

OCCURRENCE OF PRESSURE INJURY IN PATIENTS ADMITTED TO THE INTENSIVE CARE UNIT OCORRÊNCIA DE LESÃO POR PRESSÃO EM PACIENTES INTERNADOS EM UNIDADE DE TERAPIA INTENSIVA

OCURRENCIA DE LESIÓN POR PRESIÓN EN PACIENTES HOSPITALIZADOS EN UNIDAD DE CUIDADOS INTENSIVOS

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ABSTRACT

Objective: to evaluate the factors associated with the occurrence of pressure injuries in adult critical patients in the intensive care unit. **Method:** a cross-sectional study carried out in the intensive care unit of a teaching hospital in the state of Sergipe, between August/2018 and July/2019. Hospitalized patients aged over 18 years old and with a minimum stay of 24 hours were included. Eligible and aware patients were invited to participate voluntarily and offered clarifications regarding their consent. In the case of unconscious patients, authorization was requested from the family member or legal representative. In both cases, the Informed Consent Term was applied. For the analysis of risk factors associated with pressure injury, Fisher's exact test, chi-square, Shapiro-Wilks, Mann-Whitney, linear and logistic regression were used, with a significance of 5%. **Results:** the sample consisted of 99 patients. Of these, 30 (30.3%) developed pressure injuries. Most were female, with a mean age of 65 ± 14 years old and previous comorbidities such as diabetes, acute myocardial infarction, and stroke. When the risk factors for the development of pressure injury were evaluated, it was observed that acute kidney injury increased this chance by 3.5 times ($p = 0.036$) and for each additional day of hospitalization, the patient presented 3.5 times more chances of developing a new pressure injury ($p = 0.038$). **Conclusion:** acute kidney injury and length of stay in the intensive care unit were risk factors associated with the development of pressure injury.

Keywords: Pressure Ulcer; Risk Factors; Intensive Care Units; Health Status Indicators; Epidemiology.

RESUMO

Objetivo: avaliar os fatores associados   ocorr ncia de les o por press o em pacientes cr ticos, adultos em unidade de terapia intensiva. **M todo:** estudo transversal realizado na unidade de terapia intensiva de um hospital de ensino no estado de Sergipe, entre agosto/2018 e julho/2019. Foram inclu dos pacientes internados com idade maior ou igual a 18 anos e tempo de perman ncia m nima de 24 horas. Aos pacientes eleg veis e conscientes foram feitos convites para participar de forma volunt ria e oferecidos esclarecimentos quanto ao consentimento. No caso dos pacientes inconscientes a autoriza o foi solicitada ao familiar ou representante legal. E para ambos os casos foi aplicado o Termo de Consentimento Livre e Esclarecido. Para a an lise dos fatores de risco associados   les o por press o utilizaram-se os testes exato de Fisher, qui-quadrado, Shapiro-Wilks, Mann-Whitney, regress o linear e log stica, com signific ncia de 5%. **Resultados:** a casu stica foi composta de 99 pacientes. Destes, 30 (30,3%) desenvolveram les o por press o. A maioria era do sexo feminino, com idade m dia 65 ± 14 anos e comorbidades pr vias como diabetes, infarto agudo do mioc rdio e acidente vascular encef lico. Quando avaliados os fatores de risco para o desenvolvimento de les o por press o, observou-se que a les o renal aguda aumentou 3,5 vezes essa chance ($p=0,036$) e para cada dia a mais de internat o o paciente apresentou 3,5 vezes mais chances de desenvolver uma nova les o por press o ($p=0,038$). **Conclus o:** a les o renal aguda e o tempo de internat o na unidade intensiva foram fatores de risco associados ao desenvolvimento de les o por press o.

Palavras-chave: Les o por Press o; Fatores de Risco; Unidades de Terapia Intensiva; Indicadores B sicos de Sa de; Epidemiologia.

