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ORIGINAL ARTICLE

FACTORS ASSOCIATED WITH THE DEVELOPMENT OF SEPSIS IN PATIENTS HOSPITALIZED IN INTENSIVE SURGICAL THERAPY: A RETROSPECTIVE STUDY

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ABSTRACT

Objective: to check the association between risk factors and the development of sepsis in surgical or hemodynamic patients hospitalized in a surgical intensive care unit (SICU). **Methods:** cross-sectional study, with a retrospective approach, performed in the surgical ICU of a large hospital, from January to April 2018, with a final sample of 113 hospitalizations. Data were collected from medical records, transcribed into collection forms, then tabulated and analyzed through the Statistical Package for the Social Sciences (SPSS), version 22.0; Prevalence ratio (PR), Pearson's Chi-square and Fisher's exact test were calculated, considering statistically significant the results with a value of p<0.05. **Results:** sepsis had a prevalence of 8% in the study unit and a statistically significant association with prolonged SICU stay (PR=21.1; CI=2.759-162.316; p=0.000) and the occurrence of death (PR=6.6; CI=2.375-18.357; p=0.005). **Conclusion:** the data found may encourage further research, cooperating with scientific production and discussion on the topic, reflecting positively on care practice, especially in intensive care.

Keywords: Sepsis. Risk Factors.Intensive Care Units. Nursing.

INTRODUCTION

The *Centers for Disease Control and Prevention* (CDC) defines healthcare-associated infections (HAI) as a localized or systemic condition resulting from an adverse reaction to the presence of an infectious microorganism acquired after the third day of admission to healthcare services[1]. In this context, sepsis stands out, seen worldwide as a serious public health problem that has affected thousands of people, increasing morbidity and mortality rates and entailing high hospital costs. It is believed that about 30 million cases take place annually, worldwide, with a mortality of one in four people and an incidence of one in five[2-3].

Sepsis is defined as *"the presence of life-threatening organ dysfunction secondary to the body's unregulated response to infection"* [4-5]. It comprises a set of inflammatory, neural, hormonal and metabolic reactions, known as Systemic Inflammatory Response Syndrome (SIRS), resulting from the interaction between the infecting pathogen (bacterium, virus, fungus or protozoan) and the host organism[3].

With respect to the hospital environment, intensive care units (ICUs) stand out, where sepsis is considered one of the main causes of mortality, surpassing the rate of classic diseases such as ischemic stroke and acute myocardial infarction, in addition to cause more deaths than bowel and breast cancer combined. Estimates point to the existence of approximately 600,000 new cases of this illness each year in Brazil[6]. A Brazilian multicenter study shows a mortality rate of 55.7% in patients diagnosed with sepsis[7], with this disease being responsible for 25% of the occupation of ICU beds nation wide[3].

Among the factors that predispose to sepsis, advanced age, the number of

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immunosuppressed patients or those diagnosed with chronic diseases, such as systemic arterial hypertension (SAH) or Diabetes mellitus (DM), stand out. These groups deserve special attention, as they are considered vulnerable to complications resulting from this illness. In addition, the increased resistance of microorganisms and the lack of infrastructure to provide care in emergency rooms and hospitals are aspects that contribute to the spread of sepsis[6].

In this context, it is essential to highlight the role of the multidisciplinary team in the prevention and control of this disease. The dissemination of knowledge about sepsis and its complications is essential for reducing mortality, through surveillance and follow-up of patients, identification of worsening signs and prompt treatment of sepsis-related disorders[8].

Considering that the ICU is one of the most favorable spaces for the development of sepsis, due to the critical condition of patients and greater exposure to invasive procedures, it is necessary to investigate the risk factors that predispose the occurrence of this disease, in order to implement good practices by the multidisciplinary team and to facilitate prevention and control.

Nevertheless, this study was stimulated because of the scarcity of studies addressing the risk factors associated with the occurrence or development of sepsis in the ICU environment, in the adult population, and/or studies in which the studied population presents clinical and non-surgical profile. Above all, the identification of risk factors associated with the occurrence of sepsis in surgical patients will enable the adoption of strategies for prevention, early treatment and reduction of mortality rates in the surgical intensive care unit.

