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RESEARCH ARTICLE (ORIGINAL)

Risk factors for pressure ulcers in intensive care: A cross-sectional study

Fatores de risco no desenvolvimento de úlcera por pressão em unidades de cuidados intensivos: Estudo observacional

Factores de riesgo en el desarrollo de úlceras por presión en unidades de cuidados intensivos: Estudio observacional

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Abstract

Background: Critically ill patients in intensive care are more susceptible to the development of pressure ulcers.

Objective: To identify risk factors for the development of pressure ulcers in intensive care patients.

Methodology: An observational, longitudinal, retrospective, quantitative study was conducted. The clinical records of 116 patients admitted to an intensive care unit for more than 10 days between June and December 2020 were examined considering three different moments: the day of admission, the 10th day of hospitalization, and the day of discharge. The analysis included main and secondary variables.

Results: The 116 patients had a mean age of 58.98 years and 49.7% developed pressure ulcers. There was a statistically significant association between the development of pressure ulcers and the use of medical devices (NG tubes, IMV, cervical immobilization devices, and urinary catheters) in patients with altered states of consciousness on ECMO and with vasoactive amines.

Conclusion: Patient vulnerability is evident given the factors identified. Knowledge of these factors allows for the prescription of nursing interventions leading to the prevention of pressure ulcers.

Keywords: Critical Care; Nursing Care ; Pressure Ulcer; Risk Factors

Resumo

Enquadramento: A pessoa em situação crítica no contexto da medicina intensiva apresenta maior vulnerabilidade para desenvolver úlceras por pressão (UPP).

Objetivo: Identificar os fatores de risco no desenvolvimento de UPP nos doentes internados em cuidados intensivos.

Metodologia: Estudo observacional, longitudinal, retrospetivo, de natureza quantitativa. Foram analisados 116 doentes, entre junho e dezembro de 2020, internados por mais de 10 dias numa unidade de cuidados intensivos, em três momentos distintos, o dia da admissão (DO), o 10º dia (D1O) e o momento da alta (DALTA). Nesta análise incluímos variáveis principais e secundárias.

Resultados: Os 116 doentes apresentavam uma média de idades de 58,98 anos e 49,7% desenvolveram uma UPP. Houve uma associação estatisticamente significativa entre o desenvolvimento de UPP a presença de dispositivos (SNG, VMI, imobilização cervical e cateter vesical), nos doentes com alteração do estado de consciência, em ECMO com suporte de aminas.

Conclusão: A vulnerabilidade é evidente perante os fatores identificados. O seu conhecimento permite a prescrição de intervenções de enfermagem que resultem na prevenção de UPP.

Palavras-chave: cuidados intensivos; cuidados de enfermagem; úlcera por pressão; fatores de risco

Resumen

Marco contextual: Las personas en situaciones críticas en el contexto de la medicina intensiva son más vulnerables a padecer úlceras por presión.

Objetivo: Identificar los factores de riesgo para el desarrollo de UPP en doente s ingresados en una UCI.

Metodología: Estudio observacional, longitudinal, retrospectivo y de carácter cuantitativo. Se analizaron 116 doente s entre junio y diciembre de 2020, hospitalizados por más de 10 días en una unidad de cuidados intensivos, en tres momentos diferentes, el día de ingreso (DO), el 10 día (D1O) y en el momento del alta (DALTA). En este análisis se incluyeron variables principales y secundarias.

Resultados: Los 116 doentes tenían una edad promedio de 58,98 años y el 49,7% desarrolló una UPP. Hubo asociación estadísticamente significativa entre el desarrollo de UPP y la presencia de dispositivos (NGT, VMI, inmovilización cervical y sonda vesical), en doente s con estado alterado de conciencia, en ECMO con soporte de aminas.

Conclusión: La vulnerabilidad es evidente dados los factores identificados. Su conocimiento permite prescribir intervenciones de enfermería que resulten en la prevención de UPP.

