Pressure Ulcer: Patient Risk, Patient Acuity, and Nursing Workload*

Úlcera por pressão: risco e gravidade do paciente e carga de trabalho de enfermagem

Úlcera por decúbito: riesgo y gravedad del paciente y carga de trabajo de enfermería

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ABSTRACT

Objectives: to examine the association between pressure ulcer (PU) in critical care patients and their Braden scale score and the association between patient acuity and nursing workload, and to identify the risk factors for pressure ulcer among patients in critical care units (CCUs). **Methods:** This was a cross-sectional study with 74 patients in three CCUs at a major hospital. Data were collected prospectively using the simplified acute physiology score (SAPS II), the nursing activities score (NAS), and the Braden scale. **Results:** Approximately a third of patients (31%) had a PU. Factors associated with PUs were age, days of hospital stay, the score on the Braden scale, and the score on the SAPS II. The score on the NAS was not associated with PUs. Scores on the SAPS II and NAS were moderately correlated with the score on the Braden scale. **Conclusion:** The development of PUs was associated with advanced age, longer hospital stay, and patient acuity. Patient acuity and nursing workload were predictors of UPs.

Keywords: Pressure ulcer/nursing; Intensive care units

RESUMO

Objetivos: Verificar a associação entre ocorrência de úlcera por pressão (UP) em pacientes em estado crítico com escores da escala de Braden, gravidade do paciente e carga de trabalho de enfermagem e, identificar os fatores de risco para UP em pacientes de Unidade de Terapia Intensiva (UTI). **Métodos:** trata-se de estudo transversal realizado em três UTIs de um hospital, cuja coleta prospectiva incluiu dados clínicos e de internação de 74 pcientes e a aplicação dos índices Simplified Acute Phisiology (SAPS II), Nursing Activities Score (NAS) e Escala de Braden. **Resultados:** dos 74 pacientes estudados 31% apresentaram UP. As variáveis que se associaram a presença de UP foram: idade, tempo de internação, escores Braden e SAPSII. O NAS não se associou com ocorrência de UP. Escores SAPSII e NAS apresentaram correlação moderada com escores Braden e foram identificados como fatores de risco para UP. **Conclusão:** A ocorrência de UP associou-se à idade mais elevada, maior tempo de internação e gravidade do paciente. Identificaram-se como preditores de risco para UP a gravidade do paciente associada a carga de trabalho de enfermagem.

Descritores: Úlcera por pressão/enfermagem; Unidades de terapia intensiva

RESUMEN

Objetivos: Verificar la asociación entre la ocurrencia de la úlcera por decúbito (UD) en pacientes en estado crítico con escores de la escala de Braden, gravedad del paciente y carga de trabajo de enfermería e, identificar los factores de riesgo para UD en pacientes de la Unidad de Cuidados Intensivos (UCI). **Métodos:** se trata de un estudio transversal realizado en tres UCIs de un hospital, cuya recolección prospectiva incluyó datos clínicos y de internamiento de 74 pacientes así como la aplicación de los índices Simplified Acute Phisiology (SAPS II), Nursing Activities Score (NAS) y la Escala de Braden. **Resultados:** de los 74 pacientes estudiados el 31% presentó UD. Las variables que se asociaron a la presencia de UD fueron: edad, tiempo de internamiento, escores Braden y SAPS II. El NAS no se asoció con la ocurrencia de UD. Los Escores SAPS II y NAS presentaron correlación moderada con escores Braden y fueron identificados como factores de riesgo para la UD. **Conclusión:** La ocurrencia de la UD se asoció a la edad más elevada, mayor tiempo de internamiento y gravedad del paciente. Se identificaron como predictores de riesgo para la UD la gravedad del paciente asociada a la carga de trabajo de enfermería.

