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Prevalence and outcomes of infections in Brazilian ICUs: a subanalysis of EPIC II study

Prevalência e desfechos clínicos de infecções em UTIs brasileiras: subanálise do estudo EPIC II

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ABSTRACT

Objective: To determine the prevalence of infections in Brazilian intensive care units and the associated mortality by analyzing the data obtained in the Extended Prevalence of Infection in Intensive Care (EPIC II) study.

Methods: EPIC II was a multicenter, international, cross-sectional prospective study of infection prevalence. It described the demographic, physiological, bacteriological, and therapeutic characteristics, outcome up to the 60th day, prevalence of infection, and mortality of all the patients admitted to the participating ICUs between zero hour and midnight on May 8, 2007. A total of 14,414 patients were included in the original study. Of these 14,414 patients, 1,235 were Brazilian and were hospitalized in 90 Brazilian ICUs. They represent the focus of this study.

Results: Among these 1,235 Brazilian patients, 61,6% had an infection on the day of the trial, and the lungs were the main site of infection (71.2%). Half of the patients had positive cultures, predominantly gram-negative bacilli (72%). On the day of the study, the median SOFA score was 5 (3-8) and the median SAPS II score was 36 (26-47). The infected patients had SOFA scores significantly higher than those of the non-infected patients 6 (4-9) and 3 (2-6), respectively). The overall ICU mortality rate was 28.4%: 37.6% in the infected patients, and 13.2% in the non-infected patients (p<0.001). Similarly, the in-hospital mortality rate was 34.2%, with a higher rate in the infected than in the non-infected patients (44.2% vs. 17.7%) (p<0.001). In the multivariate analysis, the main factors associated with infection incidence were emergency surgery (OR 2.89, 95%CI [1.72-4.86], p<0.001), mechanical ventilation (OR 2.06, 95% CI [1.5-2.82], p<0.001), and the SAPS II score (OR 1.04, 95% CI [1.03-1.06], p<0.001). The main factors related to mortality were ICC functional class III/ IV (OR 3.0, 95% CI [1.51-5.98], p<0.01), diabetes mellitus (OR 0.48, 95% CI [0.25-0.95], p<0.03), cirrhosis (OR 4.62, 95% CI [1.47-14,5], p<0.01), male gender (OR 0.68, 95% CI [0.46-1.0], p<0.05), mechanical ventilation (OR 1.87, 95% CI [1.19-2.95], p<0.01), hemodialysis (OR 1.98, 95% CI [1.05-3.75], p<0.03), and the SAPS II score (OR 1.08, 95% CI [1.06-1.10], p<0.001).

Conclusion: The present study revealed a higher prevalence of infections in Brazilian ICUs than has been previously reported. There was a clear association between infection and mortality.

Keywords: Sepsis; Prevalence; Mortality; Infection; Intensive care units

INTRODUCTION

Infection is associated with high morbidity, mortality, and costs in intensive care units (ICUs). Most infected patients develop a systemic condition characterized as sepsis, which is the leading cause of death in noncardiac ICUs and the 10th leading cause of death in the United States.[1-4] Moreover, some epidemiological studies have found yearly severe sepsis incidences as high as three patients per 1000.[1]

The most important epidemiological studies of infection have been conducted in the United States, Europe, and Australia and have not generally included developing countries.[2] In Brazil, two major studies have evaluated the incidence density of and mortality from severe sepsis in local ICUs. The BASES study was conducted between May 2001 and January 2002. It was a multicenter observational study of 1,383 patients from five Brazilian ICUs (one private and four public hospitals). It reported sepsis, severe sepsis, and septic shock incidence densities of 61.4 (95% CI [55.5 - 67.3]), 35.6 (95% CI [31.1 - 40.1]), and 30 (95% CI [25.9 - 31.4]) per 1,000 patient-days, respectively. The mortality rates for sepsis, severe sepsis, and septic shock were 33.9%, 46.9% and 52.2%, respectively.[5] The second study was also prospective and multicenter. It evaluated a total of 3,128 patients from 75 ICUs in 65 hospitals throughout Brazil and reported sepsis, severe sepsis, and septic shock incidences of 19.6%, 29.6%, and 50.8%, respectively. The overall mortality rate was 46.6% (95% CI [42.5 - 51], with mortalities in the sepsis, severe sepsis, and septic shock subgroups of 16.7%, 34.4%, and 65.3%, respectively.[6]