RESUMEN

Objetivo: evaluar los factores asociados a la ocurrencia de  lcera por presi n en pacientes cr ticos adultos en la unidad de cuidados intensivos. **M todo:** estudio transversal realizado en la unidad de cuidados intensivos de un hospital universitario del estado de Sergipe, entre agosto / 2018 y julio / 2019. Se incluyeron pacientes hospitalizados mayores de 18 a os y con una estancia m nima de 24 horas. Se invit o a los pacientes elegibles y conscientes a participar voluntariamente y se les ofreci o aclaraciones sobre el consentimiento. En el caso de pacientes inconscientes, se solicit o autorizaci n al familiar o representante legal. Y para ambos los casos se aplic o el T rmino de Consentimiento Libre e Informado. Para el an lisis de los factores de riesgo asociados a las  lceras por presi n se utiliz o la prueba exacta de Fisher, qui-cuadrado, Shapiro-Wilks, Mann-Whitney, regresi n lineal y log stica, con una significancia del 5%. **Resultados:** la muestra estuvo constituida por 99 pacientes. De estos, 30 (30,3%) desarrollaron  lcera por presi n. La mayor a eran mujeres, con una edad media de 65 ± 14 a os y comorbilidades previas como diabetes, infarto agudo de miocardio y accidente cerebrovascular. Cuando se evaluaron los factores de riesgo para el desarrollo de  lcera por presi n, se observ o que la lesi n renal aguda aument o esta posibilidad en 3,5 veces ($p = 0,036$) y por cada d a adicional de hospitalizaci n, el paciente present o 3,5 veces m s posibilidades de desarrollar una nueva  lcera por presi n ($p = 0,038$). **Conclusi n:** la lesi n renal aguda y la estancia en la unidad de cuidados intensivos fueron factores de riesgo asociados al desarrollo de  lcera por presi n.

Palabras clave:  lcera por Presi n; Factores de Riesgo; Unidades de Cuidados Intensivos; Indicadores de Salud; Epidemiolog a.

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INTRODUCTION

Critical patients are usually in a serious, instability situation and are often subjected to prolonged hospitalizations and highly complex procedures.¹ The use of multiple devices, intravenous drugs, invasive procedures, reduced mobility, inadequate nutrition, comorbidities, decreased sensory perception and long hospital stay increase the fragility conditions of critical patients and the chances of compromising the integrity of the skin and the consequent development of a pressure injury (PI).^{2,3}

Brazilian studies show that the incidence of PI in patients admitted to intensive care units (ICU) varies from 22 to 40%,^{4,5} with 3.8 times more likely to develop a PI.⁶ The occurrence of this type of injury is related to intrinsic factors such as positioning, reduced mobility, pre-existing lesion, skin moisture, age, comorbidities, and medications in use; and extrinsic factors derived from the environment (unit) and factors external to the patient, such as shear force, pressure, and friction.^{3,7}

In daily care in the ICU, patients have other therapeutic priorities, which often hinder the use of preventive methods for PI, generating a favorable condition for the development and occurrence of these injuries.⁸ They are adverse events of rapid evolution, frequent during hospitalization and that can cause other complications such as greater chances of mortality, and prolonging the time of treatment and rehabilitation.^{2,9}

Therefore, considering the high incidence and severity of the occurrence of PI in intensive care patients, we need studies that can contribute to the diagnosis of potential risks for the appearance of injuries. Furthermore, the question in this study was: what factors are associated with the occurrence of pressure injuries in intensive care patients than those already known? The objective was to evaluate the factors associated with pressure injury in adult critical patients in the intensive care unit.

METHODOLOGY

Type of study

This is a cross-sectional study, linked to the research project entitled “Clinical characterization, severity profile, and outcomes of patients in intensive care units”.

Study location

The study was carried out in the intensive care unit of a teaching hospital located in the interior of *Sergipe*, Brazil.

Study participants

The population consisted of 99 adult patients admitted to an ICU of a teaching hospital in the state of *Sergipe*, who met the eligibility criteria in the period between August/2018 and July/2019.

All patients admitted to the study location during the data collection period, aged 18 years old or over and with a minimum stay of 24 hours in the ICU and who signed the Informed Consent Term were eligible and included. We excluded patients who had incomplete or missing data for variables studied in their medical records from this investigation.