Palabras clave: cuidados intensivos; cuidados de enfermaria; úlcera de presión; factores de riesgo

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Introduction

Pressure ulcers (PUs) are a major healthcare problem, particularly in intensive care units (ICUs) where patients are more vulnerable. Several factors contribute to the development of these injuries, including the patient's immobility, critical status, and comorbidities and the medical devices used. PUs are one of the most serious complications in ICUs, potentially affecting 21.5% of hospitalized patients (Mervis & Phillips, 2019). For this reason, their relevance in the hospital context is addressed in one of the strategic objectives of the Portuguese National Patient Safety Plan 2021-2026 (Direção-Geral da Saúde, 2022), which demonstrates the importance of developing research in this area. Laranjeira and Loureiro (2017) also suggest that it is crucial to conduct research on the risk factors for the development of PUs and their risk assessment strategies and prevention measures, as well as on the evolution of these injuries during hospitalization. Therefore, our study aims to identify the risk factors for the development of PUs in patients admitted to the ICU by analyzing the clinical records of patients admitted between June and December 2020.

Background

A PU is defined as localized damage to the skin and/or underlying tissue, usually over a bony prominence, as a result of pressure or pressure combined with shear (European Pressure Ulcer Advisory Panel, 2019). Mello et al (2017) note that the incidence of PUs varies from 23.1% to 59.5%, and Labeau et al (2020) report that the incidence of PUs in the ICU is 26.6%, with a higher prevalence in the sacrum (37%) and calcaneus (19.5%). Assessing risk factors and implementing preventive measures can reduce hospital costs by 3% of annual charges, and preventing PUs is considered more cost-effective than treating them (Silva et al., 2017). Moreover, according to Labeau et al. (2020), mortality increases with the severity of PUs. The risk of PUs is assessed using scales, but the evidence shows that the use of these instruments makes no significant difference (Moore & Patton, 2019). In Portugal, the scale used is the Braden Pressure Ulcer Risk Assessment Scale (Braden Scale), which assesses six risk factors (sensory perception; moisture; activity; mobility; nutrition; friction and shear; Direção-Geral da Saúde, 2011). However, Campbell (2016) highlights that the Braden Scale may not assess the true risk of ICU patients. Therefore, it is important to understand, in an ICU context in Portugal, which factors, beyond those included in the Braden Scale, may influence the development of PUs. The relevance of our study is clear, since it focuses on the recognition of risk factors for the increase of PUs in the ICU context and their evolution throughout the hospitalization, allowing the identification of vulnerable patients, that is, those with a higher risk of developing PUs.

Methodology

The study followed an observational, longitudinal, and retrospective design with a quantitative approach.

The non-probability convenience sampling method was used, as the study was limited to patients admitted to the ICU for more than 10 days, between June 1 and December 31, 2020. As a result, of the 356 patients admitted during this period, 116 were included in the sample and 240 were excluded based on the criterion of being admitted to the ICU for less than 10 days. This inclusion criterion was defined based on the literature, which indicates that PUs have a higher prevalence in the first two to three weeks of hospitalization, that is, from the 10th day of hospitalization onwards.

Given the nature of our study, our goal was to explore how a set of variables were associated and not to establish causal relationships, so two sets of variables were considered. The main variable, PU, took into account the number of PUs, their location and type, and the risk score according to the Braden Scale, a validated instrument recommended in clinical practice. Secondary variables included: a) sociodemographic characteristics (sex, age); b) clinical variables (diagnosis, severity of illness according to the Acute Physiology and Chronic Health Evaluation II [APACHE II] score, consciousness, sedation and analgesia, use of vasopressors, and use of medical invasive devices and cervical immobilization devices); c) contextual variables (origin, number of days of hospitalization, and level of care and nursing workload as assessed by the Therapeutic Intervention Scoring System [TISS-28]). As this was a retrospective study, the TISS-28 was included because it was the instrument used in the institution where the study took place.

All devices used to meet therapeutic needs were considered. These devices included endotracheal tubes for invasive mechanical ventilation (IMV), noninvasive ventilation (NIV) interfaces, intravascular catheters for therapy delivery, urinary catheters, and extra corporeal membrane oxygenation (ECMO). Renal replacement therapy, number of days of catheter use, number of days of catheterization, and use of cervical immobilization devices were also considered.

The data were collected retrospectively from the SClinico information system, focusing on three moments: the day of admission (D0), the 10th day of ICU hospitalization (D10), and the day of discharge (Ddischarge). These three moments were used to describe the behavior of each of the variables from a longitudinal perspective. This information was stored in a database and analyzed using IBM SPSS Statistics, version 27.0.

