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Pressure injury in critically ill patients: prevalence and associated factors

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ABSTRACT

Objective: To identify the point prevalence of pressure injuries (PI) and medical device-related pressure injuries (MDRPIs), the associated demographic and clinical factors, and to describe them in terms of classification, site, and number. **Method:** A cross-sectional study conducted in the Intensive Care Unit (ICU) of two public cardiology hospitals. Demographic and clinical data, along with information on PI, were collected from 123 patients aged 18 years old or older admitted to the ICU, through physical examination and medical records. Descriptive, univariate and multivariate analyses were used, as well as calculation of point prevalence. **Results:** The point prevalence of PIs was 46.34% (51/123 patients) and that of MDRPIs was 8.94% (11/123 patients). The most frequent anatomical site of PI was the sacral region (38.02%), classified as stage 2 (18.30%). Ears (7.03%) and stage 2 (78.57%) were the most frequent in MDRPI. Multivariate analysis indicated that patients using moisturizing creams, with a Braden score <17.5 and systolic blood pressure <134 mmHg were associated with the development of PI. **Conclusion:** The study contributed to the knowledge of the epidemiological profile of patients with PI admitted to a cardiac ICU, assisting the nursing team in planning and implementing preventive care.

DESCRIPTORS: Prevalence. Epidemiologic Studies. Pressure Ulcer. Intensive Care Units. Nursing Care. Critical Care Nursing.

Lesão por pressão em pacientes críticos: prevalência e fatores associados

RESUMO

Objetivo: Identificar a prevalência pontual de lesão por pressão (LP) e lesão por pressão relacionada a dispositivo médico (LPRDM), os fatores demográficos e clínicos a elas associados e descrevê-las quanto à classificação, localização e número. **Método:** Estudo transversal realizado em unidade de terapia intensiva (UTI) de dois hospitais públicos cardiológicos. Coletaram-se dados demográficos, clínicos e informações sobre LP de 123 pacientes com 18 anos ou mais internados nas UTIs, mediante exame físico e consulta aos prontuários. Utilizou-se análise descritiva, univariada e bivariada e cálculo de prevalência pontual. **Resultados:** A prevalência pontual de LP foi de 46,34% (51/123 pacientes) e a de LPRDM de 8,94% (11/123 pacientes). A localização anatômica mais frequente das LPs foi a região sacral (38,02%), classificadas como estágio 2 (18,30%). As orelhas (7,03%) e o estágio 2 (78,57%) foram os mais frequentes nas LPRDMs. Pela análise multivariada, pacientes em

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uso de cremes hidratantes, com escore de Braden <17,5 e pressão arterial sistólica <134 mmHg mostraram-se como fatores associados ao desenvolvimento de LP. **Conclusão:** O estudo contribuiu para o conhecimento do perfil epidemiológico do paciente com LP internado em UTI cardiológica, auxiliando a equipe de enfermagem no planejamento e na implementação de cuidados preventivos.

DESCRITORES: Prevalência. Estudos epidemiológicos. Lesão por pressão. Unidades de terapia intensiva. Cuidados de enfermagem. Enfermagem de cuidados críticos.