Data collection

The study researchers were distributed on a fixed scale so that there was a researcher every day of the week to ensure that every day there was an active search for patients in the intensive care unit of the participating hospital. When identifying an eligible patient, the researcher first applied the Informed Consent Term to request authorization for voluntary participation. The eligible and conscious patients were invited and requested authorization and to the unconscious, we asked the relative or legal representative. Throughout the study, researchers were available for clarification to patients and their families.

The researchers developed the data collection instrument containing information for the clinical and sociodemographic characterization by age, gender, weight, origin, comorbidities of the patients according to the International Classification of Diseases (ICD-10), admission support with the analysis of vasoactive and sedative drugs, and devices such as nasointestinal tube and orotracheal tube, the scores for assessing the workload of the Nursing team by the Nursing Activities Score (NAS), the severity indices of patients using the Simplified Acute Physiology Score (SAPS III), Sequential Organ Failure Assessment (SOFA) and Charlson Index and the main outcomes presented by patients during hospitalization: death, dialysis, AKI, mechanical ventilation > 48h, length of stay in the ICU and length of hospital stay.

The Charlson score has proven to be a reliable tool determining the risk of mortality and comorbidity of patients, as well as SOFA is widely used for the analysis of mortality prediction in hospitalized patients. The Simplified Acute Physiology Score (SAPS III), which determines the severity profile by quantifying acute and chronic physiological dysfunctions can be used both at admission and at discharge, allowing to observe the severity index and monitor its evolution.

Data analysis and treatment procedures

We used absolute and relative frequencies, percentages to describe categorical variables. To describe continuous variables, we used mean and standard deviation. Fisher's exact, Pearson's chi-square, and Pearson's chi-square tests with Monte-Carlo simulations assessed the association between categorical variables. The Shapiro-Wilks test assessed the adherence of continuous variables to the normal distribution. The Mann-Whitney test assessed differences in measures of central tendency. Thus, linear regression was used for continuous variables and logistic regression for binaries in confounding models. We adopted 5% as the level of significance and the R[®] Core Team 2020 software as software in all analyzes.

Ethical aspects

The study was previously approved by the Research Ethics Committee of the *Universidade Federal de Sergipe* (UFS), with a favorable opinion under CAEE: 92517018.0.0000.5546 and opinion number 2.830.187, on August 20, 2018.

RESULTS

We included 99 patients. The prevalence of PI was equal to 30.3%, most of them occurred in females (60%), with a mean age of 65 ± 14 years old and from the emergency unit (72.4%). The group that did not develop an injury was predominantly male (62.3%), with a mean age of 62 ± 17 years old, also from the emergency (52.2%). The most staging of the injuries found in the general population was in stages 1 (33.3%) and 2 (37%), with the sacral region as the area most affected (69%).

When analyzing the clinical characteristics, we observed that patients with PI have a higher frequency of comorbidities such as diabetes (55.2% vs 27.9%, $p = 0.019$), previous acute myocardial infarction (24.1% vs 6, 5%, $p = 0.033$) and previous stroke (41.4% vs 14.5%, $p = 0.005$) when compared to those who did not develop PI. Upon admission to the ICU, we noticed that patients in the PI group showed a higher frequency among those with baseline creatinine values greater than 1.5 mg/dL (65.5% vs 32.3%, $p = 0.003$), in addition to using plus sedation with fentanyl (83.3% vs 60.9%, $p = 0.028$) and midazolam (70% vs 39.6%, $p = 0.006$). In the applied severity indices, we observed a significant difference between the groups, with the highest values in patients who had PI regarding the Charlson score (3.3 ± 2.0 vs 4.3 ± 2.4 , $p = 0.047$), SAPS III at admission

(27.1 ± 12 vs 33.5 ± 10.9 , $p = 0.002$) and SOFA in the first 24 hours (2.5 ± 2.9 vs 3.5 ± 2.7 , $p = 0.023$) (Table 1).