Nonparametric descriptive statistics were used for data analysis, including frequency distributions and measures of central tendency (mean [M] and standard deviation [SD]). Parametric tests, such as the independent samples t-test and the one-way ANOVA test, were also used to compare means. The post hoc Tukey test was also used to identify statistical differences between groups of variables. The repeated measures ANOVA test was used to

longitudinally evaluate participants from the same group at the three moments - D0, D10, and Ddischarge. A significance level of 0.05 was used.

Coding ensured anonymity and confidentiality of all data, and only the principal investigator had access to the database, which was stored in physical format and on a USB pen drive. The data collected were used only for the present study. The study was approved by the ethics committee of the institution where it was conducted, through opinion no. 72-21/2021.

Results

Of the 116 patients in our sample, 49.1% developed a PU at some point during their hospitalization, and of these, 19% developed more than one PU. The sample was predominantly male (63.8%) with a mean age of 58.98 years (*SD* = 16.11; Min. = 18; Max. = 95). The nursing diagnosis of PU was confirmed at a mean of 11.7 days. Most of the PUs were category 1 (59.6%), although some patients developed PUs of categories 2 (32.1%), 3 (8.9%), and 4 (2.4%). The PUs were located (in ascending order) in the sacrum (42.1%), oral commissure (14.0%), nose (10.5%), mental region, ears, occipital region (5.3%), urethra, olecranon (3.5%), malleolus, clavicle, and calcaneus (1.8%). Throughout the hospital stay, the mean Braden Scale score remained at the high-risk cut-off for the development of PUs, as shown in Table 1.

Table 1

Mean Braden Scale score on D0, D10, and Ddischarge

Braden Scale	*Min*	*Max*	*M*	*SD*
D0	6	19	11.3	3.11
D10	7	20	12.3	2.89
Ddischarge	6	20	13.7	3.33

Note. M = Mean; *SD* = Standard deviation; *Min* = *Minimum; Max* = *Maximum;* D0 = day of admission; D10 = 10th day of ICU hospitalization; Ddischarge = Day of discharge.

As shown in Table 2, patients who had already developed a PU on D10 had a higher risk of developing a new PU by Ddischarge (p = 0.001).

Table 2

Differences in PU risk based on whether or not the patient already has a PU

Braden Scale	No (n=59)		Yes (n=57)			
	M	*SD*	*M*	*SD*	*t*	*p*
D0	11.4	2.99	11.3	3.27	0.149	0.882
D10	13.5	3.19	11.1	1.97	4.916	0.001
Ddischarge	14.4	3.18	12.9	3.54	2.338	0.002

Note. M = Mean; *SD* = Standard Deviation*; PU* = *Pressure Ulcer;* D0 = day of admission; D10 = 10th day of ICU hospitalization; Ddischarge = day of discharge.
** $p < 0.01$.

A higher risk of developing PUs was found between D0 and D10 (Table 3).

Table 3

Correlation between the number of hospitalization days and PU risk

Braden Scale score	Hospitalization days	
	r	***p***
(D0)	- 0.217	0.02*
(D10)	- 0.333	0.001**
(Ddischarge)	0.089	0.34^{ns}

Note. PU = Pressure Ulcer; D0 = day of admission; D10 = 10th day of ICU hospitalization; Ddischarge = day of discharge.
* $p < 0.05$; ** $p < 0.01$; ns = Not significant.

In terms of the reason for admission to the ICU and the level of care assigned, the most common reason for admission was a medical diagnosis (77.6%) and the most common level of care assigned was level 3 intensive care (83.6%).
Regarding the origin of the patient, 36.3% came from the community, 35.3% from another ICU, and the rest were transferred from inpatient wards.
When analyzing the differences in PU risk according to origin, there were significant differences on D0 and D10 between patients from inpatient wards and those from other ICUs, with patients from inpatient wards having a lower PU risk at both moments ($p = 0.001$) (Table 4).

Table 4

Differences in PU risk according to the patient's origin on D0, D10, and Ddischarge

	PU risk according to the Braden Scale							
	(D0)		(D10)		(Ddischarge)			
	M	***SD***	***M***	***SD***	***M***	***SD***	***F***	***p***
Inpatient ward ($n = 32$)	13.75	3.01	12.59	3.19	13.88	3.42	20.77	**0.001***
Other ICU ($n = 41$)	9.71	2.08	11.15	2.44	13.02	3.20	6.27	**0.003***
Community ($n = 42$)	11.00	2.95	13.26	0.42	14.10	3.62	1.11	0.333 ^{ns}

Note. M = Mean; *SD* = Standard Deviation; *PU = Pressure Ulcer;* D0 = day of admission; D10 = 10th day of ICU hospitalization; Ddischarge = day of discharge.
* $p < 0.01$; ns = Not significant.

