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Incidence of pressure injury in an oncological intensive care unit

Incidência de lesão por pressão em unidade de terapia intensiva oncológica

Incidencia de úlcera por presión en unidad de cuidados intensivos oncológica

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ABSTRACT

Objective: to investigate the incidence of pressure injury in cancer patients of an intensive care unit. **Method:** A longitudinal study with 105 patients admitted to an oncological intensive care unit. The incidence rate was calculated as the number of events per 100 patient-days. Cumulative incidence was calculated both globally and according to selected characteristics, and submitted to hypothesis tests. **Results:** incidence rate per 100 patient-days was 1.32, and global cumulative incidence was 29.5%. A higher incidence was observed in patients with chronic diseases who had at least one episode of diarrhea, received enteral nutrition, and took vasoactive or sedative drugs for a prolonged period of time. Regarding type of tumour and antineoplastic treatments, no differences in incidence were observed. **Conclusion:** A high cumulative global incidence of pressure lesion was reported in cancer patients admitted to the intensive care unit, although tumour characteristics and antineoplastic treatments did not affect incidence.

Descriptors: Pressure Ulcer; Neoplasms; Intensive Care Units; Cancer Care Facilities; Critical Care Nursing.

RESUMO

Objetivo: descrever a incidência de lesão por pressão em pacientes com câncer internados em unidade de terapia intensiva. **Método:** estudo longitudinal realizado com 105 pacientes internados em unidade de terapia intensiva oncológica. Calcularam-se taxa de incidência por 100 pacientes-dia e incidência acumulada – global e segundo caraterísticas selecionadas – submetendo-a a testes de hipótese. **Resultados:** taxa de incidência foi igual a 1,32 por 100 pacientes-dia e incidência acumulada global igual a 29,5%. Observou-se maior incidência entre portadores de doenças crônicas que apresentaram pelo menos um episódio de diarreia, que receberam nutrição enteral e drogas vasoativas e sedativas por tempo prolongado. Quanto ao tipo de tumor e ao tratamento antineoplásico recebido, não foram observadas diferenças na incidência. **Conclusão:** descreveu-se elevada incidência acumulada global de lesão por pressão em pacientes com câncer internados em unidade de terapia intensiva, embora características do tumor e do tratamento antineoplásico não tenham apresentado diferenças na incidência.

Descritores: Lesão por Pressão; Neoplasias; Unidades de Terapia Intensiva; Institutos de Câncer; Enfermagem de Cuidados Críticos.

RESUMEN

Objetivo: describir la incidencia de úlcera por presión en pacientes con cáncer hospitalizados en unidad de cuidados intensivos. **Método:** estudio longitudinal, en el cual participaron 105 pacientes hospitalizados en unidad de cuidados intensivos oncológica. Se calcularon la tasa de incidencia por 100 pacientes-día y de incidencia acumulada –total y según las características seleccionadas– y las sometió a test de hipótesis. **Resultados:** la tasa de incidencia fue igual a 1,32 por 100 pacientes-día y la de incidencia acumulada total fue un 29,5%. Se observó una mayor incidencia entre los portadores de enfermedades crónicas que tuvieron al menos un episodio de diarrea, que recibieron nutrición enteral y drogas vasoactivas y sedantes por tiempo prolongado. En cuanto al tipo de tumor y al tratamiento antineoplásico recibido, no se observaron diferencias en la incidencia. **Conclusión:** se describió la elevada incidencia acumulada total de úlcera por presión en pacientes con cáncer hospitalizados en unidad de cuidados intensivos, sin embargo las características del tumor y del tratamiento antineoplásico no presentaron diferencias en la incidencia.

Descriptores: Úlcera por Presión; Neoplasias; Unidades de Cuidados Intensivos; Instituciones Oncológicas; Enfermería de Cuidados Críticos.

INTRODUCTION

Pressure injuries (PIs) are damages to the skin and/or underlying soft tissues. They are usually located over prominent bones, and can also be associated with the use of medical devices or other instruments. These lesions may be painful, and present themselves either over intact skin or as open ulcers, due to intense and prolonged pressure combined with shear. The tolerance of soft tissues to pressure and shear can be affected by microclimate, nutrition, perfusion, comorbidities, and by the tissue's condition[1].

