

## Pressure Injury in Intensive Care Unit: prevalence and associated factors in patients with COVID-19


*Lesão por pressão em unidade de terapia intensiva: prevalência e fatores associados em pacientes COVID-19*

*Lesión por Presión en Unidad de Cuidados Intensivos: prevalencia y factores asociados en pacientes COVID-19*

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### ABSTRACT

**Objective:** To determine the frequency of pressure injuries and identify associated risk factors in patients affected by COVID-19 admitted to an intensive care unit.

**Method:** Cross-sectional, retrospective study with a quantitative approach carried using a documentary research. The sample included 393 medical records that were in accordance with our inclusion criteria, selected from March 2020 to March 2021 in a hospital in the south of Brazil. Data were analyzed using descriptive statistics in the software Bioestat 5.

**Results:** The prevalence of pressure injuries in COVID-19 patients was 42%, the risk factors associated with these injuries were hospitalization time, ventilation treatment, and staying in the prone position, all with a significance of  $p < 0.05$ .

**Conclusion:** Patients with COVID-19 are subject to several unmodifiable factors that are determinant for the appearance of pressure injuries. Therefore, preventive measures should be rigorously applied to this population.

**Keywords:** COVID-19. Pressure ulcer. Critical care. Nursing. Intensive care units.

### RESUMO

**Objetivo:** Determinar a ocorrência de lesões por pressão e identificar fatores de risco associados em pacientes acometidos pela COVID-19 internados em unidade de terapia intensiva.

**Método:** Estudo transversal, retrospectivo com abordagem quantitativa realizado por meio pesquisa documental. Para a amostra selecionou-se 393 prontuários que contemplaram os critérios de inclusão, no período de março de 2020 a março de 2021, de um hospital da região sul brasileira. Os dados foram analisados por meio de análise estatística descritiva, utilizou-se o programa estatístico Bioestat 5.0.

**Resultados:** A prevalência de lesões por pressão em pacientes com COVID-19 foi de 42%, os fatores de riscos associados a lesões foram o tempo de internação, terapia ventilatória e a posição prona com significância ( $p < 0,05$ ).

**Conclusão:** Pacientes com COVID-19 estão sujeitos a diversos fatores não modificáveis que são determinantes no surgimento de lesões por pressão. Portanto, infere-se que as medidas de prevenção devem ser rigorosamente aplicadas nessa população.

**Palavras-chave:** COVID-19. Lesão por pressão. Cuidados críticos. Nursing. Unidades de terapia intensiva.

### RESUMEN

**Objetivo:** Determinar la ocurrencia de lesiones por presión e identificar los factores de riesgo asociados en pacientes con COVID-19 ingresados en una unidad de cuidados intensivos.

**Método:** Estudio transversal, retrospectivo con enfoque cuantitativo realizado a través de investigación documental. Para la muestra, fueron seleccionados 393 prontuarios que cumplieron con criterios de inclusión, de marzo de 2020 a marzo de 2021, originarios de un hospital del sur de Brasil. Los datos fueron analizados mediante análisis estadístico descriptivo, utilizando el programa estadístico Bioestat 5.0.

**Resultados:** La prevalencia de lesiones por presión en pacientes con COVID-19 fue del 42%, los factores de riesgo asociados a las lesiones fueron la estancia hospitalaria, la terapia ventilatoria y el decúbito prono con significación ( $p < 0,05$ ).

**Conclusión:** Los pacientes con COVID-19 están sujetos a varios factores no modificables que son determinantes en la aparición de lesiones por presión. Se infiere que las medidas preventivas deben ser estrictamente aplicadas en esta población.

**Palabras clave:** COVID-19. Úlcera por presión. Cuidados críticos. Enfermería. Unidades de cuidados intensivos.

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## ■ INTRODUCTION

Considered to be the first worldwide pandemic of the new millennium, COVID-19 is a respiratory infection caused by the virus SARS-CoV-2. It can be a grave infection, developing into acute respiratory distress syndrome. This is why it led to high rates of admission in Intensive Care Units (ICU), and, consequently, to a high mortality rate<sup>(1)</sup>.

Due to the complexity of the hospitalizations in ICUs, the critical patients require multiple life-supports mechanisms. These, associated with reduced or nonexistent mobility, clinical instability, invasive devices, and a long hospitalization time, are predictors of vulnerability to pressure injuries. A previous study showed that this type of injury has an incidence of 39.3%, which makes it one of the most common adverse events in critical patients<sup>(2)</sup>.