In our sample, 70.7% of the patients received norepinephrine infusions, and there was an association between norepinephrine administration and the development of PUs as early as D0 ($p < 0.04$; $U = 213.50$), meaning that patients receiving norepinephrine infusions had a higher risk of developing PUs. Our study also analyzed the sample's feeding regimen. Table 5 shows that the PU risk on D0 was higher in patients who were not fed ($p = 0.001$) compared to patients who were fed orally or via an enteral feeding tube.

Table 5

Differences in PU risk according to the feeding regimen in D0, D10, and Ddischarge

Pressure ulcer risk according to the Braden Scale	**No feeding ($n = 23$)**		**Enteral feeding ($n = 26$)**		**Oral feeding ($n = 60$)**			
	M	***DP***	***M***	***DP***	***M***	***DP***	***F***	***p***
(D0)	11.70	3.38	10.15	2.68	11.69	3.4	1.66	0.180
(D10)	10.57	1.73	11.38	3.00	13.36	2.7	7.385	0.256
(Ddischarge)	10.04	3.39	12.88	3.32	15.34	2.9	21.04	**0.001** **

Note. M = Mean; *SD* = Standard Deviation; *PU = Pressure Ulcer;* D0 = day of admission; D10 = 10th day of ICU hospitalization; Ddischarge = day of discharge;
** $p < 0.01$.

Consciousness, sedation, and analgesia were assessed using the Glasgow Coma Scale (GCS) and the Richmond Agitation and Sedation Scale (RASS), respectively. Patients with higher levels of sedation and/or GCS scores below 15 had a higher risk of developing PUs, particularly on D10. Patients with lower scores on the RASS scale had a higher risk of developing PUs on D0 (r = -0.231; p < 0.001), D10 (r = -0.293; p < 0.05), and Ddischarge (r = -0.644; p < 0.001).

Regarding the GCS score, a higher GCS score was associated with a lower risk of developing PUs on D10 (r = - 0.393, p < 0.001) and Ddischarge (r = - 0.474; p < 0.001).

When looking for a relationship between the assessment of ICU nurses' workload (TISS-28) and the severity of these patients' clinical situation (APACHE II), there was a positive association between the scores obtained and the risk of patients developing PUs (Table 6).

Table 6

Correlation between TISS-28 and APACHE II scores and the risk of developing PUs

PU risk according to the Braden Scale	TISS-28	APACHE II
(D0)	0.323**	0.109 ns
(D10)	0.564**	0.309**
(Ddischarge)	0.473**	0.356**

Note. PU = Pressure Ulcer; D0 = day of admission; D10 = 10th day of ICU hospitalization; Ddischarge = day of discharge; *TISS-28 = Therapeutic Intervention Scoring System; APACHE II = Acute Physiology and Chronic Health Evaluation II score;*

** p < 0.01; ns = Not significant.

To understand the relationship between the development of PUs and the number of days with medical devices, our study found that the nasogastric tube (NG tube) was the medical device with the highest mean length of use, 30.60 ± 32.23 (Min = 0 and Max = 181.7). The urinary catheter had a mean length of use of 28.0 ± 27.98, (Min = 0 and Max =1 85.2), and the mean duration of IMV was 20.05 ± 24.96 (Min = 0 and Max = 162.7). For trauma patients requiring cervical spine immobilization, the mean number of days immobilized was 1.26 ± 5.4, with a maximum of 33.4 days. Patients on ECMO spent a mean of 10.5 ± 23.61 days on this therapy. Patients with the highest number of days with medical devices, such as NG tubes, IMV, cervical immobilization devices, and urinary catheters, had the most PUs, as shown in Table 7.