However, there is little Brazilian data on the prevalence of ICU infections and on the impact they have on outcomes in these patients. In addition, the available data were collected at the beginning of the last decade. Since then, there have been changes in care practices resulting from campaigns to prevent infections in these environments and from improved treatment of septic patients that may have impacted the clinical outcome.

Given these considerations, the present study aimed to determine the infection prevalence and its associated mortality by analyzing data from the Brazilian patients included in the Extended Prevalence of Infection in Intensive Care (EPIC II) study.

METHODS

This study evaluated Brazilian data from the EPIC II study.[7] EPIC II was a multicenter, international, prospective study of the prevalence of ICU infections. It examined the demographic, physiological, bacteriological, and therapeutic characteristics and the outcomes.[7] A total of 14,414 patients (13,796 of whom were over 18 years of age) were included in the original study, and 1,235 of these patients were Brazilian.[7]

The ICUs were invited to participate through correspondence and advertisements at congresses and international symposiums. Study participation was entirely voluntary, and it was not funded. Approval by the local ethics committee of each participating center was either granted or not necessary due to the purely observational nature of the study.

Demographic, physiological, bacteriological, and therapeutic data were collected from all of the patients admitted to the participating ICUs between zero hour and midnight on May 8, 2007. The Simplified Acute Physiology Score II (SAPS II)[8] and Sequential Organ Failure Assessment (SOFA)[9] scores were obtained on the day of the study. The data recording used specific forms that were returned via website, fax, or mail. Patient follow-up was performed until hospital discharge or until 60 days after admission (July 9, 2007), and the outcomes obtained in the ICUs and during hospitalization were recorded. Any decisions to withdraw or withhold therapy during the ICU stay were recorded. An exclusive phone line was used for questions during the follow-up period. The centers with incomplete data were contacted in an attempt to recover the information, and missing data were not included in the analysis.

Infection was defined according to the classification system of the International Sepsis Forum[10] and validated by the attending physician. The patients who were admitted to the ICU in the immediate postoperative period and who had been there for four weeks or less on the day of the study were considered to be surgical admissions. A surgery scheduled more than 24 hours before its completion was considered an elective surgery, whereas an emergency surgery was performed less than 24 hours after it was indicated. Trauma admissions were those directly associated with a traumatic event, the complications of trauma, and traumas occurring within 30 days of the event. All other admissions were considered to be medical.

The presence of the following comorbidities were recorded: chronic obstructive pulmonary disease,

metastatic cancer (metastasis confirmed by surgery or imaging), cirrhosis of the liver, heart failure (New York Heart Association class III and IV), hematologic malignancy (lymphoma, acute leukemia, and multiple myeloma), infection with the human immunodeficiency virus (HIV) (HIV-positive patients with clinical complications, such as *Pneumocystis jirovecii*, Kaposi's sarcoma, lymphoma, tuberculosis, or toxoplasmosis), chronic renal failure (need for dialysis support or history of chronic renal failure with serum creatinine levels greater than 3.6 g/dL), immunosuppression (a dose of at least 0.3 mg/Kg/day of prednisolone or the equivalent for at least one of the six months prior to the ICU admission), severe malnutrition, congenital humoral or cellular immunodeficiency, radiotherapy or chemotherapy (in the six months prior to ICU admission), and insulin-dependent diabetes mellitus.

All of the data were analyzed at the Department of Intensive Care, University of Brussels, Belgium, in collaboration with the University of Jena, Germany. SSPS version 13.0 (SSPS Inc., Chicago, Illinois) was used for the analysis. Only data from the adult patients (>18 years of age) were used.

