sedative for up to 24 hours use in the ICU, but the number of reports showing safe long-term therapy with very good tolerability is increasing. The α_2 -agonists may also attenuate hypertension, anxiety, agitation, tachycardia and fever during benzodiazepine and opioid withdrawal [1].

Objective To describe the experience with DEX in the surgical ICU, for early postoperative and long-term sedation of critically ill patients and for withdrawal syndrome management.

Design and setting A retrospective review of medical records and presentation of case-series ($n = 13$) from a surgical ICU (14 beds) of a university hospital from August 2004 to February 2005.

Results The 13 critically ill patients (eight male, five female; age 41–83 years) who received DEX were elective or complicated postoperative patients who required sedation and mechanical ventilation in the ICU for a variety of medical problems. We have included one case of withdrawal syndrome after interruption of prolonged midazolam and fentanyl infusion, and two cases of bariatric surgery (rarely reported in literature). The patients received DEX infusion during at least 6 hours. The mean time of drug administration was 45 hours (6–336 hours). Only mild falls in arterial pressure occurred in some patients, but in none of them was DEX discontinued (managed with fluid challenge or a slight

increase in vasoactive drug). Only three patients required a single dose of fentanyl (100 µg) as rescue analgesia.

Conclusion DEX is an effective and safe sedative agent that has analgesic properties and predictable cardiovascular effects, and may benefit a heterogeneous population of critically ill patients for short-term (early postoperative period) and long-term sedation. We believe that a continuous infusion of a α_2 -agonist agent for sedation-induced withdrawal syndrome management is highly applicable.

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P117

Conventional tracheostomy in critically ill patients: a safe procedure

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Introduction Tracheostomy is a very usual procedure in critically ill patients and is assumed to have a low rate of complications when executed by experienced hands. We did not have data about this issue in our setting, so we decided to perform a prospective trial in order to observe the main characteristics of tracheostomies made in critically ill patients in two of our centers: a general ICU and a trauma ICU.

Materials and methods We performed a prospective and observational trial during the period between 28 May 2004 and 16 December 2004 in two ICUs of two tertiary hospitals.

Results During this period, 601 patients were admitted: 291 patients in the trauma ICU and 310 patients in the general ICU. Sixty-six patients (10.98%) were submitted to tracheostomy in the two centers, 40 (60.6%) in the trauma ICU and 26 (39.4%) in the general ICU. Forty-four (66.7%) were male. Acute stroke (ischaemic or haemorrhagic) was the main cause of admission to the ICUs among the tracheostomized patients (28.8%), followed by brain trauma (21.2%). The major cause of admission in the general ICU was respiratory insufficiency (38.4%), and was brain injury (32.5%) in the trauma unit. The mean Glasgow, SOFA and APACHE II scores at the day of tracheostomy were 7.5 ± 3.19 , 5.4 ± 2.01 and 19.2 ± 5.46 , respectively. The main indication to tracheostomy (90.9%) was prolonged invasive ventilation (90.9%). The tracheostomies were exclusively performed by an experienced head and neck surgeon in the two centers. Tracheostomies were performed inside the ICU setting in the trauma ICU and in the operation room in the other. There were no differences in the rate of complications between the two centers. The rate of intraoperative and early complications was very low. There were three minor bleeding complications (4.5%). The mean time of invasive ventilation was 20.9 ± 10.5 days. The mean time in the ICU was 22.7 ± 10.39 days. The mortality rate was 31.8% and none of the deaths was related to the tracheostomies.

Conclusions Despite the fact that it was a procedure performed in very critically ill patients, tracheostomy was associated with very few minor complications in this sample. We hypothesized that this low rate of complications is due in part to the very high expertise of the operators involved in the realization of conventional tracheostomies in the two centers.

P118

Blood transfusion in geriatric patients who underwent orthopaedic surgery: a prospective study

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Objective Our hypothesis is that older patients more often receive packed red blood cells, motivated for comorbidity.

Methods During a 4-year period (2001–2004) we collected data on 1064 patients admitted to an ICU of an orthopaedic surgery hospital. We analyzed the use of packages of red blood cells (PRBC), the quantity of packages, and comorbidities. We excluded patients that received more than 4 PRBC.