PIs can be classified into four distinct stages: stage 1 is characterized by non-blanchable erythema of intact skin; stage 2 by partial-thickness skin loss with exposed dermis; stage 3 by full-thickness skin loss; and stage 4 by full-thickness skin and tissue loss. Additionally, a PI is classified as belonging to the 'unstageable' type when it presents obscured full-thickness skin and tissue loss; and as a 'deep tissue' PI when it presents persistent non-blanchable deep red, maroon or purple discoloration[1].

A systematic review on the risk factors for the development of PI in intensive care units (ICUs) showed that patients hospitalized in this type of hospital environment are more vulnerable. This vulnerability is mainly due to advanced age, chronic diseases such as diabetes *mellitus*, mean arterial pressure < 60–70 mmHg, prolonged mechanical ventilation, continuous venovenous haemofiltration and/or intermittent dialysis, use of vasoactive drugs and/or sedatives, insufficient changes of patient position in bed, and length of stay in the ICU[2]. It is worth emphasizing that the incidence of PIs in ICUs is high, ranging from 11% to 37%[3–10]. This indicates that PIs are a serious public health problem, which compromises patient safety and entails high health-system costs [11-12].

The extensive literature review carried out by the authors was unable to identify studies on the incidence of PIs in cancer patients hospitalized in ICUs. However, it is well known that chemotherapy and antineoplastic radiotherapy can cause changes to the skin[13–15]. One can hypothesize that these changes may increased hospitalized patients' vulnerability to the development of PIs. In view of the above, this study seeks fill a gap in health and nursing research, advancing the knowledge about the incidence of PI in cancer patients admitted to ICUs.

OBJECTIVE

To describe the incidence of PI in cancer patients admitted to an ICU.

METHOD

Ethical aspects

This study followed Brazilian guidelines and norms regulating research involving human beings. These norms are described in the National Health Council's Resolution No. 466, promulgated in December 12, 2012. It was also approved by the Research Ethics Committee of the Pedro Ernesto University Hospital, of the Universidade do Estado do Rio de Janeiro. Considering the characteristics of the study's data collection process, the committee did not deem it necessary for informed consent terms to be obtained from participants.

Design, location of the study and study period

This was a longitudinal observational study following *STROBE Statement* (http://www.equator-network.org/wp-content/uploads/2015/10/STROBE_checklist_v4_cohort.pdf) recommendations, which guided its description procedures. It was based on information recorded in the medical records of patients admitted to the ICU of a specialized oncology hospital. The hospital is located in the city of Rio de Janeiro, Brazil. Data collection occurred between May and November 2017.

Population and sample

The study's target population was comprised of all patients aged ≥ 18 years who were hospitalized in the ICU between January 1 and December 31, 2016 (n = 225), excluding those who did not survive the first 48 hours of hospitalization (n = 50). Although there were 175 survivors, only 114 medical records were taken into consideration, since the hospital's archive and documentation service was unable to locate 61. Follow-up involved all patients who presented no PI at the time of admission to the ICU. As nine patients failed to meet this criterion, the final study cohort was comprised of 105, who were followed from the moment of ICU admission to either the date of PI incidence (outcome), death, or discharge.

Protocol

Duly trained intensivist nurses collected participants' medical records and transcribed the following variables of ICU admission (baseline) into a pre-tested form elaborated especially for this purpose: sex; age; skin color (white or non-white); presence of another chronic disease besides cancer (yes or no); tumour type (solid or hematological); and body mass index. In respect to the latter, patients were categorized as having low body weight (≤ 18.4 kg/m^2), adequate body weight (between 18.5–24.9 kg/m^2), overweightness (25–29.9 kg/m^2), and obesity (≥ 30 kg/m^2)[16]. Variables of patients' hospitalization period (follow-up) were also collected from medical records and transcribed to the form, namely: use of sedative and vasoactive drugs (days); use of abdominal or thoracic drains (yes or no); use of enteral nutrition (days); at least one episode of diarrhea (yes or no); type of antineoplastic treatment received during hospitalization or up to three months prior to it (e.g., surgery, radiation therapy or chemotherapy) (yes or no); length of hospital stay (days); and incidence of PI (yes or no), including anatomical location and stage[1].