The lesions are formed by intense pressure or shearing of tissues and can lead to reduced tissue perfusion and cause tissue necrosis. According with the National Pressure Injury Advisory Panel (NPIAP), this type of injury can be classified in several stages, varying from a stage 1 to a stage 4 injury, in addition to deep tissue pressure injury and unstageable pressure injury. Additionally, it can be defined as mucosal membrane pressure injury or medical device related pressure injury<sup>(3)</sup>. Patients with COVID-19 are more likely to acquire pressure injuries due to the systemic inflammation associated with complications such as low oxygen saturation, hemodynamic alterations, hypercoagulability, among other dysfunctions the disease can generate, in addition to extrinsic factors associated to the workload of workers in the setting of COVID-19, the lack of human resources and materials, factors that also increase the risk of pressure injuries<sup>(3,4)</sup>.

As an adjuvant treatment for severe hypoxemia, the use of the prone position also increases the likelihood of pressure injuries. This technique consists in positioning the patient in a prone position to improve pulmonary mechanics and gaseous exchanges in the acute respiratory distress syndrome<sup>(5)</sup>. The prone position is indicated when the ratio of partial arterial oxygen pressure to fraction of inspired oxygen (PaO<sub>2</sub>/FiO<sub>2</sub>) is below 150 mmHg, and can last, approximately, from 16 to 20 hours<sup>(6)</sup>.

Considering the high number of pressure injuries in ICUs, especially in COVID-19 patients, it is relevant to research the topic, according with our understanding of related factors. This study aimed to determine the occurrence of pressure injuries and identify associated risk factors in patients with COVID-19 hospitalized in intensive care units.

## ■ METHOD

This is a cross-sectional, retrospective, quantitative study, based on document research in the patients' electronic records (PER). We analyzed 1000 records of patients diagnosed with COVID-19 from March 27, 2020, to March 1st, 2021. Only 393 of them were hospitalized in the ICU and, therefore, the other 607 records were excluded.

The site of the study was a COVID-19 ICU with 24 beds, in a large hospital in the south of Brazil that attended only the adult population. The sample was non-probabilistic, including data from all participants hospitalized in this ICU during the period analyzed, as long as they had a positive COVID-19 diagnosis. Exclusion criteria comprised patients whose COVID-19 diagnosis was not confirmed, who were hospitalized in a unit other than the ICU, and who were not hospitalized in the period determined by this research. Patients from other institution were also excluded.

Data collection took place using a control table used by the institution, which listed all patients diagnosed with COVID-19 and hospitalized in the period reported. Patient data was extracted from the PER, including sex, age, outcome, ventilation therapy, prone, days of hospitalization, pressure injuries, stage of pressure injuries, place of hospitalization, and comorbidities. The data was input into Microsoft Excel® spreadsheets after processing, and later analyzed in a statistical program.

The data collection process was carried out by professionals from the health field. This stage took place after a training session, in which a pretest with 10 patients of the study was carried out, in order to clarify doubts about data collection. We only used data that was followed up and updated by a professional, and only when the researcher and the person whose information was analyzed were not connected in any way nor knew each other.

Since this is a non-probabilistic sample, we included all patients with COVID-19 diagnoses who were hospitalized in an ICU in the research period. Nonetheless, document research in PER can show inconsistencies, such as no records of progress or jeopardized professional evaluations. Nonetheless, the PER records provide full access to the patient history and safer data collection, since data that include progress are situations that involved the patient and are associated with a minute, systematic, PER analysis; these patients, as well as all patients hospitalized in a COVID-19 ICU, who were also included. These measures were taken to avoid measurement bias.

To characterize the sample, continuous variables were summarized using means and standard deviation, or medians and interquartile ranges, in case they were asymmetric. Categorical variables were presented using absolute and relative frequencies. To compare interest variables according with the presence of lesions, hypothesis tests were used. Continuous variables were compared using Student's t test, which is parametric, while asymmetric variables used Mann-Whitney's, which is not. Categorical variables were compared using the chi-squared test. We considered a significance level of 5% for the hypothesis tests. The statistical software Bioestat 5.0 was used.

This study was carried out in agreement with Research Ethics Committee from the National Council of Health<sup>(7)</sup>, and approved by the Research Ethics Committee of the Universidade de Passo Fundo, under opinion 4.026.096.