The Kolmogorov-Smirnov test, histograms, and normal-quantile plots were used to check for significant deviations from normality in the continuous variables. Nonparametric tests were used to evaluate the variables that did not exhibit a normal distribution. The differences between groups were examined using analysis of variance: the Kruskal-Wallis test, the "*t*" test, the Mann-Whitney test, the χ^2 test, and Fisher's exact test, as appropriate. The Bonferroni correction was used for multiple comparisons.

A multivariable logistic regression analysis was used to determine the risk factors for infection and mortality. The following variables were investigated as independent risk factors for infection: type of admission, place of origin, comorbidities, age, sex, mechanical ventilation, hemodialysis or hemofiltration, and SAPS II score. These variables were also used as risk factors for hospital mortality in the patients who had infections, and this analysis was repeated for the subgroups defined by infection with various microorganisms.

Odds ratios were adjusted for hospital and organization-related factors, including type of ICU (open vs. closed, community vs. university, and medical vs. surgical), number of ICU beds, number of nurses and physiotherapists, continuous presence of an attending physician, consumption of health care supplies (2006 data from the information system of the World Health Organization obtained from their website, http://www.who.int/whosis/whostat/EN_WHS09_Full.pdf, pre-study length of ICU stay, and demographic region. The Cochran-Armitage trend test was used to assess the association of infection rate, the national health-related gross domestic product, SAPS II scores, and SOFA scores with length of ICU stay prior to study initiation. The data were presented as mean (95% confidence interval), median (interquartile range - IQR) or number (%), as appropriate. All of the statistical tests were two-tailed, and $p<0.005$ was considered statistically significant.

RESULTS

The EPIC II study recruited a total of 14,414 patients, of whom 13,796 were used for the analysis (older than 18 years), from a total of 1,265 ICUs in 75 countries. For the entire population, 51% were considered infected, 71% received antibiotics (even if only for prophylaxis), and 64% had pulmonary infections; the ICU and hospital mortality rates were 18.2% and 24.2%, respectively.[7]

A total of 1,235 patients were treated in 90 Brazilian ICUs and their clinical data are presented in the table 1. Of the 1,235 patients, 761 (61.6%) were considered infected on the day of the study. These patients had higher SAPS II and SOFA scores on ICU admission than did the non-infected patients. Regarding the site of infection, 71.2% of the infected patients had lung infections, 16.6% had urinary tract infections, 13.4% had abdominal infections, and 10.1% had systemic infections. Of those infected, 50.7% had microbiological isolations, of which 33.9% were gram-positive, 72% were gram-negative, and 14.5% were from fungal or other organisms, as shown in table 2. The most common gram-positive cocci were *Staphylococcus aureus* (16.6%), 7.3% of which were methicillin-resistant *Staphylococcus aureus* (MRSA), and *Staphylococcus epidermidis* (11.1%). Among gram-negative bacilli, *Pseudomonas sp* accounted for 24.6%, *Klebsiella sp* accounted for 18.7%, and *Acinetobacter sp* accounted for 15.3%.

As shown in table 3, there was a direct relationship between the severity of patient illness, as assessed by the severity (SAPS II) and organ dysfunction (SOFA) scores and the chance of acquiring an infection.

The infected patients had a higher incidence of organ dysfunction than did the non-infected patients, and the difference was statistically significant. The most prevalent organ dysfunctions were respiratory (62.9%), neurological (43.8%), and renal (31.3%). Other less prevalent disorders were circulatory (27.3%), coagulation (16.9%), and hepatic (12.8%).

