


Nursing diagnoses in septic patients: Association with signs, symptoms and SOFA score

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ABSTRACT

Objective: To associate nursing diagnoses (ND) with signs/symptoms and SOFA score in septic patients. **Methods:** Retrospective cross-sectional study that analyzed 242 medical records. **Results:** The most prevalent sign was leukocytosis (42%). The average SOFA score was 7 (53.3%). The prevalent NDs with a significant association were: Risk of Infection (IR) (86%); Self-Care Deficit Syndrome (SDA) (68%) and Impaired Spontaneous Ventilation (EPV) (54.1%). SOFA >7 was associated with IR ($p=0.002$); SDA ($p<0.001$) and VEP ($p<0.001$). Regarding signs/symptoms, IR with leukocytosis, confusion, drowsiness and agitation (all $p<0.001$); DAS with leukocytosis ($p=0.002$), confusion ($p<0.001$), drowsiness ($p<0.001$) and agitation ($p<0.001$); and VEP with leukocytosis ($p=0.016$) and agitation ($p<0.001$). **Conclusion:** Prevalent EDs had a significant association with predominant signs/symptoms and SOFA >7.

Keywords: Nursing Diagnoses, Sepsis, Intensive care unit, SOFA.

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INTRODUCTION

Sepsis is considered one of the few pathologies that affects developed countries with specialized environments and countries with scarce resources with the same level of severity (FREITAS et al, 2017), although real numbers are still unknown, it is estimated that more than 17 million deaths per year worldwide are due to sepsis. However, globally, in a sample of 12,570 patients, the lethality of sepsis was 49.6%, while in Brazil this rate was 67.4% (ILAS, 2016).

National data show high lethality in private hospitals, with rates of 36.7%, in public institutions mortality is even higher (49.1%). This divergence can be explained by the delay in diagnosis and poor adherence to treatment protocols, which occur more frequently in the public health system (ILAS, 2016).

According to a report published by the Latin American Sepsis Institute (ILAS) in 2016, with national data, 52 thousand patients diagnosed with sepsis who were hospitalized in hospitals in the country were analyzed from 2005 to 2016, the data showed that 52.4% patients had pulmonary infectious focus, and 17.5% sepsis due to urinary focus. In São Paulo, a 2014 survey of data conducted at a university hospital also showed a predominance of sepsis due to pulmonary focus in 76% of patients (BARRETO, 2016).

Another study conducted in the United States (USA) between 2004 and 2009 showed 39,893,459 hospitalizations due to sepsis in various Intensive Care Units (ICU) in the country. Among these patients, more than 50% had renal dysfunction, followed by cardiovascular and respiratory dysfunction (GAIESKI et al, 2013). A meta-analysis study, published in 2015, on the incidence and mortality of sepsis in the world, pointed to an estimated 50 million cases of sepsis with potentially 5 million deaths per year. However, the data presented in the study are not very precise, due to the fact that there is no data on the incidence of sepsis in low-income countries (FLEISCHMANN et al, 2015).

In this scenario, *the Sequential Organ Failure Assessment (SOFA)* is a valuable score used to assess the extent and severity of organ dysfunction. Scoring systems, whether generic or disease-specific, are used to establish prognosis, assess the severity of a disease, and direct therapeutic interventions. These scores assess the patient individually, and may be based on physiological derangements or resource allocation (KEEGAN, 2016).

A 2008 study conducted in the south of the country compared the first and last scores of patients admitted to the ICU, survivors and those who died, and there was a statistically significant difference in the score variables ($p < 0.001$), considering it significantly valuable (ZANON et al, 2008).



Another prospective study conducted in 2016 evaluated the variables and the SOFA score in patients under critical care for one month, the results showed an approximate efficacy of 75% in predicting mortality (SAFARI et al, 2016).

However, in view of what has already been exposed, patients diagnosed with sepsis are still a major challenge for health institutions, due to the difficulty in early identification and adequate treatment in the first hours, thus increasing mortality rates. Although ICUs are increasingly specialized, with trained professionals and innovative technological support aimed at improving the quality of care provided to critically ill patients, there is little knowledge among health professionals, especially nurses and physicians, regarding the early recognition and identification of warning signs and symptoms of severity in infectious conditions. resulting in late diagnosis and care (GARRIDO et al., 2016; FREITAS, 2017). A multicenter study conducted in 2014, with the objective of evaluating the prevalence and lethality of sepsis in Brazilian ICUs, showed that approximately 30% of intensive care beds are occupied by septic patients (MACHADO et al, 2017).