Results The percentage of patients that received PRBC progressively increases from patients in their sixties to their nineties ($r = 0.99$): <65 years, 30.6%; 65–69 years, 20.7%; 70–79 years, 33.2%; 80–89 years, 45.3%; 90 years or more, 64.7%. There was no increase in the number of packages as the age advances: <65 years, 1.81 packs; 65–69 years, 1.83; 70–79 years, 1.93; 80–89 years, 1.9; 90 years or more, 2.18. No difference was found in the postoperative hematocrit: <65 years, 33.1%; 65–69 years, 33.6%; 70–79 years, 34.8%; 80–89 years, 32.4%; 90 years or more, 32.9%. We did not find any relationship of the use of PRBC and cardiovascular comorbidities ($\chi^2 = 0.35$; $P > 0.05$).

Conclusions There was a positive correlation between age and necessity of hemotransfusion in the postoperative period of orthopedic surgeries, but it was no correlated to the cardiovascular comorbidity.

P119

Mortality in elderly patients with hip fractures: a retrospective cohort study

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Introduction The purpose of this study is to gather a population of elderly patients with hip fractures who have been through surgery hospitalized in the ICU, and to establish the validity of the APACHE II score as a tool in determining the risk of death.

Methods A retrospective cohort study was developed. During the period January–December 2003, patients were checked through a revision of medical histories up to the time when they were out of the hospital or up to their death. Initially, 65 patients aged above 60 years were included, an average of 85 (68–98) years, of which 46 (71%) were male. The depending variables were the rate of mortality and the APACHE II score. The APACHE II scale was evaluated by logistic regression procedure with the help of the StataDirect software 1.617 for Windows. We adopted a level of 5% of probability of rejection of the hypothesis of nullity.

Results The APACHE II score was 13 (6–28) and the mortality was 9.2% taking into consideration that 25% of the patients had an APACHE II score >16. The length of stay in the ICU was 9.8 (2–38) days. It was observed that the predictive model had a sensitivity of 66.7% and a specificity of 98.3%.

Conclusions The risk (odds ratio) for elderly patients who had been through hip fracture surgery was 1.4 (1.1–1.7) times greater for a score of APACHE II greater than 16. We consider that the

APACHE II score was a valid tool in determining the risk of death in this kind of patient.

P120

Dexmedetomidine for sedation following cardiovascular surgery: a two different loading doses

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Introduction Dexmedetomidine (DEX) is a selective alpha-2-adrenergic agonist used for sedation of patients in ICUs.

Hypothesis The purpose of this study was to evaluate the efficacy and safety of DEX administration after cardiovascular surgery using two different loading doses.

Methods This was a prospective, multicenter (three sites), randomized, open study. Patients were randomized to either a loading dose of 6 µg/kg/hour (group I) for 10 min or 3 µg/kg/hour (group II) for 20 min, with a total loading dose of 1 µg/kg, followed by a maintenance infusion of 0.4 µg/kg/hour, adjusted according to sedation level from 0.2 to 0.7 µg/kg/hour (Ramsay sedation scale >3 for mechanically ventilated patients and >2 after extubation). The sedation period with DEX ranged from 6 to 24 hours, beginning in the first hour after the patient's arrival in the postoperative ICU.

Results Forty-two patients were studied after elective cardiovascular surgery (34 CABG, four aortic aneurysms, four valvular heart surgery). Eighty-eight percent of patients demonstrated no need for additional sedative drugs during mechanical ventilation. Twenty-six percent of patients received analgesics while intubated. The level of sedation, evaluated based on the Ramsay sedation scale, did not show any difference between the two groups during the 24-hour infusion. No differences have been found in the heart rate, systolic blood pressure, central venous pressure and pulse oximeter saturation between the two groups during the 24-hour period.

Conclusions Our study indicates that DEX is an effective and safe drug to be used in the postoperative period of cardiovascular surgery, independent of the loading dose rate infusion.

P121

Rhabdomyolysis and acute renal failure after bariatric surgery: severe forms of crush injury

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Background Rhabdomyolysis is one of the leading causes of acute renal failure (ARF). The most commonly described crush injury is that which affects victims of natural disasters such as earthquakes, mining or industrial accidents, war, or any other situation resulting in the collapse of buildings and falling debris. It may also affect patients who, because of an altered level of consciousness, crush a part of the body with their own weight, such as after drug overdose or stroke. Surgical positioning is a much less common etiology, with few cases reported in the world literature implicating it as a cause. Among the risk factors for the development of postoperative RML, surgical time and overweight

are the most important. A few cases of RML with acute renal failure have been reported in morbidly obese patients having surgery for several reasons, and another few cases recently reported at the same time in patients undergoing gastric bypass [1,2]. As the number of bariatric procedures by laparotomy or laparoscopy has been growing fast in the past few years, mainly in Western countries, an increasing incidence of this complication may be seen. Besides, in the learning curve of laparoscopic procedures, a longer surgical time (up to 4 or 5 hours) is another risk factor [3]. Strategies to avoid and to treat this complication and the consequences must be applied in all perioperative periods.