It is also expected to contribute to the change of scenario, as the data found may encourage further research, cooperating with the scientific production and discussion on the topic, reflecting positively on care practice, especially on the team of professionals working in intensive therapy.

Based on this assumption, the following question arose: Is there an association between risk factors and the occurrence of sepsis in critically ill patients after surgical procedures or undergoing endovascular procedures from the hemodynamic center?

Accordingly, the general objective of this study is to check the association between risk factors and the development of sepsis in surgical patients or patients undergoing endovascular procedures hospitalized in a surgical ICU and, as specific objectives, to find out the prevalence of sepsis, to characterize patients with sepsis regarding the socio-demographic/clinical profile and to identify the occurrence of death in surgical patients diagnosed with this disease during their ICU stay.

METHODS

This is a cross-sectional study, with a retrospective approach, carried out in a large and highly complex teaching hospital located in the city of Salvador. The scenarioof this research was the Surgical ICU, which consists of 10 beds and admits adult patients from the operating room or the hospital's hemodynamics center.

The surgical ICU admits patients who undergo emergency and elective surgeries, and is intended for the post-operative of general surgeries, with abdominal surgeries prevailing, followed by genitourinary surgeries. It is also a reference for kidney and liver transplants, which have been taking place in the unit for a little over two years. It also receives patients from the hemodynamics center who have undergone diagnostic and therapeutic endovascular procedures, such as arteriography, angioplasty and cardiac catheterization, who meet the criteria for intensive care.

This is a non-probability sample, composed of participants who were admitted to the surgical ICU from January to April 2018, and who met the inclusion criteria: age 18 years or older. And as exclusion criteria: presenting incomplete records; presenting length of stay in the ICU less than or equal to 24 hours; being admitted to the ICU with a diagnosis of sepsis. After applying the criteria, 113 participants were selected.

Data were collected through a secondary source. From the patient's medical record, the

relevant information was transcribed to the data collection form, containing socio-demographic and clinical data, in addition to variables related to the occurrence of sepsis and ICU stay. This instrument was developed by the researcher based on the variables found in other studies with similar themes[5,9]. The patients, when diagnosed with sepsis, had to have this information confirmed by medical records in the medical chart and needed a classification according to the *Sequential Organ Failure Assessment* (SOFA) scale.

In this study, the outcome variable was the occurrence of sepsis or death, categorized as yes or no. The exposure variables related to sociodemographic and clinical conditions and hospitalization[5,9] were: age (in years); gender (female or male); presence of comorbidities (yes or no), being considered in this study SAH, DM and neoplasms; length of stay in the ICU (in days), being considered prolonged when equal to or greater than seven days; presence of invasive devices (yes or no), being considered in this study the central venous catheter (CVC), orotracheal tube (OTT) or indwelling urinary catheter (IUC).

Statistical, descriptive, and inferential analysis was performed. Data were tabulated in electronic spreadsheets and analyzed using the Statistical Package for the Social Sciences (SPSS), version 22.0. Absolute and relative frequency distributions were calculated, as well as medians and standard deviation for numerical variables. The associations between exposure and outcome variables were evaluated using generalized linear models, calculating the prevalence ratio (PR) with a 95% confidence interval. Pearson's chi-square test was used in the crossing of variables as hypothesis tests, and results with a value of $p<0.05$ and Fisher's exact test were considered statistically significant for variables with cells containing values less than five.

A waiver of the Free and Informed Consent Form (FICF) was requested, since it was not possible to apply it, since there was no direct involvement with the patients. The Data Confidentiality Agreement was signed by the researcher in order to ensure confidentiality in the collection process through access to information in the medical records.

This study considered the ethical aspects of Resolution nº 466/2012 of the National Health Council, which regulates research involving human beings in Brazil[10], approved by the Research Ethics Committee (REC) of the Hospital, through opinion nº 2.777.184.

RESULTS

Among the 113 medical records analyzed, a prevalence of sepsis of 8% was registered, and the main focus of infection was the lung, with 55.6% of the cases, followed by the abdomen (44.4%), with no records of infection in other sites.