Therefore, nurses working in ICUs care for septic patients on a daily basis, and must be able to recognize the signs and symptoms of this pathology in order to plan care with quality and safety. Nurses' updating and technical competence become extremely important in the care process that occurs through the nursing process (DUTRA, 2014).

The Nursing (NP) process begins with data collection to support the survey of Nursing Diagnoses (ND) for the adequate planning and evaluation of the care implemented (DUTRA et al, 2014).

However, the NP triggered by NDs are also not specific for septic patients, and may not include all the care required for this group of patients. There is still a scarcity of studies that address the NP of septic patients, however, according to a manual prepared by COREN-SP in partnership with ILAS, some of the prevalent NDs that were found for these patients, based on NANDA-I, are: Risk of shock; Dysfunctional gastrointestinal motility; Impaired gas exchange; Ineffective breathing pattern; Risk of bleeding; Risk of ineffective renal infusion; Decreased cardiac output; Risk of infection; Risk of imbalance in fluid volume and Risk of imbalance in body temperature (COREN-SP & ILAS, 2017)

Therefore, in view of what has already been described, it is known that the theme of sepsis is of great importance, requiring further studies in the area of nursing with a focus on NP and especially dissemination of knowledge and awareness of professionals to the urgency that this patient needs. Therefore, this study aims to associate the NDs listed with the signs and symptoms presented and the SOFA score of septic patients admitted to an ICU.



METHODS

This is a quantitative study with a retrospective cross-sectional design. It was carried out in an intensive care unit (ICU) belonging to a university hospital in southern Brazil and internationally accredited by the *Joint Commission International*. We analyzed medical records of adult patients who were hospitalized in the ICU with a diagnosis of sepsis and had a nursing record in the first 24 hours from time zero of the diagnosis of sepsis, from December 2016 to August 2017.

The sample was by convenience, consisting of 242 medical records of septic patients selected from a database of the Intrahospital Program to Combat Sepsis. Data were collected from January to March 2018 using an instrument developed by the researchers. The variables considered in this study were: sociodemographic profile; clinical history (comorbidities, length of hospital stay, reason for hospitalization, outcome: discharge/death, infectious focus); characteristic signs and symptoms of sepsis presented by patients at the time of diagnosis, collected through nursing and medical evolution in the subjective (S) and objective (O) items; SOFA score in the first assessment and Nursing Diagnoses (ND) listed in the first 24 hours from time zero of sepsis diagnosis.

Emphasizing that the NDs found in this study through online medical records are part of the *Management Application for University Hospitals (AGHUSE)* system, they advocate the NANDA-I taxonomy, but present some divergences.

The collected data were stored in an Excel® 2010 spreadsheet and analyzed using the *Statistical Package for the Social Sciences (SPSS)* version 20.0. Continuous variables were expressed as mean and standard deviation for those with normal or median distribution, and interquartile ranges (25-75) for those without normal distribution (Kolmogorov-Smirnov test). Categorical variables were described as absolute and relative frequencies. The chi-square test was used to verify the association between signs, symptoms and SOFA score and open NDs. A value of $P \leq 0.05$ was considered significant.

This study was submitted for evaluation and approval by the Research Committee (COMPESQ) of the School of Nursing, UFRGS, and the larger project, to which this study is linked, was submitted to and approved by the Research Ethics Committee (CEP) under number 16.0317.

RESULTS

The sample included 242 patients diagnosed with sepsis or septic shock who were admitted to the ICU. The patients were predominantly male (52.1%) and with a mean age of 59 years. Among the comorbidities presented, Systemic Arterial Hypertension (46.3%) and Diabetes Mellitus (29.3%) were prevalent. All the data cited are shown in Table 1.

Table 1 - Characteristics of the total sample. Porto Alegre, 2018.