Descriptores: Úlcera por presión/enfermería; Unidades de terapia intensiva

* *Study performed in a tertiary-level university hospital situated in the city of São Paulo (SP), Brazil.*

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INTRODUCTION

Critical patients show peculiar characteristics due to the severity of their clinical conditions, association with complex therapies and the need for more frequent and rigorous surveillance and control. Thus, they are more exposed to invasive procedures and a greater need for handling, causing them to be more susceptible to complications and resulting in greater length of hospital stay[1].

In Intensive Care Units (ICUs), the demand for specialized care using complex technology is high, given the need and concern of the health team to prioritize the stabilization of the patient's critical condition, thus causing procedures to maintain body health, including skin and emotional integrity and family bonds, to be compromised or hindered[2].

In this context, whether because of the difficulty to perform preventive measures to maintain skin integrity or patient severity, the appearance of pressure ulcers (PU), a commonly occurring complication, is observed in critical patients who are hospitalized[3].

In view of such observation, the process of assessment of risk of PU development is essential for the early detection of patients at risk for such injury and resulting implementation of specific preventive measures, in addition to the direction provided for nursing interventions[4].

As regards the appearance of PUs in patients admitted to ICUs, it is important to consider both the severity of their clinical condition and the nursing workload, once these aspects have direct implications for the quality of care provided to patients, quality of life of professionals, and hospital costs[5-13].

When the size of the nursing staff is not determined according to demand for nursing care, excess workload can be one of the factors causing injuries. In addition, priority intensive care and procedures aiming to stabilize physiological changes that put patients at risk of death could be valued, rather than PU preventive care.

Considering the fact that the incidence of PU is an indicator of nursing quality of care, this study was performed to answer the following question: do severe patients with high nursing workload are at risk of developing PU?

OBJECTIVES

To verify the association between the occurrence of PU in critical patients and Braden Scale scores, patient severity and nursing workload, and to identify risk factors for PU in ICU patients.

METHODS

This was a cross-sectional study with data collected prospectively from three ICUs of a tertiary-level university hospital situated in the city of São Paulo (SP), Brazil. Collection began after the study was approved by the *Comitê de Ética em Pesquisa da Universidade Federal de São Paulo* (UNIFESP – Federal University of São Paulo Research Ethics Committee) and authorized by *Hospital São Paulo* ICU managers. It was performed daily between November 2007 and January 2008.

Criteria for inclusion of patients in this study were as follows: to be hospitalized in one of the ICUs, with a minimum stay of 24 hours; and not to have PU when admitted. Patients were assessed during their stay in the ICU and, after being discharged from this unit, were followed until hospital discharge or death.

Collection included socio-demographic, clinical and hospitalization data and the Simplified Acute Physiology Score (SAPS II), Nursing Activities Score (NAS) and Braden Scale were applied to assess patient severity, nursing workload and risk of PU, respectively. Patient medical record was the data source used to obtain the necessary information and, in case of doubt, nurses of respective units were consulted.

The following variables were studied: age, sex, length of ICU stay, length of hospital stay, and NAS, SAPS II and Braden Scale scores.

Nursing workload was assessed by applying NAS, which takes the following data into consideration: monitoring and controls; patient hygiene, mobilization and positioning procedures; family and patient support and care; and administrative and management tasks. NAS was collected based on nursing records related to the 24 hours preceding the moment of collection.

SAPSII scores were used considering absolute values. Index recommendations were used to calculate SAPSII, i.e. the worst value during the 24 hours of hospitalization in the ICU were included for physiological variables; in the case of sedated patients, the Glasgow coma scale value before sedation was used; and the parameter of normality was used when information about variable was unknown. The online system provided by the *Société Française d'Anesthésie et de Réanimation* was used to calculate SAPSII and obtain the final index value[14].

Braden Scale scores were collected daily, in the ICU, until the appearance of PU. Score 18 of the Braden Scale was adopted as the cut-off point for risk of PU, considering values $\leq$9 as very high risk; between 10 and 12 as high-risk, between 13 and 14 as moderate risk, between 15 and 18 as low risk, and between 19 and 23 as absence of risk of development of PU[15].