## ■ RESULTS

Among the 393 records analyzed, 250 (63.6%) were male. The mean age was 63.09 and the standard deviation 63.1

± 15.7, with patient age varying from 19 to 100 years. 144 (36.6%) were younger than 60, and 249 (63.4%) were older. From these 393 patients, 251 did not survive (63.8%). 168 (66.9%) of the patients who died were male.

The prevalence of pressure injuries was 167 (42.5%), with a maximum of four lesions per patient. From 167 patients who presented lesions, 103 (61.7%) were related to the prone position, that is, their lesions were on the face, the anterior thorax, the abdomen, and the knees. Considering the patients who presented injuries, 118 (70.6%) were male, 109 (65.3%) were older than 60 years, (115) 68.9% did not survive. From those who died, 91 (79.1%) were male.

As Table 1 shows, there was a statistically significant association between pressure injuries and the number of days in the ICU, ventilation therapy (mechanical ventilation), and the prone position. There was no association with age.

189 (48.1%) had been put in a prone position. The anatomic regions most affected by pressure injuries are the sacrum and the face region, as presented in Table 2. The most common stage of the injuries was stage 2. There were no deep tissue pressure injuries, medical device related pressure injuries, or mucosal membrane pressure injuries.

**Table 1** – Distribution of age, days of hospitalization, prone position, and use of mechanical ventilation, according with the presence of injuries. Passo Fundo, Rio Grande do Sul, Brazil, 2021.

Variables	Presence of Injuries			P-value
	Yes	No	Total	
<b>Age</b>	62.2 ± 14.7 (n=167)	63.7±16.3(n=226)	63.1±15.7(n=393)	0.342*
<b>Days of hospitalization</b>	20.0[14.0;30.0] (n=167)	11.0 [7.0; 19.0] (n = 226)	15.0 [9.0; 24.0] (n = 393)	< 0.001†
<b>Prone position</b>				
Yes	139/167 (83.2%)	50/226 (22.1%)	189/393 (48.1%)	< 0.001‡
No	28/167 (16.8%)	176/226 (77.9%)	204/393 (51.9%)	
<b>Use of mechanical ventilation</b>				
Yes	165/167 (98.8%)	149/226 (65.9%)	314/393 (79.9%)	< 0.001‡
No	2/167 (1.2%)	77/226 (34.1%)	79/393 (20.1%)	

Source: Research data, 2021.

\* Student's t test; † Mann-Whitney's Test; ‡ Chi-squared test

**Table 2** – Distribution of frequency of injuries according to stage and anatomic location of the pressure injury. Passo Fundo, Rio Grande do Sul, Brazil, 2021.

Variables	n/N (%)
<b>Location</b>	
Sacrum	72/393 (18.3%)
Face	52/393 (13.2%)
Anterior thorax	48/393 (12.2%)
Other locations*	37/393 (9.4%)
Knee	28/393 (7.1%)
Calcaneus	18/393 (4.6%)
Abdomen	10/393 (3.6%)
Coccyx	8/393 (2.0%)
<b>Stage</b>	
Stage 2	136/393 (34.6%)
Stage 3	42/393 (10.7%)
Stage 1	22/393 (5.6%)
Stage 4	3/393 (0.8%)

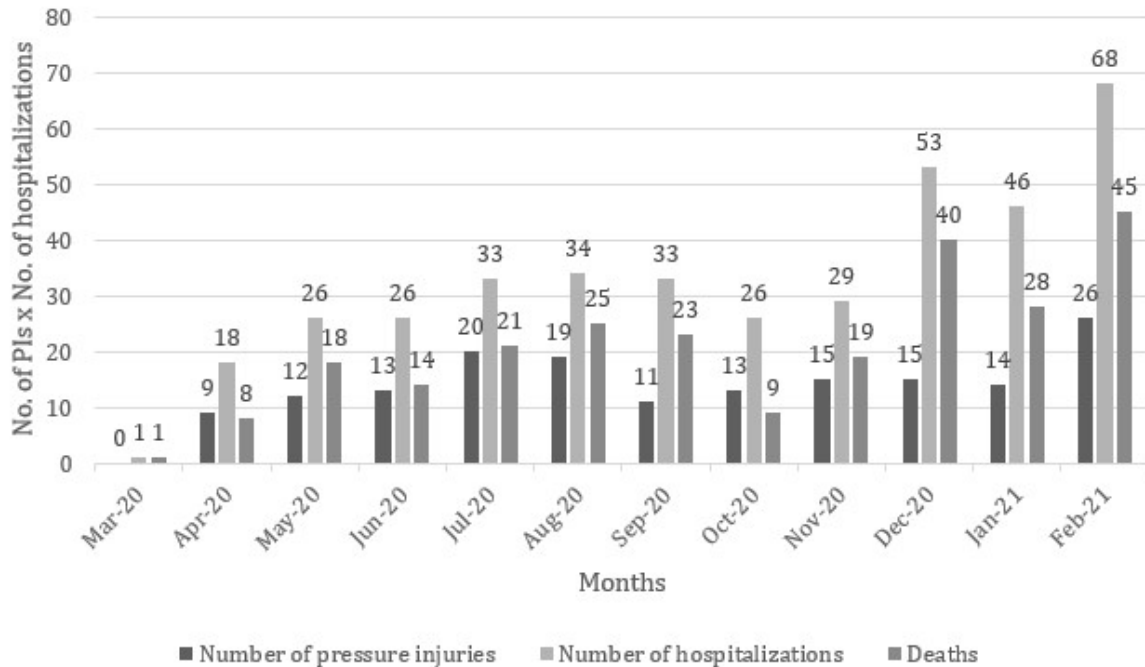
Source: Research data, 2021.