Variable	Sample n= 242
Age*	59.9 ± 16.2
Men‡	126(52,1)
Hospitalization	
Total time in hospital†	26
UTI Time†	7
Denouement	
High‡	139(57,4)
Death‡	103(42,6)
Comorbidities	
Systemic Arterial Hypertension‡	112(46,3)
Diabetes Melittus‡	71(29,3)
Neoplasm‡	51(21,1)
Heart Failure‡	41(16,9)
Active smokers‡	37(15,3)
Renal Insufficiency‡	35(14,5)
Alcoholism‡	32(13,2)
Chronic Obstructive Pulmonary Disease‡	31(12,8)
HIV‡	18(7,4)
Stroke‡	17(7)
Cirrhosis‡	11(4,5)

*Mean±standard deviation; †Median (25-75th percentile); ‡ n(%).

The predominant focus of infection was pulmonary (47.2%), in 23% of the patients the definition of focus was not found, and among the 48 reasons for hospitalization found, dyspnea was the predominant. The clinical data are described in Table 2.

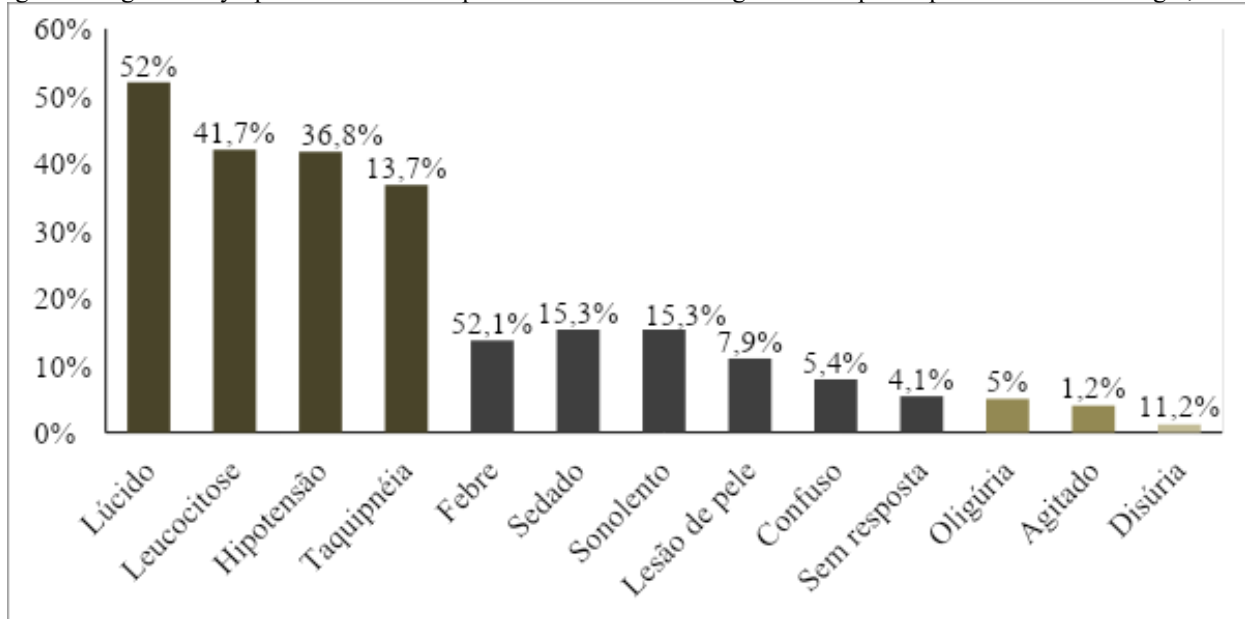
Table 2 - Clinical data of patients diagnosed with sepsis. Porto Alegre, 2017.

Data	n(%)
Clinical Profile	
Chemotherapy	18(7,4)
Immunosuppression	7(2,9)
Radiotherapy	5(2,1)
Main complaint/reason for hospitalization	
Dyspnea	42(17,4)
Abdominal pain	29(12)
Sensorium lowering	24(10)
Surgery	24(10)
Fever	18(7,4)
Infectious focus	
Lung†	47,2
Indefinite†	23,1
Abdominal†	19
Renal†	7,9
Cutaneous†	2,8

†(%)