In the analysis of the outcomes, we observed worse results in the group of patients with PI (Table 2). Pressure injury patients had more acute kidney injury (63.3% vs 34.8%, $p = 0.008$) and needed more dialysis (36.7% vs 17.4%, $p = 0.037$), in addition to remaining for more time on mechanical ventilation (> 48 hours) (93.3% vs 63.2%, $p = 0.002$). Also, they had more length of stay in the intensive care unit (15.8% vs 14.4%, $p = 0.001$) and time in hospital (20.8% vs 17.0%, $p = 0.002$) than patients who did not have PI.

When assessing the risk factors for developing PI, patients with AKI reported more than 3.5 times the chance of developing PI (95% CI, 1.08 - 11.65; $p = 0.036$). When the length of stay in the ICU was assessed, we observed that for each additional day of hospitalization, the patient has a 3.5% greater chance of developing a new PI (95% CI, 1.0 - 1.07; $P = 0.038$) (Table 3).

DISCUSSION

We noticed that most patients admitted to the ICU and who developed PI were older as identified in other studies since old age reflects more systemic impairment due to the natural aging process, which makes the development of PI.¹⁰ Skin aging is related to increasing age. Thus, the skin changes, becoming drier, thinner, and, consequently, more fragile, being less able to act as a moisture barrier and more prone to suffering injuries.^{3,11} In the admission to the ICU, the limitation in the bed predisposes to physical mobility, which is added to the fact that most bedridden patients are unable to walk. Also, low nutrition should be considered, as inpatients generally have inadequate nutrition, influencing the arrangement of nutrients in the body, oxygenation, and also blood flow.¹²

The predominance of females in the development of PI in the ICU was also observed in another study in a university hospital in Ceará, representing 59.6% of hospitalized patients.¹³ Research carried out in ICUs of two public hospitals in Iran found that 52% of patients were more likely to develop PI and most occurred in females.¹⁴

Research patients have stage 2 lesions as the most frequent, similar to the Brazilian study on the occurrence of injuries in the ICU, in which this staging represented 45.3% of the study population.¹⁵ In another study carried out in Spain, stage 2 was identified in 52.73%.⁹ Other studies indicate a higher frequency of PI, as in the analysis carried out in five ICUs in southeastern Brazil,¹⁶ which

Table 1 - Clinical and demographic characteristics of the patients studied. *Sergipe*, Brazil, 2019

Variable	Pressure Injury		p-value
	No (n=69)	Yes (n=30)	
Age (years old), mean (SD)	62 (17)	65 (14)	0.311 ^W
Gender, n (%)			
Male	43 (62.3)	12 (40.0)	0.004 ^Q
Female	26 (37.7)	18 (60.0)	
Weight (Kg), mean (SD)	61.5 (10.8)	64.7 (15.5)	0.239 ^W
Origin, n (%)			
Emergency	35 (52.2)	21 (72.4)	0.043 ^{QM}
SC	13 (19.4)	4 (13.8)	
Medical clinic	13 (19.4)	4 (13.8)	
Surgical Clinic	6 (9.0)	0 (0)	
Previous acute myocardial infarction, n (%)	4 (6.5)	7 (24.1)	0.033 ^F
Previous stroke, n (%)	9 (14.5)	12 (41.4)	0.005 ^Q
Systemic arterial hypertension, n (%)	30 (47.6)	20 (69.0)	0.056 ^Q
Peripheral vascular disease, n (%)	4 (6.5)	5 (17.9)	0.113 ^Q
Basal creatinine > 1,5, n (%)	20 (32.3)	19 (65.5)	0.003 ^Q
Diabetes, n (%)	19 (29.7)	16 (55.2)	0.019 ^Q
Admission support			
Use of vasoactive drugs, n (%)	34 (50.7)	20 (66.7)	0.111 ^Q
Use of fentanyl, n (%)	42 (60.9)	25 (83.3)	0.028 ^Q
Use of midazolam, n (%)	27 (39.7)	21 (70.0)	0.006 ^Q
NEP, n (%)	35 (53.8)	19 (63.3)	0.385 ^Q
Orotracheal tube, n (%)	45 (69.2)	26 (86.7)	0.080 ^Q
Charlson score, mean (SD)	3.3 (2.0)	4.2 (2.4)	0.047 ^W
NAS (first 24h), mean (SD)	44.6 (15.6)	53.4 (15.9)	0.166 ^W
SAPS admission, mean (SD)	27.1 (12.0)	33.5 (10.9)	0.002 ^W
SOFA (first 24h), mean (SD)	2.5 (2.9)	3.5 (2.7)	0.023 ^W