The factors associated with higher infection rates in the

Table 1 - Demographic characteristics

	All patients (N = 1,235)	Non-infected (N = 474)	Infected (N = 761)	p value
Median age	65 [48-76]	62 [47-75]	66 [49-77]	0.03
Gender (Male)	684 (55.4)	263 (55.5)	421 (55.3)	0.95
Median SAPS II score	36 [26-47]	29 [21-39]	40 [32-51]	<0.001
Median total SOFA score	5 [3-8]	3 [2-6]	6 [4-9]	<0.001
Type of admission				<0.001
Surgery/elective	215 (17.4)	131 (27.6)	84 (11)	
Medical	579 (46.9)	210 (44.3)	369 (48.5)	
Surgery/emergency	337 (27.3)	93 (19.6)	244 (32.1)	
Trauma	104 (8.4)	40 (8.4)	64 (8.4)	
Reason for admission				<0.001
Surveillance/monitoring	204 (16.5)	123 (25.9)	81 (10.6)	
Neurological	208 (16.8)	82 (17.3)	126 (16.6)	
Respiratory	316 (25.6)	69 (14.6)	247 (32.5)	
Cardiovascular	266 (21.5)	123 (25.9)	143 (18.8)	
Renal	32 (2.6)	7 (1.5)	25 (3.3)	
Digestive/hepatic	121 (9.8)	37 (7.8)	84 (11)	
Trauma	67 (5.4)	21 (4.4)	46 (6)	
Other	21 (1.7)	12 (2.5)	9 (1.2)	
Admission origin				<0.001
Other	46 (3.7)	28 (5.9)	18 (2.4)	
Emergency room/ Pre-hospital	396 (32.2)	149 (31.6)	247 (32.5)	
Surgery/PACU	271 (22)	133 (28.2)	138 (18.2)	
Infirmary	362 (29.4)	113 (24)	249 (32.8)	
Other hospital	155 (12.6)	48 (10.2)	107 (14.1)	
Comorbidities				
COPD	159 (12.9)	50 (10.5)	109 (14.3)	0.05
Cancer	176 (14.3)	56 (11.8)	120 (15.8)	0.05
Heart failure (NYHA III-IV)	103 (8.3)	39 (8.2)	64 (8.4)	0.91
Type 1 Diabetes mellitus	125 (10.1)	49 (10.3)	76 (10)	0.84
Chronic renal failure	122 (9.9)	39 (8.2)	83 (10.9)	0.13
Cirrhosis	40 (3.2)	11 (2.3)	29 (3.8)	0.15
Immunosuppression	40 (3.2)	5 (1.1)	35 (4.6)	0.001
Hematologic malignancy	19 (1.5)	3 (0.6)	16 (2.1)	0.04
HIV	22 (1.8)	3 (0.6)	19 (2.5)	0.02
Number of comorbidities				0.001
None	636 (51.5)	271 (57.2)	365 (48)	
1	391 (31.7)	143 (30.2)	248 (32.6)	
2	151 (12.2)	50 (10.5)	101 (13.3)	
3	40 (3.2)	8 (1.7)	32 (4.2)	
>3	17 (1.4)	2 (0.4)	15 (2)	
HF HD	150 (12.2)	36 (7.6)	114 (15.1)	<0.001
Mechanical ventilation	667 (54.2)	163 (34.5)	504 (66.6)	<0.001
ICU mortality	320 (28.4)	56 (13.2)	264 (37.6)	<0.001
Hospital mortality	385 (34.2)	75 (17.7)	310 (44.2)	<0.001
Median ICU length of stay	14 [4-32]	5 [2-21]	19 [8-38]	<0.001
Median hospital length of stay	25 [10-57]	14.5 [6-44]	31 [15-62]	<0.001
Median length of hospitalization in ICU prior to study	5 [1-14]	1 [0-8]	7 [2-16]	0.03

SAPS II - Simplified Acute Physiology Score II; SOFA - Sequential Organ Failure Assessment; PACU - post-anaesthesia care unit; COPD - chronic obstructive pulmonary disease; NYHA III-IV - New York Heart Association classification III-IV; HF HD - hemofiltration / hemodialysis; ICU - intensive care unit. Results expressed as a number (%) or median (minimum - maximum).

