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ORIGINAL

Incidence of prone position pressure sores during the COVID-19 pandemic: a cohort study

Incidência de lesão por pressão em posição prona durante a pandemia de COVID-19: um estudo de coorte

Incidencia de lesión por presión en decúbito prono durante la pandemia de COVID-19: un estudio de cohorte

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ABSTRACT

Objective: this study aimed to assess the incidence of prone-positioning pressure sores and its risk factors in patients admitted to intensive care units diagnosed with COVID-19. Methods: a six-month follow-up prospective cohort study (n=30) was conducted. Information regarding proning status, duration of prone position (PP), presence or absence of PPPS, and sociodemographic and clinical variables were collected. Descriptive and inferential statistics were performed to compare the patients who developed or did not develop pressure sores. Poisson regression with robust variance was used for data analysis. Results: the mean PP time was 20.1 hours (SD=3.9). The incidence of PPPS was 70%, with the most common locations being the left chest, abdomen, cheek, and forehead. When comparing the groups with and without prone-positioning pressure sores, there was no difference between them (p>0.05). Conclusion: the incidence of prone-positioning pressure sores was not associated with any sociodemographic or clinical variable of the patients. Poisson regression with robust variance was used for data analysis
Descriptors: COVID-19; Prone position; Pressure injury.

RESUMO

Objetivo: avaliar a incidência de lesão por pressão na posição prona e seus fatores de risco em pacientes admitidos em unidades de terapia intensiva diagnosticados com COVID-19. **Métodos:** trata-se de um estudo de coorte prospectiva (n=30) com duração de seis meses. Informações relacionadas a estado da prona, tempo de duração, presença ou ausência de lesão por pressão e características sociodemográficas e clínicas foram coletadas. Estatística descritiva e inferencial foi realizada para comparar os pacientes que desenvolveram e os que não desenvolveram lesão por pressão. Para análise dos dados, foi utilizada Regressão de Poisson com variância robusta. **Resultados:** o tempo médio na posição prona foi de 20,1 horas (DP=3,9). A incidência de lesão por pressão foi de 70%, sendo as localizações mais comuns: tórax esquerdo, abdômen, bochechas e testa. Ao comparar os grupos com e sem lesão por pressão, não houve diferença entre eles (p>0,05). **Conclusão:** a incidência não foi associada a nenhuma variável sociodemográfica ou clínica dos pacientes.
Descritores: COVID-19; Posição prona; Lesão por pressão.

RESUMEN

Objetivo: evaluar la incidencia de lesión por presión en decúbito prono y sus factores de riesgo en pacientes ingresados en unidades de cuidados intensivos con diagnóstico de COVID-19. **Método**: se trata de un estudio de cohorte prospectivo (n=30) con una duración de seis meses. Se recolectó información relacionada con el decúbito prono, tiempo de duración, presencia o ausencia de lesión por presión y características sociodemográficas y clínicas. Se realizó estadística descriptiva e inferencial para comparar pacientes que desarrollaron y no desarrollaron lesiones por presión. Para el análisis de datos se empleó la regresión de Poisson con varianza robusta. **Resultados**: el tiempo medio en decúbito prono fue 20,1 horas (DE=3,9). La incidencia de lesiones fue 70%, siendo las localizaciones más frecuentes: tórax izquierdo, abdomen, mejillas y frente. Al comparar los grupos, no hubo diferencia (p>0,05). **Conclusión:** la incidencia no se asoció con ninguna variable sociodemográfica o clínica de los pacientes.
Descriptores: COVID-19; Posición Prona; Úlcera por Presión.

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INTRODUCTION

The infection caused by coronavirus disease 19 (COVID-19), in its severe form, can lead to the development of acute respiratory distress syndrome (ARDS), whose treatment involves admission to intensive care and mechanical ventilation[1]. Nevertheless, the patient may have hypoxaemia that is refractory to these therapeutic resources and may need adjuvant alternatives to improve oxygenation, such as the prone position (PP)[2].

PP is indicated in the management of patients diagnosed with severe ARDS when the ratio between the partial pressure of arterial oxygen (PaO_2) and the fraction of inspired oxygen (FiO_2) is less than 150 mm Hg (PaO_2/FIO_2 <150 mm Hg)[3]. According to studies, early PP has been shown to reduce mortality in these patients[3,4]. Although PP has a pulmonary protective effect, complications can occur, such as accidental extubation, hypotension, facial edema, removal of medical devices, bronchoaspiration, corneal abrasion, brachial plexus injury, and pressure sores[5].