SC - surgery Center; SAPS-3 – *Simplified Acute Physiology Score*; SOFA - *Sequential Organ Failure Assessment*; NAS - *Nursing Activities Score*; NEP - nasogastric tube; n - absolute frequency; % - percentage relative frequency; SD - standard deviation; W - Mann-Whitney test; F - Fisher's exact test; Q - Pearson's chi-square test; QM - Pearson's chi-square test with Monte-Carlo simulations.

Table 2 - Comparison of the outcomes of the studied patients. *Sergipe*, Brazil, 2019

Variable	Pressure Injury		p-value
	No (n=69)	Yes (n=30)	
Death, n (%)	37 (53.3)	21 (71.0)	0.128 ^Q
Dialysis, n (%)	12 (17.4)	11 (36.7)	0.037 ^Q
Acute Kidney Injury, n (%)	24 (34.8)	19 (63.3)	0.008 ^Q
Mechanical ventilation (> 48 hours), n (%)	43 (63.2)	28 (93.3)	0.002 ^Q
LSICU, mean (SD)	13.5 (14.4)	24.8 (15.8)	0.001 ^W
HS, mean (SD)	22.2 (17.0)	35.1 (20.8)	0.002 ^W

TUTI – length of stay in the intensive care unit; TIH – hospital stay; n – absolute frequency; % – percentage relative frequency; SD – standard deviation; W – Mann-Whitney test; F – Fisher's exact test; Q – Pearson's chi-square test; QM – Pearson's chi-square test with Monte-Carlo simulations.

Table 3 - Factors associated with the occurrence of pressure injuries in patients in the ICU. *Sergipe*, Brazil, 2019

Variable	OR	CI 95%	p-value*
SAPS-3 admission	1.035	0.992 – 1.080	0.116
NAS (first 24h)	1.016	0.968 – 1.066	0.527
Acute kidney injury	3.560	1.087 – 11.656	0.036
Mechanical ventilation (> 48 hours)	3.022	0.569 – 16.039	0.305
LSICU	1.035	1.002 – 1.070	0.038

CI 95% - confidence interval 95%; OR - odds ratio; SAPS-3 - *Simplified Acute Physiology Score*; NAS - *Nursing Activities Score*; LSICU - length of stay in the intensive care unit; SAH - systemic arterial hypertension. Statistical test: binary logistic regression.

verified the occurrence of 94.2% of stage 2 PI. Most lesions presented in this study were located in the sacral region, corroborating other studies. In a metropolitan hospital in Australia, most injuries were also located in the sacrum region,¹⁷ and in a hospital in the state of Minas Gerais 73% of PI cases were located in the sacral region.⁴

Diabetes was the most prevalent among the most frequent comorbidities in patients with pressure injuries in the ICU, as a study at the teaching hospital in *Parabá*, in which diabetes was the main comorbidity and represented 11.76%.¹⁵ Findings indicated that diabetes was considered a favorable factor for the formation of PI due to the decrease in skin sensitivity caused by the lack of glucose generated by cell death caused by this disease.^{10,11} A study carried out in public hospitals in Iran reported that 45% of patients were diabetics and were 3.5 more likely to develop PI.¹⁴

As for the data obtained on the admission of patients to the ICU, we found that the patients in the PI group used more sedation. Considering that sedation decreases physical and physiological responses, there is research on adverse events and sedation, such as a study from São Paulo that evaluated the relationship between sedation and adverse events and research carried out in a unit in *Rio de Janeiro*, which confirm that the use of sedation provides more vulnerability of the patient since he has reduced mobility.^{18,19} Multicenter research carried out in intensive inpatient units in hospitals in Sweden, Denmark and Norway also indicated that PI in sedated patients represented 60.7%.²⁰