\*Other locations: upper and lower limbs.

Regarding the investigation of comorbidities, the highest number of comorbidities in a single patient was seven, with a median of two, and an interquartile range of 1-3. From the 393 patients, 343 (87.3%) had some type of comorbidity. 147 of them (42.9%) presented pressure injury. Therefore, from the 167 patients with pressure injuries, 147 (88%) presented some comorbidity. The most common were systemic arterial hypertension (229 – 66.8%), diabetes mellitus (132-38.5%), asthma (10-2.9%), chronic obstructive pulmonary disease (22-6.4%), cancer (29 – 8.5%), dyslipidemia (19 – 5.5%), hypothyroidism (41 – 12%), psychiatric disorder (26 – 7.6%), cardiovascular disease (32-9.3%), and smoker or ex-smokers (72 – 21%).

Regarding ventilation therapy, 314 (80%) of patients used mechanical ventilation. 58 (15%) alternated between face masks and noninvasive mechanical ventilation, 14 (3%) used nasal cannula, 3 (1%) used high flow nasal cannula, while 4 (1%) used ambient air. Mechanical ventilation patients were more likely to suffer pressure injuries, as Table 1, above, showed.

As we uncovered the number of hospitalized patients, pressure injuries, and deaths during the research, we also observed that the highest number of hospitalizations took place in February 2021, followed by December 2020, which, despite its 53 hospitalizations, presented the same number of pressure injuries as November 2020, which only registered 29 hospitalizations (Figure 1).



**Figure 1** – Number of pressure injuries in hospitalized patients and number of deaths in a COVID-19 Intensive Care Unit, from March 2020 to February 2021. Passo Fundo, Rio Grande do Sul, Brazil, 2021.

Source: Research data, 2021.

\*PI: pressure injury

## DISCUSSION

The results of this study suggest that COVID-19 patients with acute respiratory distress syndrome are more likely to develop pressure injury, especially when in prone positions. Years before the pandemic, studies had already found an association between pressure injuries and this position, finding more lesions in prone patients than in those lying on their back<sup>(8)</sup>.

Considering body sites in isolation, the most affected by pressure injuries was the sacrum, in accordance with other researches which also show this region to be the most affected<sup>(9–11)</sup>. Due to the instability and context of the patient with COVID-19, their pathophysiological changes, the need for multiple invasive devices, vasoactive drugs, and sedation, the possibility of repositioning the patient is often limited, and associated with other complicating factors that contribute for the appearance of pressure injuries<sup>(3,12)</sup>.

Although there is still a high prevalence and incidence of lesions in patients who lie on their backs, certain lesions, common in the prone position, stand out, as they seldom occurred before the pandemic and became significantly more common as this position was widely adopted as part of the routine of the patient with acute respiratory distress

syndrome. Among these, stand out facial injuries<sup>(13)</sup>, followed by ulcers in the thorax, knees, and abdomen, which accounted for 103 (62%) of all pressure injuries found in this study. Regarding the stage of the lesions, this study corroborates other researches in which most lesions were in stage 2<sup>(14,15)</sup>, followed by stage 3, 1, and 4. There were no deep tissue, unstageable, mucosal membrane, or medical device-related pressure injuries. We believe that these types of injury did occur, but the lack of knowledge of professionals or other unknown factors prevented them from being reported in the PER of the patients, preventing their analysis in this study.