Lesión por presión en pacientes críticos: prevalencia y factores asociados

RESUMEN

Objetivo: Identificar la prevalencia puntual de lesiones por presión (LP) y lesiones por presión relacionadas con dispositivos médicos (LPRDM), los factores demográficos y clínicos asociados, y describirlas en términos de clasificación, ubicación y número. **Método:** Estudio transversal desarrollado en la Unidad de Cuidados Intensivos (UCI) de dos hospitales públicos cardiológicos. Se recogieron datos demográficos, clínicos e información sobre LP de 123 pacientes de 18 años o más ingresados en las UCIs, mediante examen físico y consulta de los registros médicos. Se utilizaron análisis descriptivos, univariados y bivariados, y se calculó la prevalencia puntual. **Resultados:** La prevalencia puntual de LP fue del 46,34% (51/123 pacientes) y la de LPRDM del 8,94% (11/123 pacientes). La localización anatómica más frecuente de las LPs fue la región sacra (38,02%), clasificadas como de estadio 2 (18,30%). Las orejas (7,03%) y el estadio 2 (78,57%) fueron los más frecuentes en las LPRDMs. Mediante el análisis multivariado, el uso de cremas humectantes, con puntuación de Braden <17,5 y una presión arterial sistólica <134 mmHg son factores asociados con el desarrollo de LP. **Conclusión:** El estudio contribuye al conocimiento del perfil epidemiológico de los pacientes con LP ingresados en una UCI cardiaca, ayudando al equipo de enfermería en la planificación e implementación de cuidados preventivos.

Descriptores: Prevalencia. Estudios epidemiológicos. Úlcera por presión. Unidades de cuidados intensivos. Atención de enfermería. Enfermería de cuidados críticos.

INTRODUCTION

Pressure injuries (PIs) are among the main preventable complications that occur in hospital settings and are an important indicator of the quality of nursing care and patient safety[1-3]. In addition to generating expenses for healthcare institutions, due to the high cost of treatment, they also prolong length of stay, increase the likelihood of infection and sepsis, reduce quality of life, cause pain to patients and increase the nursing team workload[4]. Therefore, they are considered a problem of great clinical complexity and multifactorial etiology[4].

PIs are injuries that affect the skin and/or underlying tissues, usually located over a bony prominence, caused by intense pressure or a combination of pressure and shear, often related to the use of medical devices and other devices. They are classified into four stages (from 1 to 4), unclassifiable PI and deep tissue PI, in addition to two additional categories: medical device-related pressure injury (MDRPI) and PI in mucous membranes[5-7].

Global evidence shows that the highest prevalence and incidence rates of PI occur in Intensive Care Units (ICUs), where critically ill patients have factors that predispose to the development of these injuries, such as limited mobility, prolonged hospitalization, decreased tissue perfusion caused by hemodynamic instability, use of vasoactive medications, anemia, impaired sensitivity due to the use of sedatives, increased skin moisture and nutritional status deficits[1,8-10].

The prevalence rates of these injuries vary significantly and depend on several factors, including geographic location, characteristics of the hospital investigated, nursing professionals and patient profile[8]. The analysis of these rates contributes to understanding the dimension of the problem and helps in planning resources for its solution[8].

In Brazil, recent studies on the prevalence of PI show rates ranging from 22.3[2] to 40%[11]. A systematic review and meta-analysis of 22 international articles that assessed the incidence and prevalence of PI in adults admitted to the ICU demonstrated that the prevalence ranged from 16.9 to 23.8%[12].

MDRPI is an additional category of PI caused by therapeutic equipment used on patients, usually not occurring over bony prominences[1,3]. Several devices have been described in the literature as causing MDRPI, including cervical collars, endotracheal tubes, noninvasive ventilation masks, nasal oxygen catheters, nasoenteral catheters, tracheostomy tubes, indwelling urinary catheters, and fecal continence devices, among others[13].

The pressure on the skin and the fixation of these therapeutic devices increase the risk of developing MDRPI, making it essential to choose the appropriate size of the device, the correct fixation and the protection of the skin in direct contact with this equipment to prevent these injuries[14,15].

In the national context, a prevalence study carried out in the ICU of a hospital in Santa Catarina found a prevalence of MDRPI of 62.4%[16] in adults. International studies have also demonstrated varying prevalences of MDRPI in adult ICU patients, such as 11.3% in Australia, 38.1% in Jordan and 32.5% in Turkey[17]. An integrative review of 13 international studies carried out between 2000 and 2017 in ICUs showed prevalence of PI ranging from 1.4 to 121% and incidence from 0.9 to 41.2%[3].