Statistical analysis

Incidence rate was calculated by dividing the number of PI events occurring during follow-up by the sum of time periods (in days) during which each patient was at risk of developing PI in the ICU, i.e., the person-time of exposure[17]. This result was then multiplied by 100, so as to calculate the incidence rate per 100 patient-days. Cumulative incidence was calculated by dividing the number of PIs occurring during follow-up by the number of cohort patients exposed to ICU admission in the same period[17]. The result was then multiplied by 100, so as to present cumulative incidence as a percentage.

Statistical Package for the Social Sciences software (version 23.0) was employed to perform Fischer's exact test and linear association test, identifying statistically significant differences in the cumulative incidence of PI among categorical (sex, age, skin color, chronics, tumour type, antineoplastic treatment, abdominal/thoracic drainage, diarrhea) and ordinal (body mass index, enteral nutrition, sedative/vasoactive drugs) variables ($p \leq 0.05$).

RESULTS

The sum of patients' exposure periods to the risk of developing PI in the ICU amounted to 2,347 days. The number of PI incidents during the follow-up period was 31. The mean length of ICU stay was 22.3 days (± 13) and the mean age of the patients was 56.7 years (± 15.6).

Table 1 – Cumulative incidence of pressure injury according to clinical and sociodemographic characteristics (identified at the time of patient admission to the oncological intensive care unit), Rio de Janeiro, Brazil, 2016

Variables (%)	Pressure injury incidence		*p* value
	Yes n (%)	No n (%)	
Sex			0.411*
Male (58.1)	17 (54.8)	44 (59.5)	
Female (41.9)	14 (45.2)	30 (40.5)	
Age group			0.506*
18–59 years (53.3)	17 (54.8)	39 (52.7)	
≥ 60 years (46.7)	14 (45.2)	35 (47.3)	
Skin color			0.461*
White (57.1)	17 (54.8)	43 (58.1)	
Non-white (42.9)	14 (45.2)	31 (41.9)	
Body mass index†			0.063‡
Low weight (5.0)	1 (3.3)	4 (5.7)	
Adequate weight (50.0)	13 (43.3)	37 (52.9)	
Overweightness (31.0)	8 (26.7)	23 (32.9)	
Obesity (14.0)	8 (26.7)	6 (8.6)	
Chronic diseases			0.026*
Yes (41.9)	18 (58.1)	26 (35.1)	
No (58.1)	13 (41.9)	48 (64.9)	
Tumour type			0.090*
Solid (83.8)	29 (93.5)	59 (79.7)	
Hematologic (16.2)	2 (6.5)	15 (20.3)	
Surgery			0.056*
Yes (35.2)	15 (48.4)	22 (29.7)	
No (64.8)	16 (51.6)	52 (70.3)	
Chemotherapy			0.378*
Yes (36.2)	10 (32.2)	28 (37.8)	
No (63.8)	21 (67.7)	46 (62.2)	
Radiotherapy			0.573*
Yes (12.4)	4 (12.9)	9 (12.2)	
No (87.6)	27 (87.1)	65 (87.8)	

*Note: *Fischer's exact test; †Cases lacking this information were excluded; ‡Linear association test.*

The incidence rate of pressure injury was 1.32 per 100 patient-days, and the overall cumulative incidence was 29.5%. PIs were mostly observed in the sacral region (81%), followed by the sciatic (16%) and calcaneal (3%) regions. Among the analyzed medical records, only six (5.7%) referred to PI stage. All references were to stage 2 (partial-thickness skin loss with exposed dermis)[1].

Table 1 shows the cumulative incidence of PI according to patients' clinical and sociodemographic characteristics (identified at the time of ICU admission). A higher incidence of PI, with a statistically significant difference, was observed only among patients with other chronic diseases ($p = 0.026$).

Table 2 shows the cumulative incidence of PI according to the clinical characteristics of the patients (identified during their ICU stay). A higher, statistically significant difference in the incidence of PI was observed among patients who had at least one episode of diarrhea ($p = 0.009$), received enteral nutrition ($p = 0.001$), and took vasoactive ($p = 0.048$) or sedative drugs ($p = 0.050$) for an extended period of time.