A multicentric study showed the predominance of pressure injury in males<sup>(15)</sup>, corroborating our findings. It can be inferred that the high admission rates of males in the ICU reflects the little preoccupation of men about their health, as well as their little adherence to government or private disease-prevention programs<sup>(16)</sup>.

Evidence also confirm that elders are more often victimized by pressure injuries. Due to population aging, we can infer that this population is the one who is most often hospitalized in ICUs, with multiple comorbidities, immobility and alterations in skin structure as concomitant factors that contribute to form the lesion<sup>(15)</sup>. This study presented no statistically significant correlation between age and pressure

injury. Nonetheless, most patients with pressure injuries were elders, with 65% of them above 60 years old.

Ventilation therapy is also directly associated, being a complication of pressure lesions<sup>(15)</sup>. According with a retrospective cohort, with 766 patients from nine ICUs in São Paulo, Brazil, patients under mechanical ventilation are three times more likely to develop pressure injury. This is due to their reduced mobility or even immobility, associated with sedatives and/or analgesics that make position changes more challenging<sup>(9)</sup>. Hospitalization time is also directly connected to an increase in the likelihood of pressure injury. A case-control study in five Brazilian ICUs indicated that a hospitalization that lasts more than seven days corroborates for the appearance of this type of lesion<sup>(14)</sup>.

Comorbidities are complicating factors in COVID-19 patients. A study carried out in China found that half the patients affected by the disease had pre-existing chronic pathologies<sup>(17)</sup>. In this study, 88% of patients with pressure injuries had some type of comorbidity. Considering this context, although these comorbidities are not direct causes for the development of pressure lesions, it can be assumed that the clinical severity of a patient's situation, coupled with longer hospitalization and nutrition, can trigger or worsen pressure injuries<sup>(18)</sup>.

A patient in critical situation is likely to stay longer in the ICU. Consequently, this patient's skin has a higher chance of developing pressure injuries<sup>(10)</sup>. The alterations in this organ are different in COVID-19 patients, due to microvascular occlusion in tissues exposed to intense pressure and/or shearing. In the critical patients, other organs also attempt to maintain homeostasis, which, in turn prevents adequate oxygenation and nutrition, making the skin more susceptible to pressure injury<sup>(10)</sup>.

Isolate risk factors are not predictors of pressure injury, but collaborate for its development<sup>(2-19)</sup>. Currently, pressure injuries are associated to the quality factor in the assistance of health institutions<sup>(9)</sup>. Nonetheless, unmodifiable factors are evident in patients affected by COVID-19 and are inherent to the pathology or to the clinical condition of the patient. They are a relevant factor for the appearance of pressure injury. Therefore, each specific case and its associated conditions must be carefully evaluated, in order to assess the quality of care based on this indicator.

The prevalence of pressure injury in this study was 42%. A research carried out in 1117 ICUs in 90 countries found a prevalence of 16.2% in patients with pressure injuries found in the ICU, with higher levels in low-to-medium income countries<sup>(15)</sup>. We believe that the higher rate in this study is due to the fact that the patient with COVID-19 has certain specificities that contribute for the appearance of pressure

injury, which were described above. Furthermore, the high prevalence of this health issue can be related with the context generated by the pandemic, including institutional difficulties, work overload, lack of qualified human resources, and lack of supplies<sup>(3,20)</sup>.

A limitation of this study is the fact that it is a document research, and health records are completely reliant on the assessment and progress report of the worker who is filling them in. Therefore, it may present inconsistencies. On the other hand, this research provides contributions to the field as it brings to light unprecedented knowledge in its results. It can give support to activities in health education, human resource training, and foment innovative solutions in the reality found, considering a pathology that deserves attention, due to its severity and incidence.

## ■ CONCLUSION

The prevalence of pressure injuries was associated to a longer hospitalization time, ventilation therapy, and to the prone position. Patients with COVID-19 in the ICU are affected by several non-modifiable factors, and, therefore, are more likely to develop pressure injuries. Therefore, preventive measures should be more rigorous in regard to this population.

Pressure injuries are a significant challenge for health systems, patients, workers, and family. This calls attention to the relevance of this study, as it tries to guide the clinical practice of nurses towards COVID-19 patients, considering the countless specificities and risk factors that these patients present, and searching new ways to prevent these health issues. It is also useful as a way to acquire new information and reflect on the cause of these ulcers and their prevalence. Considering the above, we believe it necessary to foment further studies on the topic, encouraging continued efforts towards increasingly qualified and effective practices to prevent pressure injury.

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