Data were analyzed using the Statistical Package for the Social Science software, version 13.0. Assessment of adherence of continuous variables to the normal distribution curve was initially made to evaluate the association between the presence of PU and these

variables (Kolmogorov-Smirnov). Variables that showed adherence to the normal curve were compared among patients with and without PU, using Student' s t test. Continuous variables that did not show normal distribution were compared using the Mann-Whitney test.

Spearman correlation coefficient was applied to analyze the correlation between Braden Scale scores and the remaining variables when they did not show a normal distribution, while Pearson correlation was used when this distribution was normal.

The identification of factors associated with the risk of PU was made using multiple linear regression, with Braden Scale scores as dependent variables and nursing workload, severity, age, sex, length of ICU stay and length of hospital stay as independent variables.

Results were considered statistically significant for p value <0.05 and 95% confidence interval.

RESULTS

A total of 74 patients met the inclusion criteria, females (59.5%) in the majority and most frequently aged between 60 and 80 years (43.2%). Mean age was 57.3 years (SD=18.3; min=19, max=86).

Patients admitted to the ICUs came mostly from the Operating Room (46.0%), followed by the Emergency Room (25.6%). The main reasons for hospitalization in the ICU were the postoperative period (50.0%) and respiratory diseases (22.9%).

Mean length of ICU stay was 13.6 days (SD=14; min=2, max=82), of which 40.5% stayed up to seven days hospitalized in these units, followed by 25% who stayed between 8 and 14 days, whereas the mean length of hospital stay was 30.0 days (SD=24.7; min=4 and max=115).

In the sample studied, 26 (35.2%) died during their ICU stay, and 2 (4.2%) of the remaining 48 died during their hospital stay.

Characterization of patients according to clinical and hospitalization data is shown in Table 1.

Mean Braden Scale score was 12.5 (SD=2.4; min=7 and max=19). Of all the patients, the majority (55.4%) had Braden Scale scores between 10 and 12, which represents high risk for PU. Patients with very high risk for PU, Braden scores ≤9, totaled 10.8%. The incidence of PU in the ICUs was 31%, of which the majority (60.9%) of cases was observed in the first week of ICU stay (Table 1).

As regards the nursing workload, mean NAS was 63.4% (SD=11.6; min=37.4 and max=89.8) and mean SAPS II was 40.7 (SD=14.5; min=12 and max=75). (Table 1)

Results of the analysis of associations between continuous variables with the presence of PU or not is shown in Table 2.

By analyzing the associations between continuous variables and presence of PU (Table 2), patients with an injury had a higher mean age (p=0.044) and a longer ICU (p=0.003) and hospital stay (p=0.038), showed lower mean Braden scores (p=0.003) and were in a more serious condition (p=0.043). The only variable that did not show association with the presence of PU or not was the workload assessed by the NAS (p = 0.702).

In the correlation analysis, Braden scores reached a weak level of correlation with the length of hospital stay (r= - 0.25) and length of ICU stay (r= - 0.28), and a moderate level of correlation with SAPSII (r= - 0.58) and NAS (r= - 0.54).

Table 1 - Patients (n = 74), according to clinical and ICU stay variables. Hospital São Paulo/UNIFESP, Nov-Dez/2007 and Jan/2008. São Paulo, Brazil, 2008

Variables	n	%	Mean	SD	Median	Minimum	Maximum
Braden			12.5	2.4	12.2	7.0	19.0
≤ 9 – very high risk	8	10.8					
10 to 12 – high risk	41	55.4					
13 to 14 – moderate risk	13	17.6					
15 to 18 – low risk	11	14.9					
19 to 23 – no risk	1	1.3					
Presence of PU							
Yes	23	31.0					
No	51	69.0					
Length of time until PU (days)			9.1	11.0	4.0	1.0	48.0
until 7	14	60.9					
from 8 to 14	4	17.4					
from 15 to 21	2	8.7					
22 or more	3	13.0					
NAS			63.4	11.6	65.0	37.4	89.8
SAPS II			40.7	14.5	40.5	12.0	75.0