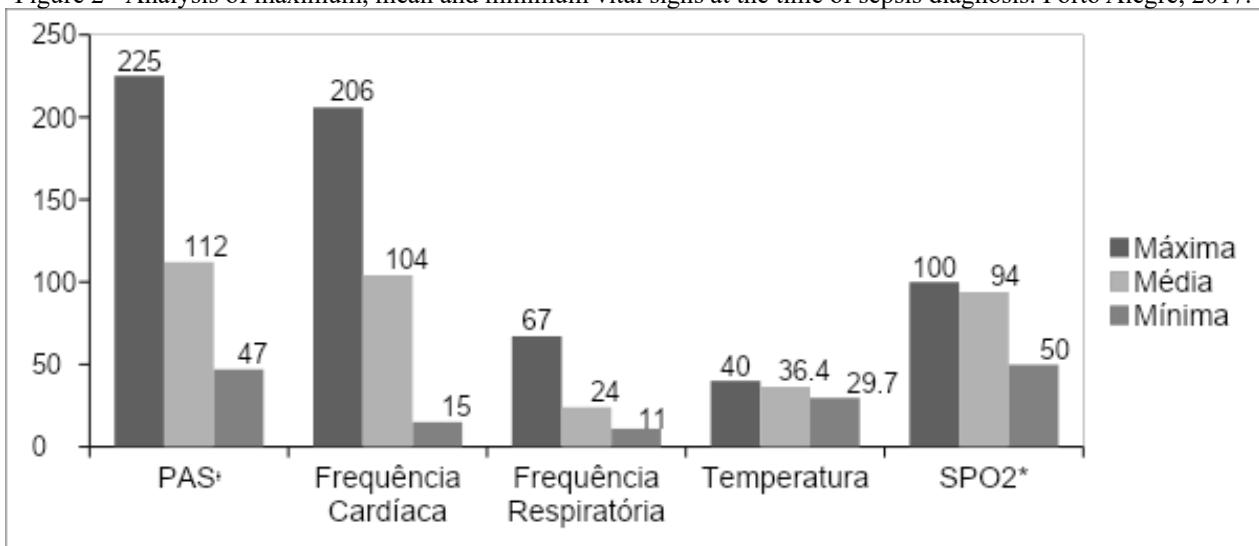
Leukocytosis (42%) was the most prevalent sign in patients, followed by hypotension (41%). In neurological regulation, more than half were lucid (52.1%). Signs and symptoms resulting from the renal system and skin were irrelevant, and most patients did not present alterations in these systems. Data depicted in Figure 1.

Figure 1- Signs and symptoms identified in patients at the time of diagnosis of sepsis/septic shock. Porto Alegre, 2017.



In the evaluation of the SOFA score, the median was 7 (5-9), and approximately half of the sample [n= 113 (46.7%)] obtained a score higher than the mean. The majority (65%) of the patients required ventilatory support. In the evaluation of vital signs, the mean values were as described in Figure 2.

Figure 2 - Analysis of maximum, mean and minimum vital signs at the time of sepsis diagnosis. Porto Alegre, 2017.



†Systolic Blood Pressure / *(%)

In the sample, 96 different NDs were listed, for the evaluation of the diagnoses, the titer and its related factor were considered, therefore, the same diagnosis could be considered with a different causal factor. For the present analysis, diagnoses with a prevalence greater than or equal to 10% were considered, with the most prevalent being *Risk of infection* (86%), followed by *Self-care deficit*

syndrome (68%) and Impaired spontaneous ventilation (54.1%). The diagnoses are described in Table 3.

Table 3 - Prevalent diagnoses listed for patients with sepsis. Porto Alegre, 2017.

Nursing Diagnosis	N	% per patient
Risk of infection	180	86,9%
Self-care deficit syndrome	141	68,1%
Impaired spontaneous ventilation	112	54,1%
Ineffective breathing pattern	47	22,7%
Risk of falls	42	20,2%
Acute pain	41	19,8%
Impaired tissue integrity	32	15,4%
Risk of Pressure Injury	28	13,5%
*Domain safety and security;		

Risk of infection was found to be predominantly related to invasive procedure (71.9%), *self-care deficit syndrome* obtained only the related factor neuromuscular/musculoskeletal impairment (68.12%), which was also related to *impaired spontaneous ventilation* (43.4%). *Ineffective breathing pattern* was related to neuromuscular/musculoskeletal impairment (6.6%). *Risk of falls with impaired mobility* (6.6%), Acute pain with *trauma* (8.7%), which was also related to the diagnosis: Impaired tissue integrity (12%), and *Risk of pressure injury* (0.4%), with the risk factor impaired mobility (10.7%).