Due to disparities in the academic training of nursing and medical teams among hospitals and regions in Brazil, epidemiological studies on PI are essential to understand the epidemiological overview of the country. Although there are statistical studies on PI developed in several Brazilian states, a comparative study of the prevalence of PI/MDRPI and associated factors in different institutions in the same region with the same patient profile has not yet been found.

The relevance of this study lies in knowing the prevalence of PI and MDRPI in critically ill cardiological patients to improve the care provided and prevent these injuries, focusing on the quality and safety of critically ill patients. Identifying factors associated with the presence of PI helps nurses identify patients at risk and define priorities in nursing interventions.

OBJECTIVES

Thus, this study aimed to identify and analyze the point prevalence of PI and MDRPI as well as demographic and clinical factors associated with the occurrence of these injuries in cardiac ICUs, in addition to describing them in terms of classification, site and number.

METHODS

This is a cross-sectional cohort study of point prevalence, which identifies the number of cases of a given condition at a specific point in time. In this case, data collection occurred on a single day and was conducted in the ICUs of two highly complex public hospitals specialized in cardiology located in the city of São Paulo, SP (institutions A and B).

Institution A has six adult ICUs (two cardiac, two clinical and two surgical), with a total of 110 beds, and institution B has three adult ICUs (cardiac, clinical, surgical), totaling 70 beds. Study participants were patients aged 18 years or older, admitted to the ICUs on the day of data collection.

Upon authorization from the executive boards of the participating institutions and approval by the Research Ethics Committees, under Opinions 2.607.092/2.629.159, data collection was carried out with patients who consented by signing the Informed Consent Form (ICF), which occurred on a single day, simultaneously, in both institutions, by the researchers in charge and research assistants (collectors). All were nurses with experience in skin care, most of them enterostomal therapists belonging to the skin care groups of the institutions. They were previously trained on the data collection instruments and scales applied. Moreover, they met with the main researchers to standardize the procedures for data collection, such as use of Braden Scale, identification and classification of PIs/MDRPIs[5], form of recording demographic and clinical information in the data collection instrument, as well as receiving illustrative and concise e-learning educational material on PIs/MDRPIs by email. The work was carried out in pairs, one from the skin care group and the other from the institution with experience in the subject, aiming to increase data reliability.

For data collection, a cephalocaudal physical examination of patients' skin was performed to identify the presence or absence of PI/MDRPI, its classification and anatomical site. The Braden Scale was applied to assess the risk of developing PI. Demographic and clinical data were obtained by consulting patients' medical records. Two collection instruments were used: one for demographic (sex and age) and clinical data (weight, height, Body Mass Index, use of mechanical ventilation, medical diagnosis, presence of comorbidities, anatomical site of surgery in patients undergoing surgical procedures, vital parameters, laboratory test results, use of vasopressors, sedatives, muscle relaxants, renal replacement therapy, use of extracorporeal circulation, Glasgow Coma Scale value, presence of urinary, fecal and mixed incontinence, use of diapers, use of medical devices); and another for PI characteristics.

Variables related to PI included Braden Scale risk score on the day of collection, presence or absence of PI/DPRLI, site, classification, number of PIs presented by the same patient on the day of collection, and preventive measures used in the ICU. The PIs identified were classified according to the consensus of the National Pressure Injury Advisory Panel (NPIAP) 2016[5].

For risk stratification, the Braden Scale[18] was used, which is an instrument composed of six subscales (sensory perception, skin moisture, activity, mobility, nutrition, friction/shear), with scores ranging from 1 to 4, except for the friction/shear subscale, ranging from 1 to 3, and a total score, which can range from 6 to 23. Higher scores indicate less risk of developing PI, whereas scores equal to or less than 18 are indicative of risk[18]. To present the results regarding the site, classification and number of injuries, the Biorender® tool was used.

Data were analyzed using descriptive statistics and bivariate analyses, including tests such as Fisher's exact test, two-sample t-test, Brunner-Munzel test, Pearson's chi-square (x2) and Wilcoxon-Mann-Whitney test, in addition to multivariate analysis, using Classification And Regression Tree (CART) to identify factors associated with PI.