Table 2 - Mean of demographic, clinical and patient ICU stay variables, according to presence of PU or not. Hospital São Paulo/UNIFESP. São Paulo, Brazil, 2008

Variables	PU				P value
	Yes		No		
	Mean	SD	Mean	SD	
Age (years)	63.35	16.15	54.53	18.74	0.044
Length of hospital stay (days)	39.13	24.89	25.94	23.78	0.038*
Length of ICU stay (days)	23.13	19.84	9.29	7.37	0.003*
Braden Scale	11.30	2.06	13.01	2.37	0.003
SAPS II	45.87	14.36	38.37	14.08	0.043
NAS	62.61	11.85	63.75	11.60	0.702

*Mann-Whitney test

Table 3 - Multiple linear regression analysis of risk of pressure ulcer in ICU patients. Hospital São Paulo/ UNIFESP. São Paulo, Brazil, 2008

Model	Variables	Coefficient		CI		R	R^2a	P value
		β1	SE	lower	upper			
1	Intercept	16.38	0.69	15	17.75	0.58	0.33	0.00
	SAPS II	-0.58	0.02	-0.13	-0.06			
2	Intercept	20.04	1.19	17.67	22.42	0.66	0.42	0.00
	SAPS II	-0.42	0.02	-0.1	-0.04			
	NAS	-0.36	0.02	-0.12	-0.03			
3	Intercept	18.31	1.51	15.29	21.32	0.68	0.44	0.07
	SAPS II	-0.44	0.02	-0.1	-0.04			
	NAS	-0.32	0.02	-0.11	-0.03			
	Sex	0.16	0.44	-0.08	1.67			
4	Intercept	18.2	-0.41	15.2	21.21	0.69	0.45	0.18
	SAPS II	-0.41	-0.3	-0.1	-0.04			
	NAS	-0.3	0.17	-0.1	-0.02			
	Sex	0.17	-0.12	-0.05	1.68			
	Length of ICU stay	-0.12	-0.41	-0.05	0.01			

The identification of determining factors of risk of PU was made using multiple linear regression analysis, with the Braden Scale score as dependent variable and all variables that showed correlation with a p value below 0.20 in the univariate analysis as independent variables.

A total of four models were tested (Table 3), of which the second was selected, once the inclusion of the remaining variables did not result in adjustment of the impact of the independent variables on the dependent one (Braden Scale).

In the final model, patient severity of condition (SAPSII) and nursing workload (NAS) were identified as independent predictors of risk, with the increase in one NAS score unit resulting in a reduction of 0.36 in the Braden Scale score (increasing the risk of PU) and the increase in the SAPS score being associated with a reduction of 0.42 in the Braden Scale score (increasing the risk of PU). These two variables explained 42% (r2a= 0.42) of this scale's score variability.

DISCUSSION

This study showed results that point to aspects which must be considered in the context of intensive hospital treatment.

Thus, assessment of risk of PU using the Braden Scale becomes necessary, aiming at early detection and the adoption of suitable interventions. It should be emphasized that other factors in the patient himself or the context of care, such as patient severity of condition and nursing workload, must also be considered, once they may contribute to the appearance of PU.

As regards the occurrence of PU, this study revealed a high incidence (31%), similarly to the finding from another national study, whose incidence was 37.7%[16]. In addition, a high frequency of occurrence of PU (44%) was observed in a Brazilian study performed in Neurology, Emergency Department and Medical Clinic ICUs of a major university hospital, whose high incidence is probably associated with severity of patients cared for and the institution's characteristics[17].