Table 2 - Infection rates and microbiological characteristics

	N (%)
Site of infection	
Respiratory	542 (71.2)
Abdominal	102 (13.4)
Systemic	77 (10.1)
Urinary tract	126 (16.6)
Skin	34 (4.5)
Catheter-related	37 (4.9)
Central nervous system	24 (3.2)
Others	44 (5.8)
Microorganisms	
Positive blood cultures	386 (50.7)
Gram-positive	131 (33.9)
Gram-negative	278 (72)
Anaerobic	4 (1)
Other organisms	10 (2.6)
Fungus	56 (14.5)
Virus	3 (0.8)
Parasites	6 (1.6)
Others	6 (1.6)
Staphylococcus aureus	64 (16.6)
Methicillin resistant *Staphylococcus aureus*	28 (7.3)
Staphylococcus epidermidis	43 (11.1)
Streptococcus pneumoniae	10 (2.6)
Enterococcus sp	11 (2.8)
Other *gram*-positive	16 (4.1)
Escherichia coli	39 (10.1)
Enterobacter sp	36 (9.3)
Klebsiella sp	72 (18.7)
Pseudomonas sp	95 (24.6)
Acinetobacter sp	59 (15.3)
Other *gram*-negative	71 (18.4)
Anaerobic	4 (1)
Other bacteria	10 (2.6)
Candida sp	50 (13)
Aspergillus sp	2 (0.5)
Other fungus	5 (1.3)
Parasites	6 (1.6)
Other organisms	9 (2.3)

Table 3 - Relationship between organ dysfunction and infection

	All patients (N=1,235)	Non-infected (N=474)	Infected (N=761)	p value
Respiratory	618 (56.2)	168 (43.8)	450 (62.9)	<0.001
Coagulation	172 (14.9)	48 (11.5)	124 (16.9)	0.01
Hepatic	90 (11.1)	20 (7.5)	70 (12.8)	0.02
Central nervous system	413 (34.4)	86 (18.9)	327 (43.8)	<0.001
Renal	306 (26.3)	75 (17.6)	231 (31.3)	<0.001
Circulatory	250 (21.6)	51 (11.8)	199 (27.3)	<0.001

Results expressed as a number (%).

multivariable logistic regression were emergency surgery (OR=2.89, 95% CI [1.72 - 4.86], p<0.001), mechanical ventilation (OR=2.06, 95% CI [1.5 - 2.82], p<0.001), and the SAPS II score (OR=1.04, 95% CI [1.03 - 1.06], p<0.001) (Table 4).

Table 4 - Multivariable logistic regression analysis as variable dependent of infection

	OR* (95%CI)	p value
Type of admission		
Elective surgery	Reference	NA
Medical	1.58 (0.92 - 2.73)	0.1
Emergency surgery	2.89 (1.72 - 4.86)	<0.001
Trauma	1.97 (0.97 - 3.97)	0.06
Admission origin		
Operating room/PACU	Reference	NA
Others	0.5 (0.22 - 1.13)	0.1
Emergency room/Ambulance	1.08 (0.66 - 1.77)	0.76
Infirmary	1.23 (0.74 - 2.02)	0.42
Other hospital	1.64 (0.9 - 2.98)	0.1
COPD	1.01 (0.66 - 1.56)	0.95
Cancer	1.55 (0.95 - 2.53)	0.08
Heart failure (NYHA III-IV)	1.1 (0.65 - 1.88)	0.72
Diabetes mellitus	0.9 (0.56 - 1.44)	0.66
Chronic renal failure	0.9 (0.52 - 1.54)	0.69
Immunosuppression	2.1 (0.73 - 6.02)	0.17
Cirrhosis	1.07 (0.45 - 2.55)	0.88
Hematological malignancy	0.98 (0.24 - 3.93)	0.98
HIV	7.43 (0.84 - 65.5)	0.07
Age (per year)	1 (0.99 - 1.01)	0.42
Male gender	1 (0.75 - 1.34)	0.97
Mechanical ventilation	2.06 (1.5 - 2.82)	<0.001
Hemodialysis/Hemofiltration	0.99 (0.58 - 1.68)	0.97
SAPS II (per score)	1.04 (1.03 - 1.06)	<0.001

OR - odds ratio; CI- confidence interval; NA - not applicable; PACU - post-anaesthesia care unit; COPD - chronic obstructive pulmonary disease; NYHA III-IV - New York Heart Association classification III-IV; SAPS II - Simplified Acute Physiology Score II. *Adjusted for the hospital and organizational factors.