Table 1. Associations between the occurrence of sepsis and variables related to the sociodemographic and clinical conditions of the patients. Salvador/BA - Brazil - 2018

Variables	Sepsis				
	Yes (n=9) n (%)	No (n=104) n (%)	PR	CI	Fisher's exact test
Age					
≥ 61 years old	6 (10.5)	51 (89.5)	1.9	0.517-7.474	0.254
Up to 60 years old	3 (5.4)	53 (94.6)			
Gender					
Female	3 (5.6)	51 (94.4)	0.5	0.144-2.078	0.291
Male	6 (10.2)	53 (89.8)			
Presence of comorbidities					
Yes	6 (7.7)	72 (92.3)	0.8	0.238-3.384	0.569
No	3 (8.6)	32 (91.4)			
Prolonged hospitalization stay					
Yes	8 (25.8)	23 (74.2)	**21.1**	**2.759-162.316**	**0.000**
No	1 (1.2)	81 (98.8)			
Presence of invasive devices					
Yes	9 (8.6)	96 (91.4)	0.9	0.862-0.969	0.503
No	0 (0.0)	8 (100.0)			

Source: Data collection, Salvador/Bahia, 2018.

Considering the patients who developed sepsis after ICU admission, 55.6% were between 61 and 80 years of age, with a median age of 72 years and a range of 36 to 85 years. Regarding gender, 66.7% of the patients with sepsis were male.

Regarding the clinical condition, most of the septic patients had comorbidities, being SAH the main one (44.5%), followed by neoplasms (33.3%) and DM (22.2%), and all those who had sepsis used invasive devices.

Among the study participants, 71 underwent abdominal and/or gastrointestinal procedures and 42 underwent endovascular procedures, amputations, urological surgeries and neurosurgeries. Among the patients who developed sepsis, 6 underwent abdominal surgery and 3 underwent amputation, brain embolization and aneurysm repair, respectively. Patients diagnosed with sepsis had prolonged hospitalization, with a median of 20 days (±9.4). As for the clinical outcome, 44.4% of the patients who had sepsis died.

Taking into consideration the variables studied, statistical differences were observed between the groups with and without sepsis for the prolonged length of stay (p=0.000), which showed a 21.1 times greater probability of developing sepsis in patients hospitalized for a prolonged period (Table 1), and the occurrence of death (p=0.005), with a 6.6 times greater probability of death in patients with sepsis (Table 2).

Table 2. Association between the development of sepsis and the occurrence of death. Salvador/BA - Brazil - 2018

	Death				
	Yes n (%)	**No n (%)**	**PR**	**CI**	**Fisher's exact test**
Occurrence of sepsis					
Yes	4 (44.4)	5 (55.6)	**6.6**	**2.375-18.357**	**0.005**
No	7 (6.7)	97 (93.3)			

Source: Secondary data collection, Salvador/Bahia, 2018.

The variables on age, gender, presence of comorbidities and invasive devices did not significantly influence the development of sepsis; however, this complication took place more frequently in elderly male patients, with associated comorbidities and using invasive devices.

DISCUSSION

In this study, the occurrence of sepsis reached a rate of 8%, demonstrating a relatively low prevalence of this complication. Two other studies brought similar data: one conducted in the general, clinical, and surgical ICUs of a public hospital in São José do Rio Preto showed a prevalence of 9.2% among patients who developed sepsis during hospitalization [11]; another conducted in the ICU in Santa Catarina, in 2013, showed an incidence of nosocomial sepsis of 9.7% among hospitalized patients[12].

However, most studies found in the literature contradict the findings of this research and indicate higher rates of sepsis, ranging from 13.5% to 22.3% among the studied population [13-16]. It is worth noting that, unlike this study, the other findings do not relate to units specifically with a surgical profile, which limits the comparison.

The lower occurrence of sepsis in this study is probably due to the fact that these patients come from the surgical center and the hemodynamics center, and are often submitted to simple or elective procedures, such as angioplasties and surgeries like laparoscopic cholecystectomies, which generate hospital stays for short periods of time and, therefore, a population less exposed to invasive interventions and, consequently, to infectious processes.

As observed in this study [9], the high frequency of invasive procedures (central vascular catheter, mechanical ventilation, and bladder catheter), length of stay longer than five days, and the presence of comorbidities (DM, SAH and neoplasms) contribute to the worsening of sepsis and increase the risk of death in ICU patients.