The level of statistical significance adopted was 5% ($p<0.05$). To calculate point prevalence, the recommendation of international guidelines[7] was used, which considers the number of patients with PI/MDRPI included in the study in relation to the total number of patients present in ICUs multiplied by 100.

RESULTS

The study population consisted of 132 patients, 80 from institution A and 52 from institution B. In institution A, the sample consisted of 76 patients (61.79%), as there were two refusals: one patient who did not meet the inclusion criteria and another who was unable to sign the ICF, in addition to his family not being present to authorize his participation in the study. In institution B, the sample consisted of 47 patients (38.21%), with five refusals. Therefore, the total study sample consisted of 123 patients.

The majority of study subjects, 67 patients (54.47%), were male, with a mean age of 60.76 years (SD = 15.24). The mean length of ICU stay was 17.79 days (SD 46.39). Sixty patients (48.78%) underwent surgical procedures, and the majority of them, 48 (80%), cardiac surgeries.

The main medical diagnosis present in 74 patients (60.17%) was clinical cardiac conditions, followed by cardiac surgeries in 33 (26.83%) patients and other diseases in 16 patients (13%). Concerning comorbidities, 51 patients (41.46%) were diabetic and 24 (19.51%) had renal failure. As for the use of medications, 50 (40.65%) were using vasopressors and 33 (26.83%) were under sedation. Approximately 37 patients (30.08%) were using mechanical ventilation and 19 (15.45%) were on renal replacement therapy. The mean Body Mass Index (BMI) was 25.76 (SD=5.36), whereas the most common devices found on the day of the study were disposable diapers, used by 91 patients (73.98%), central venous catheter, present in 88 (71.55%), and indwelling urinary catheter, in 66 (53.66%).

Among the 123 patients who participated in the study, 51 presented PI, representing a point prevalence of 41.46%. As fir the total number of patients, 11 presented MDRPI, corresponding to 8.94% of total point prevalence. There were cases in which the patient presented more than one PI in different anatomical regions. A total of 71 injuries were identified, 57 classified as PI and 14 as MDRPI.

In institution A, of the 76 patients, 39 presented PI, with a prevalence of 39.47%, of which nine (11.84%) were MDRPI. In total, 46 injuries were identified, 34 classified as PI and 12 as MDRPI. In institution B, 12 of the 47 patients presented PI, with a prevalence of 25.53%, of which two were MDRPIs (4.25%). In total, 25 injuries were identified (23 PIs and two MDRPIs).

Figure 1 shows the injuries in relation to anatomical sites and stages.

Tables 1 and 2 present the associations of quantitative and categorical clinical variables with the presence of PIs. There was no statistically significant difference in patients with PI regarding demographic variables (sex and age) as well as clinical variables (weight, height, BMI), vital parameters (except respiratory rate), laboratory tests (except urea), comorbidities, surgical procedures, anatomical site of surgery, use of extracorporeal circulation, mechanical ventilation, renal replacement therapy, vasopressors, sedation, muscle relaxants, urinary, fecal and mixed incontinence and hospitalization outcome.

Regarding the devices used by patients on the day of the study, Table 3 shows their association with the presence or absence of PI.

As evidenced in CART analysis (Figure 2), patients who use moisturizing cream and have a score lower than 17.5 on the Braden Scale and systolic blood pressure (SBP) lower than 134 mmHg are 60% more likely to develop PI.