Table 7

PU development based on the number of days with medical devices

	With PU (n = 57)		Without PU (n = 59)			
Number of days	***M***	***SD***	***M***	***SD***	***t***	***p***
NG tube	43.54	36.56	17.02	19.89	-4.81	**0.001**
IMV	29.98	29.82	9.53	11.81	-4.81	**0.001**
Cervical spine immobilization	2.47	7.30	.10	.44	-2.45	**0.018**
Urinary catheter	37.09	33.85	18.20	15.88	-3.82	**0.001**

Note. PU = Pressure ulcer; M = Mean; *SD* = Standard deviation; NG tube = Nasogastric tube; IMV = Invasive mechanical ventilation.

There was an association between the risk of developing PUs and ECMO therapy, with a higher risk on D0 (p = 0.005).

Discussion

Our study analyzed a non-probability sample of 116 patients admitted to an ICU. The sample was predominantly male with a mean age of 58.98 ± 16.11 years, which was similar to the study by Coyer et al. (2020).

Individuals admitted to the ICU are in a state of greater physiological vulnerability compared to those admitted to other healthcare settings.

One of the most serious complications associated with ICU hospitalizations is the development of PUs, which are associated with a high degree of dependence and the inability to maintain skin integrity. The longitudinal nature of our study distinguishes it from other studies, as patients were assessed at three different moments during

their hospitalization and it incorporated variables such as the use of ECMO and the application of the RASS and GCS scales, considered to be potential risk factors for the development of PUs. The validity and relevance of our study is based on the awareness that PUs are an long-standing and widespread health problem and that solutions are still far from ideal.

All data were analyzed and discussed using the Braden Scale, since this was the instrument used and is the one recommended by the Portuguese National Health Service. The results show that patients in our sample were always at high risk of developing PUs at the three assessed moments, with mean scores ranging from 11.3 to 13.7, similar to those presented by Monteiro (2020) and Sousa et al. (2016). However, this factor may reflect the low specificity and sensitivity of the Braden Scale in the ICU context, as demonstrated by Soares at al. (2023). These authors consider the Cubbin and Jackson and EVARUCI PU risk assessment scales to have a greater sensitivity in the ICU context. Despite their greater sensitivity, the same authors underline the need for further research in order to consolidate their results, since their study is limited by the times of assessment.

The studies also differ with regard to the mean number of days spent in the ICU. In our study, the patients with longer stays were those who required ECMO. This was a differentiating factor compared to the studies by Monteiro (2020) and Sousa et al. (2016), which did not include patients on ECMO. Almost half of our sample (49.1%) had a PU, and of these, some patients had more than one PU (19%). Pachá et al (2018) report a lower prevalence of PUs, with a percentage of 28.6% and variations between 11% and 41.5%. The different types of patients between ICUs may explain these differences. In our study, PUs of category 1 were predominant (59.6%), while in other studies PUs of category 2 were the most common (Monteiro, 2020; Pachá et al., 2018). One third of the patients in our sample (36.3%) came from the community, another third (35.3%) from other ICUs, and the rest (27.6%) from inpatient wards. Patients from inpatient wards had the lowest risk of developing PUs on D0 and D10 compared to patients from other ICUs. The same was true for patients from the community. Monteiro (2020) found that patients coming from the community had a higher PU incidence compared to patients transferred from inpatient wards. However, the author pointed out that patients transferred from other ICUs had the lowest PU incidence. We believe that these differences are due to the wide variation in the type of patients admitted to the different types of ICUs, with our sample having a predominance of level 3 patients (83.6%).

The variability in the level of consciousness and sedation due to immobilization and inability to respond to discomfort was found to be a significant factor in the development of PUs. On D0, more than half of the patients were sedated (69.8%), while at discharge, more than half of the sample was not sedated (64.5%). Patients with higher GCS scores were less likely to develop PUs compared to sedated patients with lower RASS scores. This was particularly true on D0 and D10, when there were more patients with lower mean scores, which implies greater immobility, greater disability and dependence, and thus an increased risk of PUs. The studies by Fernandes and Caliri (2008) and Amini et al. (2022), despite the time difference between them, confirm this finding. Patients with lower GCS scores have a higher risk of developing a PU compared to patients with higher scores. Sayan et al (2019) state that there is a clear association between GCS scores <10 and the development of PUs.