Pressure injuries usually occur in tissues underlying a bony prominence or related to a medical device[6]. When they are related to the PP, they can be called prone-positioning pressure sores (PPPS)[7], whose incidence varies from 14% to 56.9%[5,8,9].

The prevalence of pressure-related injuries in health care institutions is considered an indicator of the quality of nursing care[10]. Considering nurses have primary responsibility for pressure injury risk assessment and skin integrity management, investigating the incidence of pressure injuries in the prone position, which came to be used more frequently during the pandemic, as a result of the management of critically ill patients affected by COVID-19, will assist in the implementation of effective measures to prevent this adverse event, thereby contributing to patient safety and well-being.

This study aimed to assess the incidence of PPPS and its risk factors in patients admitted to intensive care units (ICUs) diagnosed with COVID-19.

METHODS

Design

Cohort study reported in line with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement[11].

Participants and settings

All adult patients diagnosed with COVID-19 undergoing PP for the treatment of ARDS, admitted to the ICU during the data collection period, under mechanical ventilation, to be aged 18 or over and free of PPPS before undergoing PP were considered eligible to participate in the study. The study was carried out in a university hospital of Campinas, state of São Paulo, Brazil, with a capacity of 410 beds, including 53 ICU beds, and out of these 30 beds were intended for patients diagnosed with severe ARDS caused by COVID-19.

Severe ARDS was defined as a PaO2/FIO2 (partial pressure oxygen in arterial blood/fraction of inspired oxygen) ratio of <150 mmHg with a FIO2 of ≥ 0.6, a positive end expiratory pressure (PEEP) of ≥5 cm H2O, and a tidal volume (V_T) of 6 ml/kg predicted body weight[3].

Procedure

A six-month follow-up prospective cohort study was conducted from September 2020 to February 2021. Before the patient was submitted to PP, a physical examination was performed, with inspection of the entire surface of the skin for changes, applying the Braden Scale[12] and Acute Physiology and Chronic Health Evaluation II (APACHE II)[13], and clinical information was collected from the medical and nursing charts by trained researchers. At the end of the positioning, a physical examination was performed, looking for PPPS, such as injuries on the forehead, cheek, ala nasi, lip, chin, chest, knee, leg, or toes. In the absence of PPPS, follow-up was maintained until the appearance of PPPS, discharge, or death.

All patients placed in the PP received a letter-C-shaped pad on the head to prevent facial pressure injuries, and limbs were positioned to prevent abnormal extension or flexion against the shoulders and elbows. Pillows were added to provide additional support to the hips and shoulders, and adjustment was made to the transverse rollers placed below the pelvis and chest in patients with poor neck flexibility, following university hospital protocol.

Demographic and clinical information

A form was used with questions involving age, sex, race/ethnicity, previous tobacco use, body mass index (BMI), comorbidities, use of sedation and vasoactive drugs, and use of enteral nutrition.

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Braden Scale

To assess the risk for pressure injuries and incidence, the Brazilian version of the Braden Scale[12] was applied to all patients in the study before they were placed in the PP. This scale assesses the risk for developing pressure injuries and scores in a range from 6 to 23 points, with the patient classified as no risk (19–23 points); low risk (15–18 points); moderate risk (13–14 points); high risk (10–12 points); and very high risk ≤9 points for pressure injuries[14]. For patients who developed PPPS, pressure injuries were classified from stage I to IV, following the guidelines of the National Pressure Injuries Advisory Panel (NPIAP) and the European Pressure Injury Advisory Panel (EPIAP)[6].

Apache II

The APACHE II is a commonly used severity-of-disease scoring system in ICUs worldwide[13]. Within the first 24 hours of patient admittance, the worst value for each physiological variable is calculated into an integer score from 0 to 71. Higher scores represent a more severe disease and a higher hospital mortality risk.

Data analysis

Data were tabulated in Excel for Windows®, and absolute and relative frequencies of categorical variables and position and dispersion measurements of continuous variables were calculated. Comparisons between quantitative variables were made using the unpaired Student's t-test or the Mann–Whitney test, depending on the data distribution. Associations between the presence of injury and categorical variables were assessed using Fisher's exact test. The incidence of PPPI was calculated considering the number of new cases of patients with PPPS in the period studied/number of people exposed to the risk of developing PPPS in the period x 100. Simple modified Poisson regression with robust variance was used for data analysis[15] considering pressure injury as a dependent variable. In the results, the estimates obtained for the prevalence ratio were presented, as well as their respective confidence intervals and p-values.

Ethical considerations

This study was approved by the Research Ethics Committee of the University of Campinas and followed all Brazilian and international standards for research involving human beings. An information sheet and an informed consent form were delivered and signed by the family caregivers before enrollment.

