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ISSN 2179-7692
OPEN ACCESS

Rev. Enferm. UFSM, v.13, e32, p.1-16, 2023 •
Submission: 5/5/2023 • Acceptance: 8/14/2023 • Publication: 9/26/2023

Original article

Incidence of medical device-related pressure injuries in an adult intensive care unit*

Incidência de lesões por pressão relacionadas a dispositivos médicos em unidade de terapia intensiva adulto

Incidencia de lesiones por presión relacionadas con dispositivos médicos en unidades de cuidados intensivos para adultos

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*** Extracted from the dissertation "Medical device-related pressure injury in an intensive care unit: incidence, risk factors and nursing performance", presented to the Nursing Postgraduate Program, of the Federal University of Santa Catarina, in 2021.**

Abstract

Objective: to determine the incidence of medical device-related pressure injuries and associated factors in adult intensive care unit. **Method:** quantitative, observational, prospective. Data were collected between September and November 2020, in a public hospital. An instrument was used for daily evaluations of the skin under and peri the devices. **Results:** 1,579 devices were analyzed in 292 evaluations in 47 patients, identifying 233 injuries (14.9%). The incidence of injuries was 6.1%. In 20.9% (n = 61) of the devices used, the injuries were related to the orotracheal tube. Regarding the regions affected by injuries, 10.4% (n = 24) occurred in the ears; 7.8% (n = 18) in the face. Stage 1 injuries were the most frequent (n=147; 63.3%) in the evaluations performed. **Conclusion:** incidence was 6.1%. The need to maintain surveillance is emphasized, especially in patients with endotracheal tube. Prevention measures should be adopted to reduce the occurrence of these injuries.
Descriptors: Pressure Ulcer; Equipment and Supplies; Intensive Care Units; Critical Care; Patient Safety

Resumo

Objetivo: determinar a incidência de lesões por pressão relacionadas a dispositivos médicos e os fatores associados em unidade de terapia intensiva adulta. **Método:** quantitativo, observacional, prospectivo. Os dados foram coletados entre setembro e novembro de 2020, em um hospital público. Utilizou-se instrumento para avaliações diárias da pele sob e peri os dispositivos. **Resultados:** foram analisados 1.579 dispositivos em 292 avaliações, em 47 pacientes. Identificando-se 233 lesões (14,9%). A incidência de lesões foi de 6,1%. Em 20,9% (n= 61) dos dispositivos utilizados, as lesões foram relacionadas ao tubo orotraqueal. Com relação às regiões acometidas por lesões, 10,4% (n= 24) ocorreram nas orelhas; 7,8% (n= 18), na face. As lesões estágio 1 foram as mais frequentes (n=147; 63,3%) nas avaliações realizadas. **Conclusão:** observou-se incidência de 6,1%. Ressalta-se a necessidade de manter a vigilância, em especial em pacientes com tubo endotraqueal. Medidas de prevenção devem ser adotadas para diminuir a ocorrência destas lesões.
Descritores: Lesão por Pressão; Equipamentos e Provisões; Unidades de Terapia Intensiva; Cuidados Críticos; Segurança do Paciente

Resumen

Objetivo: determinar la incidencia de lesiones por presión relacionadas con dispositivos médicos y los factores asociados en la unidad de cuidados intensivos para adultos. **Método:** cuantitativo, observacional, prospectivo. Los datos fueron recogidos entre septiembre y noviembre de 2020, en un hospital público. Se utilizó instrumento para evaluaciones diarias de la piel bajo y peri los dispositivos. **Resultados:** se analizaron 1.579 dispositivos en 292 evaluaciones, en 47 pacientes. Identificándose 233 lesiones (14,9%). La incidencia de lesiones fue del 6,1%. En el 20,9% (n= 61) de los dispositivos utilizados, las lesiones fueron relacionadas al tubo orotraqueal. Con relación a las regiones afectadas por lesiones, 10,4% (n= 24) ocurrieron en las orejas; 7,8% (n= 18), en la cara. Las lesiones etapa 1 fueron las más frecuentes (n=147; 63,3%) en las evaluaciones realizadas. **Conclusión:** se observó incidencia de 6,1%. Se subraya la necesidad de mantener la vigilancia, en especial en pacientes con tubo endotraqueal. Se deben adoptar medidas preventivas para reducir la aparición de estas lesiones.
Descriptores: Úlcera por Presión; Equipos y Suministros; Unidades de Cuidados Intensivos; Cuidados Críticos; Seguridad del Paciente

Introduction

Patients in the Intensive Care Unit (ICU) have a high risk of developing pressure injuries (PI) compared to those admitted to other hospital units, due to hemodynamic instability and number of devices used. High rates of injuries related to their use and severity of patients would therefore be justified.[1-2]

Medical devices include machines and instruments used in diagnostic, surgical and therapeutic procedures such as oxygen masks, urinary catheters, cervical collars, endotracheal tubes and cannulas, compression socks and nasogastric catheter[3]