Only the three most prevalent NDs showed any association with signs/symptoms and SOFA score. Described in Tables 4 and 5, respectively.

Table 4 - Prevalent nursing diagnoses associated with the mean SOFA score. Porto Alegre, 2017.

Nursing Diagnosis	SOFA score >7	n(%)	P*
Risk of infection*	> 7	94(83,2)	0,002
Self-care deficit syndrome*	> 7	82(72,6)	<0,001
Impaired spontaneous ventilation*	> 7	70 (61,9)	<0,001

*Chi-square test

Table 5 - Prevalent nursing diagnoses associated with the signs and symptoms presented by septic patients.

Nursing Diagnosis	Sign/symptoms	n(%)	P*
Risk of infection*	Leukocytes	86(86)	<0,001
	Confusion	16(84,2)	<0,001
	Sleepiness	33(89,2)	<0,001
	Agitation	8(80)	<0,001
Self-care deficit syndrome*	Leukocytes	70(70)	0,002
	Confusion	15(78,9)	<0,001
	Sleepiness	25(67,6)	<0,001
	Agitation	9(90)	<0,001
Impaired spontaneous ventilation*	Leukocytes	55(55)	0,016
	Agitation	7(70)	<0,001

*Chi-square test

Hypotension, tachypnea, hyperthermia, and signs related to the renal system (oliguria, dysuria) and skin (lesion) were not significantly associated with the prevalent nursing diagnoses in this sample.

DISCUSSION

This study identified that the most prevalent nursing diagnoses that had significant associations in this sample of septic patients admitted to the ICU were: *Risk of Infection (IR)*, *Self-Care Deficit Syndrome (ADS)* and *Impaired Spontaneous Ventilation (VEP)*. The most identified sign in the medical records of this sample was leukocytosis, and this was significantly associated with the three diagnoses mentioned above.

The diagnosis *Risk of Infection*, most prevalent in this sample, as described in NANDA-I (2015), is defined as a "state of vulnerability to invasion or multiplication of a pathogenic organism". Among its associated conditions, the relationship with *invasive procedure* was evidenced in more than 70% of the sample. It should be noted that another condition of this diagnosis described in NANDA-I is *a chronic disease* and was exemplified by the pathology Diabetes Mellitus (DM), the second most identified comorbidity in the patients in the present study.

In a study aimed at looking for the most prevalent NDs in septic patients, ND *Risk of infection* was identified as the main diagnosis and 89% was related to an invasive procedure (DUTRA, 2014).

Risk of infection may seem controversial in this sample, due to the fact that the infection is already installed, but there is still a risk of acquiring a new infection associated with health care, since the hospital infection rate in Brazil is 14% (WHO, 2015), of which the majority comes from ICUs (ANVISA, 2016). Regarding healthcare-associated infections, national studies evaluating patients on mechanical ventilation showed that 32-35% of patients developed pneumonia (SILVA et al, 2014; WALTRICK et al, 2015).



Following the same reasoning, data published by the National Health Surveillance Agency (ANVISA) at the end of 2016 indicate that 35-45% of nosocomial infections are of urinary origin, with an incidence of 3-7/1000 catheters/day, considering that approximately 25% of hospitalized patients undergo bladder catheterization. Another national study that evaluated the risk factors for worsening sepsis showed that 71% of the patients were on mechanical ventilation, 78% with a bladder catheter and 72% with a central venous catheter, and through a multiple linear regression analysis proved that exposure to invasive procedures is one of the factors that aggravate the disease and progress to death (BARROS, 2016).

In view of this, it is noteworthy that care with these devices is delegated to the nursing team, when analyzing the taxonomy of the *Nursing Intervention Classification–NIC* (2016) among the interventions proposed for ND *Risk of infection* are listed: airway control; care with urinary tubes and care with incision sites. From the above, it can be inferred that the ND *Risk of Infection* allows a demand for appropriate interventions for this sample of patients studied.

The second most prevalent ND in this sample, *Self-care deficit syndrome*, is not part of the NANDA-I taxonomy, but is available in the *AGHUSE system*, in which it presented the condition associated with *neuromuscular/musculoskeletal impairment*. A similar ND listed in NANDA-I is *the Self-Care Deficit*, which is divided in four ways: deficit in self-care for eating, bathing, intimate hygiene, and dressing, all with the associated condition *neuromuscular/musculoskeletal impairment* (NANDA I, 2018).