Our study observed that patients receiving norepinephrine infusions were more likely to develop PUs. This finding may be interesting, as the European Pressure Ulcer Advisory Panel (2019) only mentions the use of vasopressors as a risk factor. However, it points out that this is a consensus opinion that is not based on a body of evidence. Thus, we believe that our study can support this finding. In a similar study, Cox et al (2020) also found that more than half of the patients (63.6%) that were given norepinephrine infusions were at risk of developing PUs. The European Pressure Ulcer Advisory Panel (2019) warns of the importance of nutrition in preventing and reducing the risk of developing PUs. Wenzel and Whitaker (2021) recommend starting enteral feeding in ICU patients between the first 24 and 48 hours of hospitalization, when the patient is clinically stable, to avoid potential complications and prolonged hospitalizations, as well as to reduce infections and pressure injuries. In our study, patients who were still not fed at the time of discharge were more likely to develop PUs.

Our study also shows an association between a higher APACHE II score and a higher risk of developing a PU on D10 and Ddischarge. The minimum APACHE II score was 5 and the maximum was 44, with a mean score of 19.96. These results were higher than those presented by Becker et al. (2017), who reported a mean score of 14.9. These authors found that higher APACHE II scores increased the risk of developing PUs by 75%. As the TISS-28 score is an indicator of the level of complex care required by patients, we can see that higher TISS-28 scores are associated with a higher risk of developing a PU on D0, D10, and Ddischarge. These data confirm that the more complex the care, the more time nurses need to spend on providing direct care.

Identifying the patients most at risk at the different assessment moments (D0, D10, Ddischarge) was one of the concerns of our study. Thus, the patients most at risk of developing PUs (lowest score on the Braden Scale) on D0 were those coming from other ICUs, with lower RASS scores, receiving norepinephrine infusions, and subsequently diagnosed with PUs in the ICU, those with more days in the ICU, higher TISS-28 scores, and requiring ECMO, and those who developed two or more PUs during their hospitalization. Patients at higher risk of developing a PU (lower Braden Scale score) on D10 were those coming from other ICUs, with lower RASS and GCS scores on D10, a higher number of days in the ICU, higher TISS-28 and APACHE II scores, and a diagnosis of at least one PU during hospitalization. Patients who were clinically discharged with "improved" status had a higher Braden Scale score (low PU risk) on D10. The patients

with the highest risk of developing PUs on Ddischarge were those with the highest TISS-28 and APACHE II scores and who were without food on Ddischarge. The use and duration of medical devices (NG tube, urinary catheter, cervical collar) and medical therapy (IMV) and increased local pressure were also found to be risk factors for the development of PUs. The results of our study allow us to identify those who are more susceptible to PUs, rather than identifying isolated risk factors. The more vulnerable patients are those with a higher number of hospital days, who use medical devices (NG tubes, IMV, urinary catheters, and cervical immobilization devices), and who have been diagnosed with a PU.

In this context, we suggest the promotion of preventive strategies for PUs, such as the future development and validation of tools to measure the real risk of PUs in more vulnerable patients. Further approaches should also include the use of real-time pressure sensors in areas under medical devices, the implementation of early nutritional assessment and interventions, mattresses equipped with artificial intelligence that automatically adjust pressure, clothing capable of monitoring pressure levels, the use of advanced skin care materials, automated patient mobilization, and nurse training using virtual reality-based simulation (João et al., 2023).

Conclusion

PUs are a consequence of the health status of ICU patients and, as such, patients' susceptibility to PUs varies according to the specific factors involved in each episode of hospitalization.

According to the objective of our study, it was possible to identify the risk factors that characterize the groups of patients most at risk of developing PUs at different moments of hospitalization (D0, D10 and Ddischarge). This made it possible to identify the more vulnerable patients at an early stage, to prescribe nursing interventions in a timely manner, and to monitor their progress.

Within their scope of practice, nurses are responsible for preventing complications and providing differentiated care. As critically ill patients are the target of complex care due to their vulnerable state, it is crucial to understand the extent to which nurses' clinical practice can prevent the consequences of this vulnerability. The limitations inherent in retrospective studies have an impact on the findings and conclusions of our study, therefore the development of prospective case-control or quasi-experimental studies on the development of PUs in ICU patients may help to understand the impact of nursing interventions on these vulnerable patients. Although the literature suggests that PUs occur from D10, we believe that prospective studies with patient assessments prior to D10 could increase the sensitivity of these results.

Furthermore, knowledge of these factors may serve as a basis for the development and implementation of appropriate and feasible protocols to prevent PUs in the ICU setting.

Author contributions

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