The overall mortality rate in ICU was 28.4%; this rate was 37.6% for the infected patients, and it was 13.2% for the non-infected patients (p<0.001). The overall hospital mortality rate was 34.2%; this rate was 44.2% for the infected patients, and it was 17.7% for the non-infected patients (p<0.001).

The infected patients had longer ICU stays (19 days, [8-38 days]) and hospital stays (31 days, [15-62 days]); for the non-infected patients, the ICU stay was five days [2-21 days] and the hospital stay was 14.5 days [6-44 days] (p<0.001).

The factors linked to higher mortality rates in the multivariate analysis of the infected patients were ICC functional class III/IV (OR=3.0, 95%CI [1.51 - 5.98], p<0.01), diabetes mellitus (OR=0.48, 95% CI [0.25 - 0.95], p<0.03), cirrhosis (OR=4.62, 95% CI [1.47 - 14.5], p<0.01), male gender (OR=0.68, 95% CI [0.46 - 1.0], p<0.05), mechanical ventilation (OR=1.87, 95% CI [1.19 - 2.95], p<0.01), hemodialysis (OR=1.98, 95% CI [1.05 - 3.75], p<0.03), and the SAPS II score (OR=1.08, 95% CI [1.06 - 1.10], p<0.001) (Table 5).

Table 5 - Multivariable logistic regression analysis with hospital mortality in the infected patients as the dependent variable

	OR* (95%CI)	p value
Type of admission		
Elective surgery	Reference	NA
Medical	0.81 (0.36 - 1.82)	0.62
Emergency surgery	1.24 (0.59 - 2.59)	0.57
Trauma	0.48 (0.17 - 1.34)	0.16
Admission origin		
Operating room/PACU	Reference	NA
Others	0.15 (0.03 - 0.91)	0.04
Emergency room/Ambulance	0.64 (0.33 - 1.25)	0.19
Infirmary	1.21 (0.63 - 2.33)	0.56
Other hospital	0.76 (0.35 - 1.63)	0.48
COPD	1.51 (0.87 - 2.63)	0.14
Cancer	1.32 (0.76 - 2.28)	0.32
Heart failure (NYHA III-IV)	3 (1.51 - 5.98)	<0.01
Diabetes mellitus	0.48 (0.25 - 0.95)	0.03
Chronic renal failure	0.64 (0.32 - 1.29)	0.21
Immunosuppression	1.23 (0.47 - 3.21)	0.68
Cirrhosis	4.62 (1.47 - 14.5)	<0.01
Hematological malignancy	3.96 (0.89 - 17.68)	0.07
HIV	1.17 (0.26 - 5.2)	0.84
Age (per year)	0.99 (0.98 - 1.0)	0.10
Male gender	0.68 (0.46 - 1.0)	0.05
Mechanical ventilation	1.87 (1.19 - 2.95)	<0.01
Hemodialysis/hemofiltration	1.98 (1.05 - 3.75)	0.03
SAPS II (per score)	1.08 (1.06 - 1.1)	<0.001
Staphylococcus aureus	1.51 (0.75 - 3.02)	0.25
Enterococcus sp	0.53 (0.09 - 3.16)	0.49
Other gram-positive	2.35 (0.82 - 6.71)	0.11
Escherichia coli	0.98 (0.41 - 2.33)	0.96
Klebsiella sp	1.02 (0.54 - 1.89)	0.96
Pseudomonas sp	0.99 (0.56 - 1.77)	0.98
Acinetobacter sp	1.97 (0.96 - 4.08)	0.07
Other gram-negative	0.94 (0.5 - 1.78)	0.86
Fungus	1.54 (0.75 - 3.15)	0.24
Other organisms	0.55 (0.09 - 3.46)	0.52

OR - odds ratio; CI - confidence interval; NA - not applicable; PACU - post-anaesthesia care unit; COPD - chronic obstructive pulmonary disease; NYHA III-IV - New York Heart Association classification III-IV; SAPS II - Simplified Acute Physiology Score II. *Adjusted for the hospital and organizational factors.