Table 2 – Cumulative incidence of pressure injury according to clinical and sociodemographic characteristics (identified at the time of patient admission to the oncological intensive care unit), Rio de Janeiro, Brazil, 2016

Variables (%)	Pressure injury incidence		*p* value
	Yes n (%)	No n (%)	
Abdominal/thoracic drainage			0.106*
Yes (28.6)	12 (38.7)	18 (24.3)	
No (71.4)	19 (61.3)	56 (75.7)	
Diarrhea			0.009*
Yes (39.0)	25 (80.6)	39 (52.7)	
No (61.0)	6 (19.4)	35 (47.3)	
Enteral nutrition			0.001†
No (18.1)	-	19 (25.7)	
Up to 7 days (19.0)	5 (16.1)	15 (20.3)	
≥ 8 days (62.9)	26 (83.9)	40 (54.1)	
Vasoactive drugs			0.048†
No (17.1)	1 (3.2)	17 (23.0)	
Up to 3 days (21.0)	8 (25.8)	14 (18.9)	
≥ 4 days (61.9)	22 (71.0)	43 (58.1)	
Sedative drugs			0.050†
No (10.5)	1 (3.2)	10 (13.5)	
Up to 3 days (11.4)	2 (6.5)	10 (13.5)	
≥ 4 days (78.1)	28 (90.3)	54 (73.0)	

*Note: *Fischer's exact test; †Linear association test.*

DISCUSSION

The overall cumulative incidence of PI observed in this study was high. Patients with other chronic diseases, who presented at least one episode of diarrhea while in the ICU, received enteral nutrition, and took vasoactive drugs or sedative drugs for a prolonged period were the most affected. No statistically significant differences in PI incidence were observed in association with tumour types and antineoplastic treatment types.

As mentioned previously, the extensive literature review performed by the authors found no studies on the incidence of PI in cancer patients admitted to the ICU. This makes it difficult to subject our results to comparison. In other studies conducted in non-specialized Brazilian ICUs[4–8], the overall cumulative incidence of PI was lower, varying between 3.5% and 23.1%. However, a study conducted in a Chinese ICU (also not specialized in oncology) found an overall cumulative PI incidence of 31.4%, similar to this study's[10].

Regarding the incidence rates found here, result comparison was an even more difficult task. This is because our literature review was unable to find studies conducted in ICUs employing this measure of frequency. It is worth noting that incidence rates are the most indicated measure of frequency for dynamic populations, such as the one targeted by this study—in which individuals enter the cohort and leave it at different times during the follow-up period[17].

A reasonable explanation for the elevated global cumulative incidence of PI found in this study is the four-hour interval for patient repositioning adopted as a measure of prevention in the studied ICU. As a PI prevention measure, the scientific literature recommends patient repositioning to be performed every two hours[5,18], or even at shorter intervals, depending on the patient's need and, in particular, on the nurse's clinical evaluation[19]. The large time interval between changes of patient position may explain why the sacral and sciatic regions were the ones with the highest PI incidence. In addition, it is worth emphasizing that the *Fowler* and *semi-Fowler* bed positions—very common in ICUs due to enteral nutrition and the need to prevent ventilator-associated pneumonia—increase the pressure in these regions and may also have contributed to a high incidence of PI. On the other hand, the low incidence of these lesions in the orthopedic region may be explained by the fact that all ICU patients receive orthopedic heel protection.

Another explanation for the high cumulative incidence of PI may be the fact that approximately 2/3 of the patients received vasoactive and sedative drugs for four or more days during their ICU stay. It is known that prolonged administration of vasoactive drugs—in addition to requiring extended bed rest—causes significant, and occasionally excessive, peripheral vasoconstriction[20]. Moreover, the administration of sedative drugs impairs sensory perception and bed mobility[21], making the patient more vulnerable to PIs. This is likely why a higher cumulative incidence of PI was observed, with statistically significant differences, among patients who received these drugs during their ICU admission.

Tissues' tolerance to pressure and shear is affected by nutritional conditions, comorbidities, and patient clinical condition[1]. The results of this study corroborate this assertion, since a higher accumulated incidence of PI was observed among those who received enteral nutrition for a prolonged time, had chronic diseases besides cancer, or at least one episode of diarrhea while admitted to the ICU.