RESULTS

The study included 30 patients, who had a mean age of 57.1 years (SD=14.9) and were mostly male (n=17; 56.7%), white (n=19; 63.33%), and non-smokers (n=23; 76.6%). Comorbidities were hypertension (24; 80%), diabetes mellitus (DM) (9; 30%), dyslipidaemia (6; 20%), stroke (4; 13.3%), venous insufficiency (2; 6.7%), and arterial insufficiency (2; 6.7%).

Regarding BMI, the participants' mean was 30.9 kg (SD=7.6), and 12 (40.0%) were considered obese. The majority (n=17; 56.7%) were receiving an enteral diet and had the infusion interrupted for at least two hours before the procedure. The average calorie intake was 782.3 (SD=346.8).

Regarding the use of sedoanalgaesia, 30 (100%) received midazolam, 27 (90%) fentanyl, and 3 (10.0%) propofol. When considering vasoactive drugs, 20 individuals (66.7%) were receiving such drugs, with noradrenaline being the most used (n=19; 95.0%).

When evaluating the parameters of mechanical ventilation, it was possible to observe that 20 (66.7%) patients used the volume-controlled ventilation mode. The mean FiO_2 was 0.9 (SD=0.1), and the PEEP was 10.2 (SD=2.2). Among the patients who participated in the study, the average PaO_2/FiO_2 ratio was 108.8 (SD=24.4).

Regarding PPPS, most patients (n=14; 66.67%) had the injury in the first prone cycle, 3 (14.3%) patients in the second cycle, and 4 (19.0%) patients in the third. The APACHE II score ranged from 12 to 31, with a mean of 21.4 (SD=21.4), indicating that the patients had an average risk of death of 40%. In this study, 11 patients (36.7%) died.

Regarding the Braden Scale, the mean score obtained was 8.9 (SD=0.8), which classified patients at very high risk for developing pressure injuries. The patients' mean time in PP was 20.1 (SD=3.9) hours. Most patients (n=21; 70.0%) developed PPPS while on PP, leading to an incidence of 70%; however, it is noteworthy that some patients developed more than one pressure sore, totalling 44 pressure sores. The stages of pressure sores and the sites of greatest occurrence are highlighted in Table 1.

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When comparing the groups with and without PPPS, there was no difference between them (p>0.05). Furthermore, the incidence of PPPS was not associated with any sociodemographic or clinical variable of the patients (Table 2).

Table 1 - Stages and sites of higher occurrence of pressure injuries in patients in the prone position (n=44). Campinas, SP, Brazil, 2021

PU	n	%
Stage		
I	15	34.1
II	29	65.9
Site		
Left chest	9	20.4
Abdomen	8	18.2
Cheek	5	11.4
Forehead	4	9.1

Source: Elaborated by the authors, 2021.

Table 2 shows the results from the Simple modified Poisson regression analysis, considering pressure injury as a dependent variable. There was no significant relationship between the variables.

DISCUSSION

PP is routine in ICUs for patients with ARDS, but there has been an increase in this practice due to the severity of the clinical picture of COVID-19 patients[16]. Although PP has demonstrated lung protection, it is not free from complications, as in the case with pressure sores. Our study demonstrated an alarming incidence of pressure injuries in PP patients diagnosed with COVID-19; however, research that investigated the prevalence of PPPS had similar results to our study[7]. Our findings may be due to the study being carried out at the beginning of the pandemic in the country, in which the opening of new beds, overload, relocation, and emergency hiring of human resources were a constant reality, and the training of professionals became more focused on handling of personal

Table 2 - Relationship between patients' personal and clinical variables and the development of pressure sores (n=30). Campinas, SP, Brazil, 2021