DISCUSSION

The present study found a high prevalence (61.6%) of and high mortality rates (37.6%) associated with infection. These numbers are larger than those reported in the literature, which vary from 21.1% to

44.5% for infection prevalence[5,6,11,12] and which are approximately 30% for mortality.[13-17]

International data have shown that infection incidence varies according to the origin of the patient (emergency room, operating room, or infirmary) and the type of ICU. Medical ICU patients have higher incidences of infection (41%), while those destined for elective surgeries have the lowest incidence (12.1%).[11] Despite these findings, the severity and occurrence of organ dysfunction do not depend on these factors.[11,14] These data are consistent with the findings of the present study. The high mortality rate found is also compatible with national and international studies, but recent data show a reduction in this rate from 37% to 30.8% ($p < 0.001$).[12] There is consistency in the literature, but the reported rates vary between 27 to 50%;[1,5,6,13,17,18] one of the possible explanations for this variation is the variation in the rate of treatment compliance.[12]

The primary site of infection was the lungs (71.2% of the cases), which is consistent with previously published results.[5,6,11,13,14,16,17] In contrast to previous publications,[5,6,11-14,16,17] the urinary tract rather than the abdomen was the second most common site. The literature identifies pulmonary infections, peritonitis, primary bacteremia, and microbiological isolation of gram-positive cocci and gram-negative bacilli as risk factors for increased symptom severity and progression to sepsis.[11,16]

Microbiological isolation was achieved in 50.7% of the infected patients. International data show a wide variation in this rate (from 47.7% to 85.8%).[11,13-15,19] Gram-negative bacilli remain the most commonly isolated organisms in Brazil, but the incidence was higher than has been previously reported (72% vs. 40.1%).[6] *Pseudomonas aeruginosa* remains the most frequently isolated (24.6%) gram-negative bacillus.[6] The incidence of gram-positive cocci infections in Brazil (33.9%) is increasing, although it is currently lower than the international incidence;[11] however, there is a growing trend toward more gram-negative bacillus infections in the worldwide literature.[15,17]

The infected patients had a significantly higher prevalence of organ dysfunction and higher SOFA scores (Table 3) than did the non-infected patients.[6,12] Higher mortality proportional to the greater organ dysfunction and higher SOFA scores were noted among these patients; the mortality rate in the patients with four or more organ dysfunctions was (65%).[6,11,13] The SAPS II scores were higher in the infected patients ($p < 0.001$) and were related to higher mortality rates (both ICU and hospital) in these cases.[5,6,8,11,12,14-16,19] The infected patients also had longer ICU and hospital stays.[6,11-13,19] The patients who were already infected at the time of ICU admission or who acquired infection during hospitalization were defined as a high-risk population for mortality.[11]

According to the multivariate analysis (Table 4), increased risk of infection was associated with emergency surgery ($p<0.001$), mechanical ventilation ($p<0.001$), and higher SAPS II scores ($p<0.001$). These results are consistent with those of other publications.[5,6,13,16,20] In contrast to previous reports, comorbidities such as cirrhosis, immunosuppression, ICC functional class III/IV, diabetes mellitus, and solid and hematological malignancies were not directly correlated with infection.[11] One study found that cirrhosis is associated with a greater risk of progression from infection to sepsis.[16]

The difference between the mortality rates of the infected and non-infected patients in the Brazilian intensive care units was statistically significant (37.6% vs. 13.2%, with $p<0.001$). This result is similar to the findings of previous reports, although the values are lower.[5] The hospital mortality findings were similar (44.2% vs. 17.7%, $p<0.001$, for the infected and non-infected patients, respectively).[5,13] The factors linked to increased mortality risk among the infected patients in the multivariate analysis were ICC functional class III/IV, diabetes mellitus, cirrhosis, male gender, mechanical ventilation, dialysis, and SAPS II score. There was an association between higher mortality rates and male gender, which is consistent with reports of sex hormones protecting against infection and lowering mortality rates.[21-23] The majority of studies have shown an association between comorbidities and higher mortality rates; not all have found statistically significant associations for previous organ dysfunction, however.[5,6,11-13,16,17,19]

The present study has limitations related to the clear differences in the protocols for approaching ICU infections, which vary with region and the type of hospitals (public or private).