The preferential access for providing nutritional support to critically ill patients who are unable to ingest food spontaneously, and therefore are at risk of malnutrition, is the enteral route. In this way, the patient can be provided with the necessary calories, proteins, amino acids, vitamins and water, maintaining an adequate nutritional status[22]. A longitudinal study conducted among 471 hospitalized adults identified a higher incidence of PI among those who received enteral nutrition, and also among patients with malnutrition[23]. The causal relationship between nutritional status and PI is yet to be fully clarified[23]. However, observational studies have been pointing to a consistent association between malnutrition and PI incidence[23–25].

Furthermore, several chronic diseases may influence the incidence of PI, especially when they interfere in the tissue's tolerance to pressure, or in oxygen and nutrient distribution[2,26]. Among those, diabetes *mellitus*, smoking, and chronic obstructive pulmonary disease are worthy of mention. Many patients admitted to the studied ICU were carriers of these diseases (data not shown).

Skin exposure to moisture increases the chances of PI incidence in hospitalized patients by a factor of four[26]. When this exposure is caused by fecal incontinence, the skin becomes even more susceptible to maceration, friction lesions, irritations and even colonization by microorganisms[27]. Therefore, the use of topical barriers and skin protectors (protective films or zinc oxide-based creams) should be implemented, in order to provide a moisture barrier and thus protect the patient's corneal layer against diarrhea, an aggressive agent that needs to be regularly investigated and promptly treated by ICUs.

In 2014, the National Pressure Ulcer Advisory Panel, the European Pressure Ulcer Advisory Panel and the Pan Pacific Pressure Injury Alliance formed a partnership to release a guide containing scientifically grounded recommendations for the prevention and treatment of PIs. The guide suggests interventions that should be adopted by all health professionals involved in the care of patients at risk of developing PIs. In short, the suggested interventions are the following: assessment of the risk of developing PI at admission; risk reassessment at daily—or shorter—intervals (during hospitalization); skin inspection at all risk assessments; maintenance of clean, dry and hydrated skin; optimization of nutrition and hydration; minimization of pressure, especially on bony prominences, via repositioning[19]. In view of the above, the document emphasizes the importance of the routine and systematic action of the nursing team in the application of these PI prevention strategies.

The identification and notification of PIs is essential to evaluate the magnitude of this phenomenon in ICUs. It is also a challenge for nursing professionals performing bedside care[4]. It is clear that PI incidence extrapolates nursing care, given its multifactorial etiology, which involves factors intrinsic and extrinsic to the individual. However, as nurses provide direct care to critical patients and remain by their side 24 hours a day, it is of the utmost importance that these professionals commit to the adoption of preventive measures[5], especially when considering that PIs compromise patient safety and entail high health-system costs[11-12].

Study limitations

Among the limitations of this study, it is worth pointing out that it was developed with information recorded in medical records. The fact that these records have a strict clinical care purpose is probably related to the low number of PI reports containing stage information. This made it impossible to draw statistical comparisons referring to PI stage. Another important limitation concerns the hospital's archival and documentation service's inability to recover 61 medical charts. As a result, approximately 35% of eligible patients could not be followed and, consequently, we were unable to perform a statistically robust description of the incidence of PI, which prevents the generalization of our results to the target population. Finally, it is worth noting the impossibility of constructing a multivariate regression model capable of identifying characteristics associated with PI incidence. This was due to the small number of participants.

Contributions to the area of nursing and health

Despite its limitations, it is important to highlight the originality and novelty of this study, as well as the use of a frequency of measure appropriate for dynamic populations—the incidence rate[17]. Although our results refer to a particular sample, which

limits their generalization, the study contributes to filling a gap in health and nursing research, as well as advancing the knowledge about the incidence of PI in cancer patients admitted to specialized ICUs. This points to the importance of carrying out future longitudinal investigations with a greater number of participants, so that more sophisticated statistical analyzes can be used, allowing for the identification of the characteristics associated with the incidence of PI in cancer patients hospitalized in ICUs—especially characteristics related to tumour types and antineoplastic treatments.

CONCLUSION

The overall cumulative incidence of PI observed in this study was high. Patients with other chronic diseases who presented at least one episode of diarrhea while in the ICU, received enteral nutrition, and took vasoactive or sedative drugs for a prolonged period of time were the most affected. However, other studies are needed to investigate whether tumour characteristics and antineoplastic treatments are in fact irrelevant to the incidence of PI in cancer patients admitted to the ICU.

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