Two other conditions described in the literature can also be considered: alteration in cognitive function and perceptual disorders, since the diagnosis of self-care deficit syndrome was significantly associated with signs of neurological alteration: agitation, drowsiness and confusion. Another association was leukocytosis, but no evidence was found in the literature to justify this association.

The diagnosis of impaired spontaneous ventilation was also prevalent in this sample, which was similar to another study (OLIVEIRA et al, 2014), and obtained significant associations with signs and symptoms presented. Its definition in NANDA-I: diminished energy reserves, resulting in an inability to maintain independent and adequate breathing for life sustenance. The most commonly identified associated condition in the records was *neuromuscular/musculoskeletal impairment*, but this is not described in the taxonomy.

This ND is justified by the presence of respiratory dysfunction, commonly identified in septic patients, since there is an impairment of gas exchange with hypoxemia and arterial blood gas analysis results indicative of respiratory alkalosis, one of the causes would be the reduction of pulmonary compliance (ILAS, 2016).

The above-mentioned findings are among the defining characteristics described in NANDA-I, cited as: decrease in partial pressure of oxygen (pO₂) and increase in metabolic rate, which may

indicate this ND as a priority for this sample of critically ill patients, since most required ventilatory support.

In the metabolic part, an important marker in sepsis is lactate, high lactate levels due to hypoxia are commonly found (ZAVARIZ et al, 2006). Reinforcing this information, a study that aimed to characterize the metabolic acidosis of septic patients described a mean pO₂ value of 72 ±14 mm/hg and lactate levels of 2.4 ±1.2 mEq/L (PARK et al, 2011). In this sample there was a significant association between VEP and agitation, this association can be validated by taxonomy, because in the defining characteristics of this ND a similar term is described: restlessness. It is also known that this ND is commonly listed as a patient on MV in the ICU (TRUPPEL, 2008; SANTOS, 2010), 21% of the patients in the sample were on mechanical ventilation (MV).

When analyzing the association between the signs and symptoms of infection and the most prevalent NDs, it can be seen that the clinical reasoning used in care practice is not always transcribed into the nurses' records.

The leukocytosis sign was associated with the three most prevalent NDs, although it was not present in the risk factors (RF) or defining characteristics (CD) of any of them. It should be noted that this sign is implicit, like infection and SIRS, in the conditions associated with the ND *Risk of shock*, because one of the criteria for defining the SIRS is the presence of leukocytosis (VALEIRO, 2012). However, the ND Risk of shock is not in the computerized system of the study institution, although this ND does not have risk factors, and they still need to be developed (NANDA-I, 2018).

The patients in this study were admitted to the ICU due to the evolution of shock. Therefore, it is important for nurses to work with the ND *Risk of shock in* the early stages of sepsis, in order to implement interventions that can control or suppress this complication.

Leukocytosis is one of the hematological disorders commonly present in septic patients (ILAS, 2016). A study that evaluated the survival of patients with sepsis showed that leukocytosis was the main alteration in the leukocyte count and was associated with mortality in these patients (P = 0.03) (OLIVEIRA, 2008). In NANDA-I (2015) this sign is not described as a risk factor for this diagnosis, only leukopenia and the suppressed inflammatory response make up the group of conditions associated with this ED.

Signs of confusion, drowsiness and agitation, related to altered levels of consciousness, were predominant in the sample evaluated, and were also significantly associated with the three most prevalent NDs. *Impaired spontaneous ventilation* was associated only with agitation, the identification of these signs and association with NDs becomes relevant since the assessment of neurological status is one of the criteria evaluated in the SOFA and qSOFA scores, already validated and used for the diagnosis and screening of patients with suspected sepsis (SINGER, 2016; MACHADO, 2016).



Neurological alteration or septic encephalopathy affects more than half (60%) of septic patients. Changes can present in varying degrees, ranging from agitation, delirium, drowsiness and coma. Delirium presents quite frequently in critically ill and elderly patients, and the persistence or recurrence of the condition may be suggestive of uncontrolled sepsis (SINGER et al 2016; EIDELMAN et al 1996; EBERSOLDT, 2007; ILAS, 2016), making its early recognition essential.