Regarding the focus of infection, there are studies[9,16] that also point to the pulmonary and

abdominal focus as the main sites of infection in septic patients. Others also highlight the respiratory tract as the most incident site[3, 13, 15]. This finding is probably due to the use of mechanical ventilation through the orotracheal tube, which becomes a facilitator for the installation and dissemination of an infectious process. The presence of this device, most often for prolonged time, serves as a gateway for microorganisms, thus favoring the development of sepsis [12].

Moreover, the greater occurrence of abdominal surgeries in the hospital in question may be a determining factor in the incidence of infections of the abdominal focus.

Considering the age factor, the elderly citizens were the majority among patients who developed this disease in this study, and some studies bring similar data [3, 9, 11, 12, 15], showing that 25% of patients with sepsis were older than 65 years and, of these, 76% died regardless of the worsening of the disease, showing that the high age favored their susceptibility.

The findings are justified considering it is a population with a higher number of associated comorbidities. Compared to other age groups included in the studies, the elderly citizens are admitted in greater proportion in ICUs around the world [12]. In addition, the elderly individuals have a reduction in innate immunity, thus increasing their susceptibility to infectious processes.

The occurrence of sepsis in this study was more frequent in male patients, 66.7%, and this finding corroborates other studies found in the literature literatura [3, 11, 13, 15, 16]. The discussion based on results according to gender is a matter of ongoing study. Some studies argue for the existence of hormonal differences between the sexes and higher levels of anti-inflammatory mediators in women, these being the probable causes of higher incidences of sepsis and worse outcomes in males; others find no differences, some show worse outcomes in women. Inclusively, another aspect has added to the gender discussions, some studies have shown that women receive less treatment for sepsis once diagnosed, demonstrating the complexity of these findings[17,18,19].

As for previous comorbidities (SAH, DM and neoplasms), they were present in most patients who developed this condition, certainly as a reflection of the predominance of those with older age.

Another study[9] found similar results, as the most frequent comorbidities in patients with sepsis were DM (19.9%), SAH (16.3%) and neoplasms (16.3%). One explanation for this finding is that these diseases lead to a series of systemic physiological changes that, with other risk factors, can contribute to trigger inflammatory and infectious processes and, consequently, sepsis.

Regarding length of stay, studies show an average ICU stay of 11.7 days in patients with sepsis [9,15], while those without this dysfunction were hospitalized for an average of 6 days.

In this study, patients had a median length of stay in the critical care unit of 20 days and showed a higher probability of sepsis when compared to those who remained hospitalized for a shorter period. Thus, prolonged hospitalization may predispose the individual to develop sepsis, considering that the individual is subject to greater exposure to invasive procedures and, consequently, to the invasion of multiresistant microorganisms.

Moreover, patients with infection and hospitalized for long periods can directly influence the increase in hospital costs. In addition to the direct expenses during the provision of care, the increase in the length of stay in the ICU can have an impact no less important in terms of public health, since it limits access to intensive care[20].

As for invasive procedures, other studies [16,21] conducted in ICUs have shown that all patients with sepsis underwent at least one invasive procedure, the main ones being indwelling urinary catheter, central venous catheter, and orotracheal intubation, corroborating the findings of the present study.

Regarding the clinical outcome, there were more discharges from the ICU than deaths. Despite this finding, this study showed a statistically significant association between sepsis and death, corroborating the results of a retrospective research [11], with similar inclusion criteria, carried out with 116 patients, of whom 33.4% died and 66.5% were discharged, being this the clinical outcome more frequently observed. However, a high lethality rate is observed in septic patients.

Both studies, which were developed in

public and teaching hospitals, were also similar as to comorbidities (SAH, DM) and age range of the studied patients. Regarding the clinical profile, differently from the research in question, which studies surgical patients, the research [11] did not delimit, by including patients admitted to other ICUs, such as the General, Clinical and Surgical ICUs.

The analysis of risk factors associated with mortality in patients with sepsis is relevant, since the worsening of this disease is directly related to the risk of death in the ICU environment. Nonetheless, an engaged multidisciplinary team and the creation of well-defined flows and protocols for sepsis can have a positive impact, contributing to early detection of the problem and a possible reduction in mortality [22].