Medical Device-Related Pressure Injuries (MDR PI) are those associated with the use of devices applied for diagnostic or therapeutic purposes in which the injury has the same

configuration of the device.[1] They can develop in any anatomical location in which there is insertion of devices, and tend to progress rapidly, because they usually occur in areas without adipose tissue, where the pressure is constant and the microclimate may be impaired.[4] In addition, the materials used to fix the devices can compress the tissue, disrupt blood and lymphatic circulation and cause edema.[4-5]

Other contributing factors include the occlusion of the device on the skin, which can cause excessive moisture and increased temperature, damaging the microclimate and causing friction. Periodic evaluation of the skin under the devices allows the identification of signs, such as whitening erythema, which can lead to the development of injuries. Any patient in use of a medical device has the potential to develop MDR PI, so that the evaluation is fundamental for prevention and/or early identification of injuries.[1-2]

Prevention of MDR PI can be a challenge, as the device is often an essential part of treatment. Moreover, some patients are sedated or cannot report discomfort or pain associated with the use of the devices.[4] The development of MDR PI represents one of the main indicators of quality of care and is related to an adequate evaluation and well-designed care plan, assistance and organizational protocols of care, human, material and structural resources of the institution. The treatment of a PI increases costs, risk of infection and prolongs hospitalization time.[1,6-7]

Although they are not new events, the context of the Covid-19 pandemic has highlighted the MDR PI due to prolonged hospitalization of patients in ICU and strategies used on a large scale, such as prone positioning.[8] Despite the increase in the number of studies addressing the subject, there is still a lack of strategies for their minimization from the determination of the prevalence of this type of injury. In this sense, the objective of this manuscript was to determine the incidence of medical device-related pressure injuries and the associated factors in adult intensive care unit.

Method

Quantitative, observational, descriptive and prospective study, reported according to the criteria of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) initiative.

It was developed in an adult general ICU, in a municipality in the southern region of Brazil, which assists neurocritical patients or with polytrauma and general surgery, with an

average of 50 patients/month. The unit has 15 beds, of which seven were intended for exclusive care of patients with Covid-19 during data collection and, for administrative reasons, could not be included in the study. Thus, the collection occurred during two months (September and October 2020) in eight beds, and one month (November 2020), in 15 beds. The nursing team consisted of 19 nurses and 53 nursing technicians distributed in two shifts, three nurses and nine nursing technicians per shift. The number of professionals working at the time of data collection varied due to temporary leave due to suspicion or confirmation of contamination by Covid-19.

The study sample was by convenience and composed of the evaluations of the devices performed in patients admitted to the ICU who had invasive devices in the period of 90 days. The following inclusion criteria were adopted for patients: age 18 years or older, hospitalized for clinical, surgical or polytrauma treatment of any specialty; use of at least one medical device, device insertion for less than 24 hours of the first evaluation for data collection. As exclusion criteria: large burned patients; patients with comorbidities related to skin change, such as pemphigus vulgaris and epidermolysis bullosa.

The first evaluation of each patient was performed within the first 24 hours of hospitalization and insertion of the device; the second evaluation was made 24 hours after the first evaluation; the third, 24 hours after the second evaluation, and so on, always at the same time, with the exception of tracheostomy cannulas, which were mostly installed during hospitalization. The patients were evaluated in the first 24 hours of hospitalization, considering the possibility of clinical deterioration of the hospitalization process. Each device was evaluated separately for length of stay and possible injuries. If a device was removed from the patient, the others continued to be evaluated independently until the eleventh day of hospitalization of the patient in the ICU, and the follow-up was discontinued if the patient was discharged, transferred or died. In addition, the presence or absence of non-MDR PI was also observed, evaluating site and stages.

Patients were followed-up until the 11th day in view of the use of more invasive devices in the acute phase of hospitalization from a study conducted in Turkey, which showed that the incidence tends to increase over the days, pointing out that 11.8% of injuries occurred in the first 24 hours; on the fourth day, the number of occurrences rose to 48.0% and on the eleventh day, to 82.3%. A possible explanation for the early development of MDR PI may be the severity of the disease during the first days of hospitalization, through interaction with surgical interventions,

malnutrition and immobility.[9]

Injuries were assessed according to the definitions of the National Pressure Injury Advisory Panel (NPUAP)[1], which defines staging of injuries according to the compromised tissues, namely: Stage 1 pressure injury characterized by unbleachable erythema of intact skin; Stage 2, where there is partial thickness skin loss with exposed dermis; Stage 3, which presents total thickness skin loss, in which adipose tissue is visible; Stage 4, which is characterized by total loss of skin and tissues, exposure of fascia, muscle, tendon, ligament, cartilage or bone. Moreover, there are unclassifiable pressure injuries, which show a loss of obscure full-thickness skin and tissue covered by necrotic plaque or crumbling; and non-staging mucous membrane injuries.[1] Data were collected by nurses with experience in intensive care with previous training with stomal therapy nurse.