Objective To report a series of six cases (five male, one female) of severe rhabdomyolysis after bariatric surgery from a surgical ICU (14 beds) of a university hospital.

Conclusions Bariatric surgery, and probably other surgical procedures in morbidly obese patients, is a significant form of crush injury (overweight and prolonged immobilization on the operating table) leading to postoperative rhabdomyolysis (maximum CPK value: 29,150 ± 17,129 IU/l) and reversible myohemoglobinuric acute renal failure (66.6% of cases). Fluid expansion, urine alkalinization and renal replacement therapy are the mainstays of treatment. Cases of complete crush syndrome (hypotension, coagulopathy, acute renal failure) and death (0%) are rare according to our series and the specific literature.

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P122

A new model of uncontrolled hepatic hemorrhage from trocar insertion simulating iatrogenic lesions during video-assisted surgeries

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Background Visceral iatrogenic lesions during video-assisted surgeries may occur during the blind insertion of trocars. Life-threatening hemorrhage and conversion to open surgery may occur. The use of topical hemostatic agents may control the hemorrhage and avoid the need for laparotomy. Our goal is to develop a model simulating liver injury produced by trocar insertion.

Methods Ten male Landrace pigs weighing 16–20 kg were anesthetized and submitted to pneumoperitoneum using CO₂ for introduction of a laparoscopic camera into the abdominal cavity. Under direct vision, the anterior surface of the right hepatic lobe liver was perforated by a trocar. The animals were previously divided into two groups: controls ($n = 5$) and heparin ($n = 5$), in which 200 UI/kg heparin was administered intravenously 10 min before the liver lesion, simulating a coagulopathic scenario. Before (0 min) and 10 or 20 min after induction of the liver lesion, hematologic and hemodynamic parameters including hematocrit (Ht), mean arterial pressure (MAP), cardiac output (l/min) and intra-abdominal blood loss (ml) were determined.

Results See Table 1 and Fig. 1.

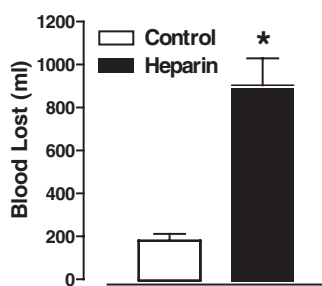
Conclusion We conclude that trocar-induced liver injury promotes limited blood loss, discrete hypotension and a minor decrease in cardiac output. The use of heparin promotes a significant increase

Table 1

	Group	0 min	10 min	20 min
Ht (%)	Control	26.6 ± 0.9	26.6 ± 1.0	26.4 ± 0.9
	Heparin	28.4 ± 0.6	25.2 ± 1.7	26.6 ± 1.6
MAP (mmHg)	Control	89.4 ± 6.9	76.4 ± 8	76.4 ± 4
	Heparin	87 ± 14	44 ± 17*	42.2 ± 17*
Cardiac output (l/min)	Control	5.1 ± 0.7	4.0 ± 0.6	4.23 ± 0.7
	Heparin	5.8 ± 0.4	2.7 ± 1.1*	2.73 ± 1.4*

Data presented as the mean ± SEM; * *P* < 0.05 compared with controls.

Figure 1



in blood loss and severe hemodynamic compromise. Both models may be useful to test interventions to stop bleeding and to reverse hemodynamic instability due to uncontrolled hemorrhage.

P123

Hemodynamic patterns in trauma patients

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Introduction The main cause of shock in trauma patients is hypovolemia secondary to blood loss; other causes are cardiac tamponade, tension pneumothorax, myocardial contusion and neurogenic shock. However, there are several patients who remain in shock after adequate fluid resuscitation and without other causes of shock.

Objective To identify the hemodynamic pattern of patients with trauma and shock, after hemorrhagic control and correct fluid administration.

Materials and methods We included consecutive patients admitted to a trauma ICU, from 1 January 2003 to 31 December 2004, who had hemorrhagic control of the trauma lesions and were treated with fluid and remained dependent on vasoactive drugs.