We applied severity indexes (Charlson, SAPS III, SOFA) showing a significant difference in the values of patients with PI. Research in a public hospital in the South reinforces this result. SAPS III at admission to this study was also higher in the group of patients with injury.²¹

Also, SOFA showed a significant difference between groups with and without injury. We also noticed, in oth-

er studies that considered SOFA as a score, that the more severe the patient, the greater the risk of developing PI. A study carried out in the intensive care unit of a hospital in Argentina revealed that the high values of the SOFA score can be considered indicative for the development of PI.² A Finnish study also confirmed SOFA as a risk indicator for PI and the higher the SOFA, the greater the incidence of PI.²²

When investigating the workload scores of the Nursing team by the NAS, we expected that there was a relationship for the occurrence of PI since more severe patients need more assistance time and more hours of care. However, it was not significant in our study, differently from what was found in the study,¹² in which the Nursing workload was a predictor for the development of pressure injuries, inferring that care for critically ill patients is more specific and complex.

The unfavorable outcomes in the group of patients with injury included dialysis, acute kidney injury (AKI), mechanical ventilation > 48h, and longer hospital stay and in the ICU. Acute kidney injury showed more statistical significance, meaning that patients with PI had more acute kidney injury. In Paraná, a study carried out in 10 intensive care units found that 37.8% of patients with PI had a higher incidence of acute kidney injury (AKI) outcomes. Associated with AKI, the length of hospital stay was also identified, being described that this type of kidney damage requires other types of clinical support and, consequently, longer hospitalization time.²³

The main risk factors were acute kidney injury and length of stay in the intensive care unit. Patients with AKI have more than 3.5 times the chance of developing PI, which converges with research that addresses the incidence and clinical and epidemiological characteristics of patients with PI in ICUs, carried out in 10 intensive care units in Paraná, where AKI was the only comorbidity that showed a correlation with the increased incidence of PI.²³

Regarding the length of stay in the intensive care unit, there is a 3.5% greater chance of developing a new PI every day of hospitalization. Research carried out in Korea considers the length of stay in the ICU as a direct and significant predictor of the development of PI, and the longer this time, the greater the chance of developing it. This is in line with Brazilian studies that consider the length of stay in the ICU as a factor directly associated with the development of PI since the ICU is a place of long hospitalization where patients are generally elderly and undergo debilitating treatments and also prolonged. This fact provides the propensity to develop PI, considering that the prevalence of PI was considerably higher in patients with more than 10 days of stay in the unit.^{3,12,24}

In this study, patients who suffered pressure injuries required more time on mechanical ventilation (> 48 hours). This was also reported in other studies, which found that the longer the time under mechanical ventilation, the greater the risk of developing PI since the use of this ventilation often impairs mobility and causes poor tissue perfusion.^{6,8,24}

Despite the findings presented in this study contribute greatly to the improvement of Nursing care practice in the place of study, we need to highlight some limitations. First, the study was carried out in a single center, which hinders extrapolate the data to other populations. Second, the sample size did not allow some analyzes to be carried out. Also, the study reinforces the need to develop additional research on the prevention and treatment of PIs to contribute to making clinical prevention and treatment decisions.²⁵

CONCLUSION

The associated factors in the group of patients with PI in this group were the acute kidney injury and the patients needed more dialysis, remained on mechanical ventilation for a longer time, and with longer hospital stay in the ICU and hospital. The risk factors associated with the development of PI were age, length of stay in the ICU, and AKI. We considered that the older the age and the days of hospitalization, the greater the chance of developing a pressure injury.

This study contributed to assess the factors associated with pressure injury in adult patients in the therapy unit. Although the nature of the study cannot explain the causal relationships, it presents an epidemiological profile that confirms important clinical and severity outcomes. Thus, such findings can and should be incorporated into clinical guidelines, public policies, protocols,

and also professional training, so that injuries can be prevented and the entire team that assists the critical patient can be guided to reduce the incidence rates of PI in intensive care units.

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