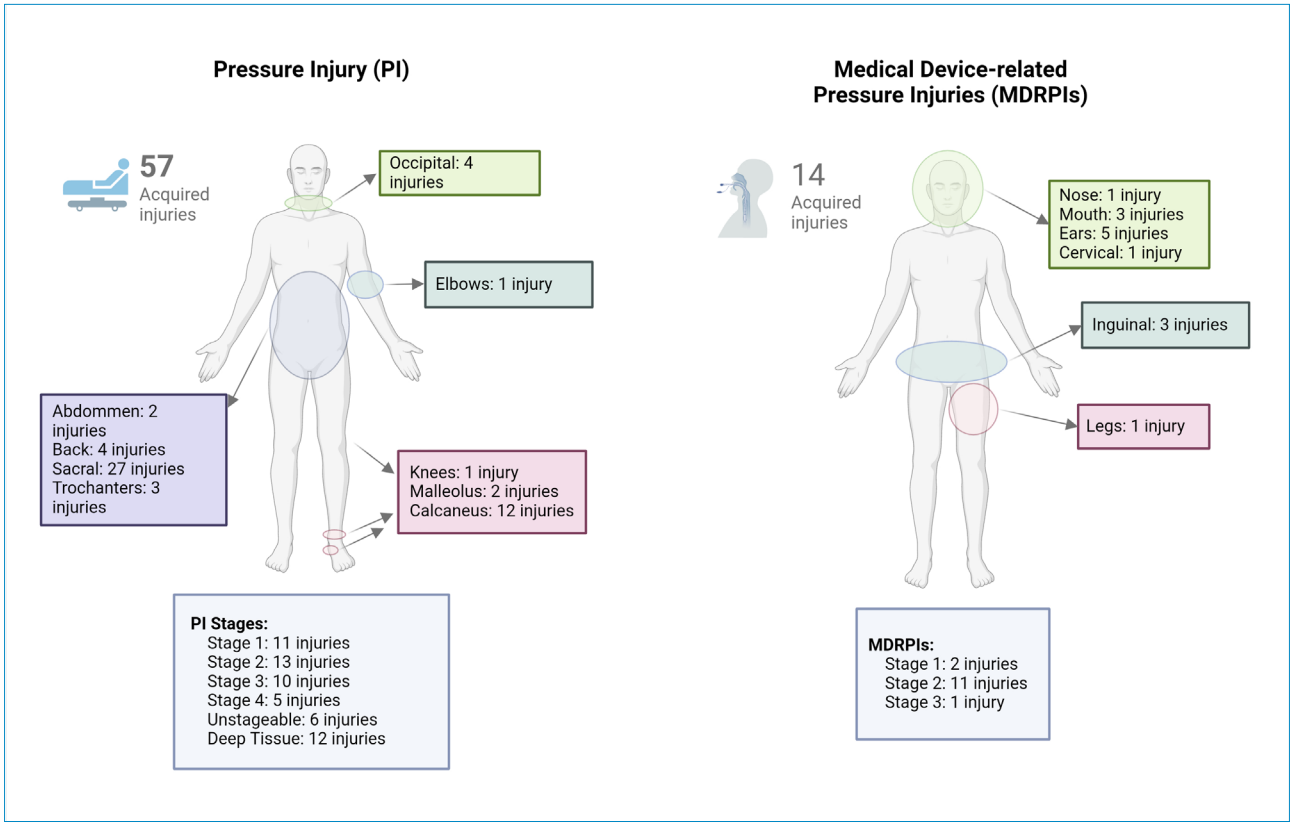

Figure 1. Anatomical sites and stages of pressure injuries. São Paulo (SP), 2018. Created in BioRender®.

Table 1. Prevalence of pressure injury according to quantitative clinical variables. São Paulo (SP), 2018.

Quantitative clinical variables	PI		P-value
	Absent	Present	
Length of stay in ICU			
Mean	7.88	36.90	<0.001*
Min-max.	0–61	0–349	
SD	13.59	73.98	
Total length of stay			
Mean	26.04	39.94	0.009*
Min-max.	1–158	5–125	
SD	27.87	33.14	

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Table 1. Continuation.