Hypotension and tachypnea, prevalent in the sample, are important signs evidenced in sepsis, but did not present significant associations with the NDs sampled. Sustained hypotension (mean arterial pressure < 65mmHg), without correction with blood volume and requiring high doses of vasopressors, is one of the indicative signs of septic shock, a condition that increases the complication and mortality rate of patients (SINGER et al, 2016). Insensible losses through tachypnea and fever are factors that contribute to this hypovolemia (ILAS, 2016).

The identification of these signs and the non-association with the listed diagnoses is a concern, since the prevention of the progression of sepsis to septic shock should be a concern of the care team. Studies show that septic shock is the final route of cases of uncontrolled sepsis, with an approximate rate of 55-70% of patients with sepsis progressing to septic shock (PRADO, 2017; KEELEY, 2017; BARROS, 2016).

Analyzing studies with prevalent nursing diagnoses in ICU patients, this diagnosis discussed above was also not identified, with ND being prevalent in the studies *Risk of infection* as the main diagnosis in all samples, still predominant *Self-care deficit*, *Ineffective breathing pattern*, followed by *acute pain* and *impaired tissue integrity* (FERREIRA et al, 2016; CHIANCA, 2012; CABRAL et al, 2017). In this study, these also had a prevalence percentage, although there was no significant association of signs and symptoms with any of the last three NDs mentioned.

In addition to signs and symptoms, the SOFA score was also evaluated considered a simple and effective score used in intensive care units, its score is correlated with the mortality rate, severity, and demand for care (FILHO, 2018; HISSA, 2013). The SOFA evaluates the parameters of six organ systems: cardiovascular, respiratory, neurological, hepatic, renal and coagulatory (JONES, 2009). A score ≥ 2 already indicates organ dysfunction, in the present study the score \geq to 7 and the three most prevalent NDs were associated.

In Iceland, a study that evaluated the profile of septic and potentially severe patients showed a maximum SOFA score of 9 ± 3.74 , of which 19% had five or more organ dysfunctions (VESTEINSDOTTIR et al, 2011), this score higher than 2 demonstrates the severity of the samples studied, given the high number of organ dysfunctions identified.

Regarding the process for listing nursing diagnoses, according to the *NANDA-I* (2018) taxonomy, the nursing diagnostician should use his or her clinical reasoning together with information about the patient to formulate hypotheses that explain real and potential problems, risks



and/or opportunities for health promotion. Currently, the diagnostic and prognostic scores used in clinical practice and validated/evidenced by the scientific literature are not, in most diagnoses, included in the NANDA-I taxonomy, either as RF/associated condition or CD, their inclusion could be an ally of nurses in the definition of accurate diagnoses.

This diagnostic reasoning based on signs, symptoms, and scores becomes even more relevant in critical care units, where the nurse is directly involved in the care, evaluation, and treatment provided to the patient. Therefore, it is believed that nurses' knowledge about sepsis concepts and indicators will contribute to the provision of effective care based on scientific guidelines (KLEINPELL, 2013).

In the present study, the signs and symptoms related to sepsis were described in the nurses' records, but not always associated with the NDs listed, it is inferred that one of the reasons is the lack of a more accurate ND for this population. (2015; FAVARIN, 2012; TEIXEIRA, 2006), also reminds us of the need for clinical reasoning to be a competence in constant improvement in the clinical practice of nurses.

CONCLUSION

This study showed that there was an association between the signs described for septic patients and the most prevalent NDs: *Risk of infection*, *Self-care deficit syndrome*, and *Impaired spontaneous ventilation*. All were associated with signs of leukocytosis, neurological alterations, and a SOFA score greater than 7. These three NDs describe a level of dependence and vulnerability that meets the profile of septic patients admitted to the ICU.

The evaluation of the SOFA score showed the severity of the patients and, consequently, a greater dependence on care and an increase in the probability of death. Sepsis is still a challenge for health professionals and there are still few studies that address the nursing process for septic patients, and the literature is still not consensual regarding specific diagnoses. Therefore, studies are needed that seek to evaluate the clinical reasoning of nursing in the care of these patients, seeking the development and clinical validation of accurate diagnoses, in order to qualify the care contributing to the search for better results and outcomes for these patients.



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