Lower rates could be expected, considering that the incidence of PU is an indicator of quality of patient care and safety. Results of studies performed in Holland and Germany show a much lower incidence (3.3%), in relation to that observed in this study, in a population

comprised of 56.2% of male patients, 19% unconscious and with a mean ICU stay of 7 days[18].

With the application of the Braden Scale, a predominance of patients (98.7%) at risk of PU (Braden score≤18) was observed, a result similar to that found in another national study performed in an ICU of a major referral university hospital, where 88.5% of the population studied showed a Braden score≤18[17]. These findings indicate the vulnerability of ICU patients to PU.

In the analysis of care needs and nursing work demand, mean NAS found in this study (63.4%) was not different from the values observed in other national studies, whose variation was between 51% and 70.7%[19-22]. The differences found in the amount of workload in these studies could be explained by both the characteristics of the patients in the ICUs and the nature of hospitals (public or private, university-associated or not).

Patient severity of condition, observed in the first 24 hours of hospitalization in the ICUs, resulted in a mean SAPSII of 40.7 points, a value considered high when compared to certain Brazilian studies, whose mean SAPSII varied between 27 and 44.9 points[23].

In this study, the occurrence of PU was associated (p=0.044) with higher mean age (63.35 vs 54.53 years), although not as high as that observed in a multi-center study performed in Finland, together with general and rehabilitation hospitals, in addition to health centers, whose mean age of patients with PU was 75 years[16]. It should be emphasized that age is indicated as one of the most relevant factors involved in the appearance of PU[24-25]. Moreover, vulnerability to health problems increases with population aging, with the resulting need for interventions that require longer length of hospitalization and intensive care, aiming to stabilize the patient's clinical condition.

Mean Braden scores of the group of patients with PU (11.3) was statistically associated (p=0.003) with higher risk of PU. Similar result was found in other national studies. In addition to the risk identified by the Braden scores, a predominance of the use of controlled mechanical ventilation, sedatives, vasopressors and cardiotonics was found among patients who developed PU. This fact directly influences Braden Scale domain scoring, decreasing the total score and increasing the risk of PU(5,17). Severity of patients who had PU, mean SAPSII of 45.87 points, was statistically higher (p=0.043), indicating that the higher the patient's severity of condition, the greater the incidence of PU. Patients' SAPSII scores in this study reflect unstable hemodynamic conditions, whose therapy consisted of vasoactive drugs, sedatives and analgesics; which could contribute to a reduction in the organism's reflexive and protective responses, restricting its physical mobility and sensory perception and contributing to the appearance of PU.

In the analysis of the association between NAS and the presence of PU (Table 2), a significant statistical association was expected to be found. This, however, was not observed (p=0.702). Such observation could be associated with the amount of workload itself, once the NAS scores the care needs required by patients in 24 hours; thus, a high workload may mean that the patient is being sufficiently cared for, reducing the occurrence of PU.

By analyzing the risk factors for PU, this study showed that the nursing workload and patient severity condition explained only 42% of the Braden Scale score variability, suggesting that other factors, and not only these variables, determine the patient's risk of developing PU.

In the present study, factors that have already been studied, such as age, length of hospital and ICU stay and the risk calculated by the Braden Scale, confirmed their association with the occurrence of PU. Although an association between nursing workload and the incidence of PU could not be found, a moderate correlation between both scores was observed.

Despite the results having enabled the identification of patient severity and nursing workload as risk factors for PU, it is important to consider, in this preliminary analysis, the aspects that could have limited the study, such as the sample size, data obtained from only one hospital and the fact that the types of therapies were not included in the analysis. Thus, it is the researchers' intention to increase sample size and perform analyses, considering types of therapies and, above all, NAS and Braden Scale domains.

CONCLUSIONS

Results from this study revealed a high incidence of PU (31%), observed in patients of the ICUs studied and associated with aging, longer length of ICU and hospital stay and higher patient severity of condition. Workload was not associated with the occurrence of PU, although it was identified as a predictor of risk of PU when associated with patient severity.

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