Quantitative clinical variables	PI		P-value
	Absent	Present	
Glasgow Coma Scale			
Mean	14.94	14.02	0.005*
Min-max.	12–15	5–15	
SD	0.13	2.19	
Braden Scale			
Mean	14.62	11.45	<0.001†
Min-max.	7–21	6–18	
SD	3.92	3.33	
Respiratory frequency			
Mean	18.86	17.68	0.044†
Min-max.	12.50–30	10–26	
SD	3.21	3.10	
Serum urea			
Mean	65.50	89.17	0.019*
Min-max.	20–175	21–229	
SD	38.10	54.72	

PI: pressure injury; ICU: Intensive Care Unit; SD: standard deviation. *Brunner-Munzel test; †Wilcoxon-Mann-Whitney test.

Table 2. Prevalence of pressure injury according to categorical clinical variables. São Paulo (SP), 2018.

Categorical clinical variables	PI				P-value
	Absent		Present		
	n	%	n	%	
Main medical diagnosis					0.022*
Malnutrition					
Yes	7	8.64	11	26.19	0.009*
No	74	9.36	31	73.81	
Exit condition					
Dead	17	20.99	19	45.24	0.005*
Alive	64	79.01	23	54.76	

PI: pressure injury. *Pearson's $\chi 2$ test.

Table 3. Prevalence of pressure injury according to variables related to the use of medical devices. São Paulo (SP), 2018.

Devices	PI				P-value
	Absent		Present		
	n	%	n	%	
Tracheostomy cannula					
Yes	0	0	9	100	<0.001*
No	81	71.05	33	28.50	
Mediastinal drain					
Yes	14	100	0	0.00	0.002*
No	67	61.47	42	38.53	
Nasogastric catheter					
Yes	9	34.62	17	65.38	<0.001†
No	72	74.23	25	25.77	

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Table 2. Continuation.

Devices	PI				P-value
	Absent		Present		
	n	%	n	%	
Gastrostomy					
Yes	0	0.00	3	100	0.038*
No	81	67.50	39	32.50	
Disposable diaper					
Yes	53	58.24	38	41.76	0.003†
No	28	87.50	4	12.50	

PI: pressure injury. *Fisher's exact test; †Pearson's $\chi 2$ test.