As for the limitations of the present study, it should be highlighted the fact that it was conducted in only one ICU of the institution, the small size of the sample and consequently of the patients who developed sepsis in the study, the absence of an institutional protocol on sepsis implemented in the hospital, the difficulty to find relevant information in the medical charts, such as the SOFA scale and the severity scores, such as APACHE and SAPS-3.

CONCLUSION

Based on the results, there was a low prevalence of sepsis in the studied unit, it was possible to find an association between prolonged ICU stay and the development of sepsis. In addition, there was a higher probability of death among patients who developed sepsis when compared to those who did not develop sepsis, which calls attention to the adoption of preventive and therapeutic measures for this profile of patients.

FATORES ASSOCIADOS AO DESENVOLVIMENTO DE SEPSE EM PACIENTES INTERNADOS EM TERAPIA INTENSIVA CIRÚRGICA: ESTUDO RETROSPECTIVO

RESUMO

Objetivo: verificar a associação entre os fatores de risco e o desenvolvimento de sepse em pacientes cirúrgicos ou hemodinâmicos internados em uma unidade de terapia intensiva (UTI) cirúrgica. **Métodos:** estudo de corte transversal, de abordagem retrospectiva, realizado na UTI cirúrgica de um hospital de grande porte, no período de janeiro a abril de 2018, com uma amostra final de 113 internamentos. Os dados foram coletados em prontuários, transcritos para formulários de coleta e, em seguida, tabulados e analisados por meio do programa *Statistical Package for theSocial Sciences*(SPSS), versão 22.0.Calcularam-se razão de prevalência (RP), Qui-quadrado de Pearson e teste exato de Fisher, considerando estatisticamente significantes os resultados com o valor de p<0,05. **Resultados:** a sepse teve uma prevalência de 8% na unidade de estudo e uma associação estatisticamente significativa com o tempo de internamento prolongado na UTI (RP=21,1; IC=2,759-162,316; p=0,000) e a ocorrência de óbito (RP=6,6; IC=2,375-18,357; p=0,005). **Conclusão:** os dados encontrados poderão estimular a realização de novas pesquisas, cooperando com a produção científica e a discussão sobre a temática, refletindo positivamente na prática assistencial, especialmente em terapia intensiva.

Palavras-chave: Sepse. Fatores de Risco. Unidades de Terapia Intensiva. Enfermagem.

FACTORES ASOCIADOS AL DESARROLLODE SEPSIS EN PACIENTES INTERNADOS EN CUIDADO INTENSIVOQUIRÚRGICO: ESTUDIO RETROSPECTIVO

RESUMEN

Objetivo: averiguar la asociación entre los factores de riesgo y el desarrollo de sepsis en pacientes quirúrgicos o hemodinámicos internados en una unidad de cuidados intensivos (UCI) quirúrgica. **Métodos**: estudio de corte transversal, de abordaje retrospectivo, realizado en la UCI quirúrgica de un hospital de gran tamaño, en el período de enero a abril de 2018, con una muestra final de 113 hospitalizaciones. Los datos fueron recogidos en registros médicos, transcriptos para formularios de recolección y luego tabulados y analizados por medio del programa *Statistical Package for the Social Sciences* (SPSS), versión 22.0. Se calcularon razón de prevalencia (RP), Chi-cuadrado de Pearson y prueba exacta de Fisher, considerando estadísticamente significativos los resultados con el valor de P<0,05. **Resultados**: la sepsis tuvo una prevalencia del 8% en la unidad de estudio y una asociación estadísticamente significativa con el tiempo de hospitalización prolongado en la UCI (RP=21,1; IC=2,759-162,316; p=0,000) y la ocurrencia de óbito (RP=6,6; IC=2,375-18,357; p=0,005). **Conclusión**: los datos encontrados podrán fomentar la realización de nuevas investigaciones, colaborando con la producción científica y la discusión sobre la temática, repercutiendo positivamente en la práctica asistencial, especialmente en cuidados intensivos..

Palabras clave: Sepsis. Factores de Riesgo. Unidades de Cuidados Intensivos. Enfermería.

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