Results Eighty-five patients, or 6.2% of the patients admitted during the recruitment, met the criteria. The mortality was 59%, against 34% (*P* < 0.01) of the population without the criteria. The main cause of death was refractory shock. The mean crystalloid used in the first 24 hours was 9015 ml (±3202 ml), the mean hydroxyethyl starch was 1463 ml (±1868 ml), the mean red cell pack administration was 3 U (±3.43 U) and the mean fresh frozen plasma was 2 U (±2.82 U). Twenty-five patients (30%) were submitted to invasive monitoring with a pulmonary arterial catheter. The mean PAOP was 16 mmHg (±5.67 mmHg) but six patients had a PAOP below 12 mmHg; the mean CI was 5.3 l/m² (±2.3 l/m²) but five patients had CI < 3.0 l/m²; and the mean SVRI was 1132 dyn/m²/s (±508 dyn/m²/s).

Conclusion The presence of shock was associated with high mortality. The most prevalent hemodynamic pattern was hyperdynamic shock; but 25% (six patients) had hypovolemia even after vigorous fluid resuscitation, and 12.5% (three patients) had hypodynamic shock. The invasive monitoring of the pulmonary artery was important to diagnose the class of shock and to identify the presence of residual hypovolemia.

P124

The incidence of organ dysfunction and failure in patients with abdominal trauma

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Introduction Trauma patients have a high mortality and more often develop organ failure with poor outcome.

Objective To study the incidence of organ dysfunction and failure, and the impact on mortality of patients who were admitted to an ICU with abdominal trauma without other lesions.

Materials and methods We studied patients admitted to a trauma ICU from 1 January 2001 to 31 December 2003. The Sequential Organ Failure Assessment score at admission was measured; we considered points 1 and 2 of the score as dysfunction and points 3 and 4 as failure.

Results A total of 77 patients were studied and the mortality was 31%; the mortality of the general population with multiple traumas (725 patients) was 39%. The incidence of organ dysfunction and failure, with the correspondent mortality, is illustrated in Table 1.

Table 1

Incidence of organ dysfunction and failure in abdominal trauma patients

		Dysfunction		Failure	
		Incidence (%)	Mortality (%)	Incidence (%)	Mortality (%)
Respiration	Abdominal	76	33	18	43
	Multiple trauma	63	22	24	60
Coagulation	Abdominal	41	50	11	100
	Multiple trauma	25	44	2	82
Liver	Abdominal	35	38	-	-
	Multiple trauma	20	38	1	40
Cardiovascular	Abdominal	-	-	30	100
	Multiple trauma	3	58	21	61
Renal	Abdominal	35	62	18	100
	Multiple trauma	10	56	4	71

Conclusion The frequency of coagulation and renal dysfunction and failure is higher in patients with abdominal trauma than in patients with multiple trauma. The presence of renal, cardiovascular and hematological failures was associated with higher mortality in patients with abdominal trauma than in patients with multiple trauma.

P125**The incidence of organ dysfunction and failure in trauma patients****MC Oliveira, A Réa-Neto***CEPETI, Hospital do Trabalhador da UFPR, Curitiba, Brazil
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Introduction Trauma patients have a high mortality and more often develop organ failure with worse outcome.

Objective To study the incidence of organ dysfunction and failure, and the impact on mortality in patients who were admitted to an ICU with multiple trauma.

Materials and methods We studied patients consecutively admitted to a trauma ICU from 1 January 2001 to 31 December 2003. The Sequential Organ Failure Assessment score at admission was measured; we considered points 1 and 2 of the score as dysfunction and points 3 and 4 as failure.

Results: A total of 802 patients were studied; the mortality of the general population without organ dysfunction was 39.65%. The incidence of organ dysfunction and failure, with the correspondent mortality, is illustrated in Table 1.

Table 1**Incidence of organ dysfunction and failure in major trauma**

Major trauma	Dysfunction		Failure	
	Incidence (%)	Mortality (%)	Incidence (%)	Mortality (%)
Respiration	63	26	25	79
Coagulation	26	50	2.5	84
Liver	23	38.6	1,7	54
Cardiovascular	12.6	53	12	77.8
Renal	11.5	59	4.8	60

Conclusion The presence of organ dysfunction worsened the outcome of patients with multiple trauma; the respiratory dysfunction is more prevalent than others but with a lower impact on mortality, followed by coagulation and liver dysfunction. The presence of coagulation, respiratory failure and cardiovascular failure is associated with higher mortality than liver or renal failure.