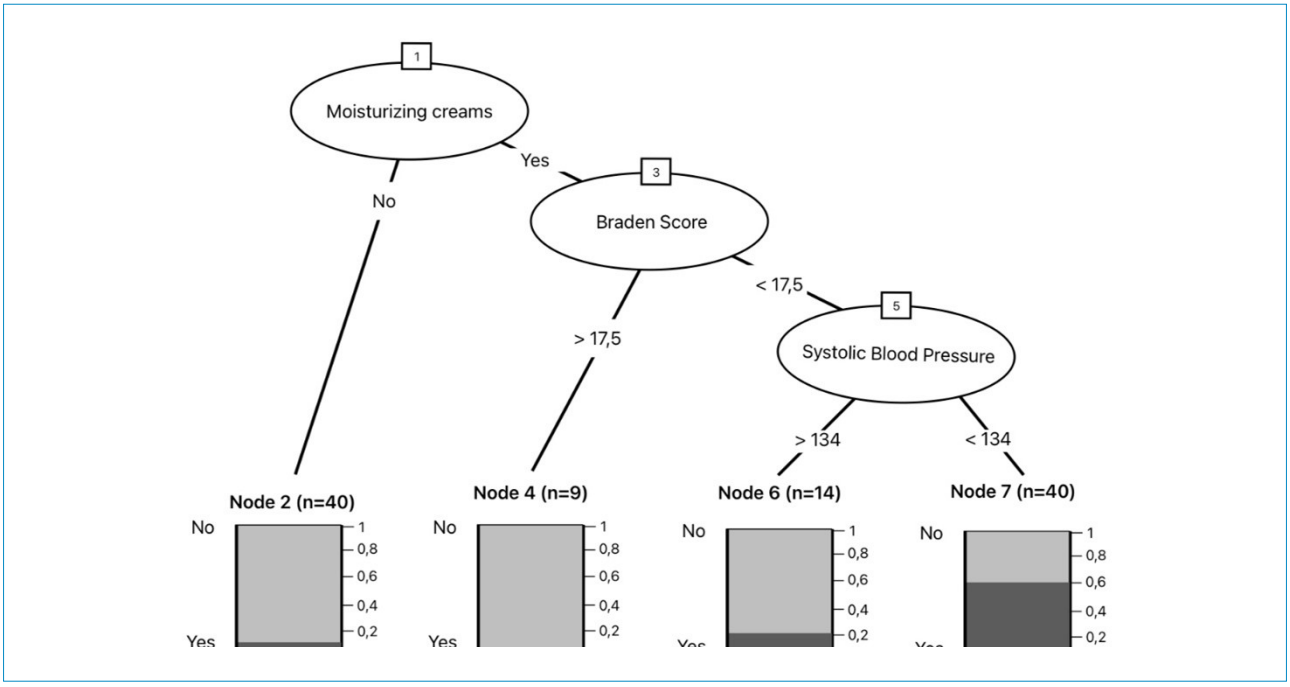

Figure 2. Factors associated with the development of pressure injuries according to Classification and Regression Tree analysis. São Paulo (SP), 2018.

DISCUSSION

The prevalence of PI is considered an important indicator of the quality of care provided, in addition to being widely used as a parameter in the assessment of injury prevention strategies and protocols[3,4,9]. Identifying patients at risk as well as the prevalence of PI/MDRPI and the factors associated with its development help to establish effective prevention and treatment actions, aimed at patient safety and the quality of healthcare services[3,16].

The prevalence found in this study was higher than that found in another study conducted in the ICU of a university hospital in Pernambuco[2], whose prevalence was 22.3%. Other national studies conducted in hospitals also found lower prevalence rates compared to those found in this study, ranging from 21.2[19] to 40%[11], such as the study conducted in the countryside of the state of São Paulo, with patients admitted to an emergency unit, where the total prevalence found was 40%. However, when verifying the prevalence of PI in ICUs, it was observed that this sector had an even higher prevalence (75%), even exceeding that found in this study.

In the international context, a multicenter study assessed point prevalence during a day of data collection in 86 ICUs in France, finding a prevalence of PI of 18.7%[20]. Another multicenter point prevalence study in 1,117 ICUs from 90 countries found a prevalence of PI of 16.2%[10]. In a point prevalence study of PI carried out in 16 ICUs in Australia, with 288 patients, the prevalence found was 9.7%[21].

As evidenced in other studies, in this study, the sacral region was the most affected by PIs[10,20], followed by the calcaneus, with the majority of them classified as stages 2 and 1, respectively[8,10,21]. PIs occur in areas subject to greater pressure from body weight, especially areas of bony prominence. Patients in intensive care often have limited mobility, are bedridden, sedated, on mechanical ventilation and restricted to the supine position, where the sacral region and calcaneus are support sites that suffer excess pressure when positioned in this position with the head elevated at an angle greater than 30º[1,10,20,22].

Stages 1 and 2 are initial classifications in which restoration of skin integrity occurs more easily than in more advanced stages of the injury. Therefore, skin assessment is essential to identify the presence of injuries early and reduce harm to patients through preventive interventions[7].

As for MDRPIs, the prevalence found in this study was much lower than that identified in another Brazilian study carried out in an ICU with 93 adult patients, which obtained a prevalence of 40% of MDRPIs[16]. In international literature, studies indicate the prevalence of MDRPIs in critically ill patients ranging from 1.4 to 38.1%[13,15]. A multicenter point prevalence study conducted in 44 ICUs in Australia and New Zealand, with 624 patients, found the prevalence of MDRPIs to be 4.3%[22].

The most common sites and stages of MDRPI found in this study are similar to those found in a study conducted in Turkey, which aimed to determine the point prevalence and risk factors associated with MDRPIs in intensive care patients. The study found that 65 of the 200 participants developed MDRPIs, resulting in a point prevalence of 32.5%, with 71% of these injuries on the face, 18.5% classified as stage 2, and the majority of them caused by the use of nasogastric catheter (29.2%), endotracheal tube (18.5%), and noninvasive ventilation mask (15.4%).