CONCLUSION

In summary, the present study revealed a higher prevalence of infections in Brazilian ICUs than has been previously reported. There was a clear association between infection and mortality. These findings may be useful for generating institutional health care infection prophylaxis policies and for defining public educational and research priorities in this area.

RESUMO

Objetivo: Demonstrar as taxas de prevalência de infecção em unidades de terapia intensiva brasileiras e mortalidade atribuída pela análise dos dados obtidos pelo estudo *Extended Prevalence of Infection in Intensive Care* (EPIC II).

Métodos: O EPIC II é um estudo multicêntrico, internacional, prospectivo, de prevalência de infecção em UTIs, realizado em apenas um dia. Ele descreve as características demográficas, fisiológicas, bacteriológicas, terapêuticas, acompanhamento até o 60º dia, a prevalência de infecção, a taxa de mortalidade de todos os pacientes internados nas unidades de terapia intensiva participantes entre zero hora e meia noite do dia 8 de maio de 2007. Um total de 14.414 pacientes foram inlcuídos no estudo original, sendo que destes, 1.235 eram brasileiros provenientes de 90 unidades de terapia intensiva do país, que representaram o foco do estudo.

Resultados: Dos 1.235 pacientes, 61,6% apresentavam infecção no dia do estudo, sendo que o pulmão era o principal sítio de infecção (71,2%). Metade dos pacientes apresentava cultura positiva, sendo que o predomínio foi de bacilos *Gram*-negativos (72%). No dia do estudo, o *Sequential Organ Failure Assessment* (SOFA) mediano foi 5 (3-8) e o *Simplified Acute Physiology Score II* (SAPS II) mediano 36 (26-47). Os doentes infectados apresentaram escore SOFA significativamente maior do que os não infectados, 6 (4-9) e 3 (2-6), respectivamente. A taxa de mortalidade global na unidade de terapia intensiva foi 28,4%, sendo de 37,6% em infectados e 13,2% em não infectados (p<0,001). Da mesma forma, a taxa de mortalidade hospitalar foi maior em pacientes infectados (44,2% *versus* 17,7%), tendo como taxa global 34,2% (p<0,001). Na análise multivariada, os principais fatores relacioanados ao desenvolvimento de infecção foram cirurgia de emergência (OR: 2,89, IC95%=1,72-4,86; p<0,001), ventilação mecânica (OR=2,06, IC95%=1,5-2,82; p<0,001), SAPS II – por ponto obtido (OR=1,04, IC95%=1,03-1,06; p<0,001) e para mortalidade foram insuficiência cardíaca congestiva (ICC) Classe Funcional III/IV (OR=3,0, IC95%=1,51-5,98; p<0,01), *diabetes mellitus* (OR=0,48, IC95%=0,25-0,95; p<0,03), cirrose (OR=4,62, IC95%=1,47-14,5; p<0,01), gênero masculino (OR=0,68, IC95%=0,46-1,0; p<0,05), ventilação mecânica (OR=1,87, IC95%=1,19-2,95; p<0,01), hemodiálise (OR 1,98, IC95%=1,05-3,75; p<0,03), SAPS II – por ponto obtido (OR=1,08, IC95%=1,06-1,10; p<0,001).

Conclusão: Taxas de prevalência de infecção e de mortalidade mais elevadas que outros relatos foram observadas na presente amostra. Há clara relação entre infecção e mortalidade.

Descritores: Sepse; Prevalência; Mortalidade; Infecção; Unidades de terapia intensiva

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