Variables	No pressure sores				With pressure sores				p	PR (CI 95%)†	P
	mean	SD	n	%	mean	SD	n	%			
Outcome											
Discharge	-	-	5	26.3	-	-	14	73.6	0.68*	1,16(0.69-1.95)	0.58
Death	-	-	4	36.4	-	-	7	63.6			
Sex											
Female	-	-	2	15.4	-	-	11	84.6	0.22*	1.44(0.91-2.28)	0.12
Male	-	-	7	41.2	-	-	10	58.8			
Vasoactive drug											
Yes	-	-	5	25.0	-	-	15	75.0	0.43*	1.25(0.71-2.20)	0.44
No	-	-	4	40.0	-	-	6	60.0			
Enteral diet											
Yes	-	-	5	29.4	-	-	12	70.6	1.00*	1.02(063-1.64)	0.93
No	-	-	4	30.8	-	-	9	69.2			
Age	**52.3**	**15.8**			**59.1**	**14.4**			**0.25****	**1.01(0.99-1.03)**	**0.27**
BMI	**33.6**	**8.9**			**29.8**	**6.8**			**0.16‡**	**0.98(0.94-1.01)**	**0,22**
Time spent for each cycle PP	**20.1**	**3.3**			**20.1**	**4.3**			**0.78****	**1.0(0.95-1.05)**	**0.99**
PaO_2/FiO_2	**102.3**	**21.0**			**111.6**	**25.6**			**0.34****	**1.0(1.0-1.01)**	**0,29**
Braden Scale	**9.1**	**0.6**			**8.8**	**0.9-**			**0.22‡**	**0.86(0,63-1.17)**	**0,33**
APACHE Scale	**19.7**	**6.1**			**22.1**	**4.8**			**0.25****	**1.03(0.98-1.08)**	**0,23**

Source: Elaborated by the authors, 2021.
* p-value obtained using Fisher's exact test. ** p-value obtained using the unpaired student's t test. ‡p-value obtained using the Mann–Whitney test. †The probability of presenting the result "Yes" was estimated. PR prevalence ratio

protective equipment of the team and in the assistance of possible emergency situations.

Despite the evident lack of protocols and the team's ability to carry out PPPS prevention, the results of this research are fundamental, as they reinforce the need for permanent education to act in all procedures to be performed with patients, even in those who are less frequent, as the case with PP, before the onset of the pandemic.

There are few studies on the incidence of pressure injuries in patients with COVID-19 in PP. A 10-year retrospective study investigating PP-related complications in patients without a diagnosis of COVID-19 found a low incidence of pressure sores (14%)[5]. However, all patients received an antidecubitus mattress with alternate pressure as well as application of thin hydrocolloid dressing for pressure injuries prevention on risk areas: face, thorax, iliac crests, and tibial plateau. In our study, patients did not receive dressing for pressure injuries prevention on risk areas. Our patients were kept on a pneumatic mattress; for pressure point relief, they received a letter-C-shaped pad for the head, and pillows were added to provide additional support to the hips, shoulders, and face. Transverse rolls were placed under the pelvis and the chest. However, these supports were not enough to prevent PPPS, since in our sample of 30 patients, 21 had PPPS, demonstrating that more effective interventions are necessary.

Regarding the most common sites for the development of lesions, the forehead, cheek, and chin stand out; however, in our study, we also identified the chest and abdomen. Regarding pressure sore severity, the majority (65.9%) were classified as stage II according to the NPIAP classification[6]. Despite the high incidence of pressure sores found in this study, it is noteworthy that none were classified in stages III or IV, a fact observed in another study that investigated this prevalence[7].

The appearance of stage II or higher pressure injuries, especially on the face, adds to the other complications after COVID. Previous studies indicated that this may generate stigma in patients and require different long-term treatments (with dressing or surgery) with a multi-disciplinary team[7,17,18].

According to a previous study, the relative risk rate for the occurrence of pressure sores is higher for patients undergoing PP when compared to the supine position[19]. Risk factors related to the development of pressure sores in PP are not well defined in the literature[7]. Among those described for the development of pressure sores, age, poor perfusion, vasopressor infusion, and prolonged immobilisation stand out[20]. However, our data corroborate those of another publication, in which there were no differences between groups regarding age, sex, Braden Scale score, previous tobacco use, BMI, DM, hypertension or peripheral vasculopathy, use of vasoactive drugs, and length of stay in the ICU[7]. A meta review that investigated the effect of prone positioning on pressure injury incidence in adult intensive care unit patients[19] reinforced that different prevention measures should be implemented. Some examples are frequent skin and tissue assessment (before and after PP), skin cleansing and hydration, redistribution of pressure points and coverage in risk areas, and, finally, changes in the individual's posture, as these are injuries that can be avoided.

Limitations to our study include the performance of the study in a single centre, which limits the generalisation of the findings. The few studies published on the subject in patients with COVID-19 also made it difficult to discuss the findings. The small number of patients was due to difficulties in contacting the legal guardians to obtain consent to participate in the study, since face-to-face visits by family members were temporarily prohibited based on the institution's protocol.

CONCLUSIONS

In conclusion, this cohort study has shown that patients with ARDS undergoing PP are vulnerable to the occurrence of pressure sores, whose incidence was 70%. No personal or clinical variables were associated with the appearance of PPPS. It is urgent to develop and implement protocols to limit the occurrence of these complications and permanent education programmes to train the multidisciplinary team.

CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

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