Other studies have noted that most injuries occurred to the head or neck[22,23]. A systematic review that included 22 studies on the incidence and prevalence of PI in adult ICUs, not just MDRPI, described that the occurrence of PI in the ears ranged from 4.3 to 19.7%[12]. These results can be explained by the widespread use of nasal cannulas, endotracheal tubes and tracheostomy tubes in ICUs, whose fixation is often supported by the auricle.

The use of moisturizing cream is one of the preventive measures recommended by international guidelines[7]. However, the moisturizers used at the study institution are usually brought by family members and often do not have the same compositions recommended by the guidelines. Dry or inadequately hydrated skin favors the development of PI, due to the fragility and inelasticity of the most superficial layer of the skin and the stratum corneum, making it more susceptible to rupture under the effect of external mechanical forces, especially when there is excess hydration[24].

A systematic review that sought to examine skin hydration and determine whether it could be a predictor for the development of PI in adults already at risk identified 1,727 records, of which only nine were included in the study. As a result, it was found that 33.3% (3) of studies showed a statistically significant association of skin hydration with the development of PI[24].

The Braden Scale, the most widely used in Brazil and worldwide, identifies individual risk factors, regardless of pathologies and comorbidities, for the development of PI[9]. Its use is important to standardize the assessment of PI risk in different populations and institutions, which can significantly impact the prevalence of PIs, as it allows nurses to plan care and implement measures to prevent PIs[9,25].

A study by Galeto *et al.*[16] demonstrated that the Braden Scale is a sensitive marker for predicting not only the risk of PI, but also of MDRPI, since patients with lower scores on the scale had a higher prevalence of injuries, including those caused by medical devices[16].

Concerning the SBP value, studies have demonstrated a statistical association with perfusion, circulation and development of PIs, as described in a Lebanese study, in which a statistically significant relationship was found between hypotension (<90 mmHg) and the development of PI in critically ill patients[8]. Conceptually, hypotension compromises blood circulation and increases the likelihood of developing PI, making tissues more susceptible to the effects of pressure[7].

As this is a study carried out in two hospitals in the state of São Paulo and considering the scarcity of studies on MDRPI, the need for new research that considers other realities and expands the sample to validate the data found is highlighted.

It is important to highlight that the limitations of the study include its cross-sectional nature, which allows only a

snapshot of reality, with data collected simultaneously with patient exposure and outcome development. In addition, there was no segregation of devices used by patients who presented MDRPI from patients who developed PI, which made it impossible to identify the devices that resulted in MDRPI.

In healthcare, preventing skin injuries is essential for patient safety, since the skin is the body's first barrier against microorganisms. Preserving it prevents infections, prolonged length of stay, pain, and costs of hospital treatments. Knowing the profile of patients at higher risk of developing these injuries helps healthcare professionals to identify them more easily and implement effective preventive care. This study allowed us to understand the prevalence of a recurring problem in hospitals, PIs and MDRPIs, the latter being a type of injury that has been little studied in Brazil, especially with regard to comparing patients with the same profile in different hospitals.

CONCLUSION

The point prevalence of PI was 46.34% and that of MDRPI was 8.94%. The factors associated with these injuries support those found in other studies.

It is worth noting that the research presented contributed to the knowledge of the epidemiological profile of patients with PI admitted to a cardiac ICU, assisting the nursing team in planning and implementing preventive care.

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Authors' Contributions: TMPS: conceptualization, data curation writing – first draft, writing – review and editing, investigation, resources, software. PCN: project administration, formal analysis, conceptualization, funding acquisition, methodology, visualization. VLCGS: validation. TCGFC: supervision. RSCSS: data curation, software. ELSO: data curation, software.

Availability of Research Data: All data were generated or analyzed in the present study.

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Conflict of Interest: None.

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