The categorical variables were represented by absolute frequency (n) and relative frequency (%). The variables studied were described by device or day. Comparisons of proportions between groups were performed by the chi-square test. The Shapiro-Wilk test was used to test the normality of the variables. Age and SAPS 3 were represented by mean and standard deviation. The variables BMI and surgical time were represented by median, percentile and interquartile interval (P50 [P25; P75]). The database was organized in Excel® and the analyses were performed in the Statistical Package for the Social Sciences (SPSS), version 25.

The project was evaluated by the human research ethics committee of the Federal University of Santa Catarina following the precepts of Resolutions 466/2012 - 510/2016 - 580/2018 of the Ministry of Health, with opinion number 4.193.870 on August 5, 2020. The Informed Consent Form was signed by the patients or their guardians when the patient was unable to attend. The present study had no funding sources or competing interests.

Results

The study evaluated 1,579 devices, present in 47 patients, from 292 evaluations performed. Epidemiologically, the length of stay in the ICU was up to six days for 27 (57.4%) and more than six days for 20 (42.5%) of the sample. Among these, 9 (19.1%) remained hospitalized for two days and 11 (23.4%) for 11 days. Regarding sex, color, age and reason for hospitalization, 33 (70.2%) were men, 26 (55.3%), white, with a mean age of 46.2 years

(SD=3.68), 25 (53.2%) hospitalized for postoperative monitoring, with surgeries of up to three hours in duration, on average.

The SAPS 3, calculated in the first 24 hours of hospitalization and described in the medical record, presented a mean of 54 points (SD = 16.8, ranging from 23 to 95 points). BMI ranged from 19 to 47 kg/m^2 (50% eutrophic and 50% overweight or obese). Regarding comorbidities, 16 (34.7%) patients were hypertensive and eight (16.4%) had associated Diabetes Mellitus. Dyslipidemia, cancer and depression were also identified. As for the outcome, 85.1% of patients were discharged to wards, 5 (10.6%) died and 1 (6.4%) transferred to another institution.

No significant differences were observed between the variables (reason for hospitalization, age, sex, race and BMI) of the patients. There was a higher incidence of injuries related to medical devices in obese and overweight patients, with self-report or guardian's report as brown, with high mean SAPS and unfavorable clinical outcome, although this number is not statistically significant. It was observed p<0.001 for active smoker, ex-smoker and non-smoker, showing not being a smoker as a protective factor for the non-development of MDR PI (Table 1).

Table 1 - Demographic and clinical characterization of patients, comparing the group with injury to the group without injury. São José, Santa Catarina, Brazil, 2021.

Variable		Total	Injury	No injury	P
		47(100%)	16 (34%)	31 (66%)	
		n (%)	n (%)	n (%)	P1
Sex	Male	33 (70.2)	12 (36.4)	21 (63.6)	0.742
	Female	14 (29.8)	4 (28.6)	10 (71.4)	
Race/color	White	26 (55.3)	8 (30.8)	18 (69.2)	0.243
	Black	14 (29.8)	7 (50)	7 (50)	
	Brown	7 (14.9)	1 (14.3)	6 (85.7)	
Smoking	Active Smoker	2 (4.3)	2 (100)	0 (0)	<0.001
	Ex-Smoker	6 (12.8)	0 (0)	6 (100)	
	Non-Smoker	39 (83)	10 (25.6)	29 (74.4)	
Hospitalization	Clinical	10 (21.3)	4 (40)	6 (60)	0.660
	Surgical	25 (53.2)	7 (28)	18 (72)	
	Trauma	12 (25.5)	5 (41.7)	7 (58.3)	
BMI	Eutrophic	23 (48.9)	10 (43.5)	13 (56.5)	0.409
	Overweight	16 (34)	4 (25)	12 (75)	
	Obese	8 (17)	2 (25)	6 (75)	
Clinical outcome	Discharge	40 (85.1)	15 (37.5)	25 (62.5)	0.241
	Death	5 (10.6)	- (0)	5 (100)	
	Transfer	2 (4.3)	1 (50)	1 (50)	
		mean (SD)	mean (SD)	mean (SD)	P2

Age	46.2 (17.1)	45.8 (17.4)	46.4 (17.2)	0.913
SAPS3	54.0 (16.8)	48.6 (15.0)	56.8 (17.2)	0.110
	P50 [P25; P75]	P50 [P25; P75]	P50 [P25; P75]	P3
BMI	25.0 [22.0; 28.0]	23.0 [21.5; 26.0]	25.0 [23.0;28.0]	0.305
Surgical time	3.0 [2.0; 3.0]	3.0 [2.0; 3.0]	2.0 [2.0; 3.0]	0.136

BMI: Body Mass Index; SAPS: *Simplified Acute Physiology Score* III
P1 - chi-square test; P2 - independent sample T test; P3 - Mann-Whitney test

There were 292 evaluations (one evaluation per day in 47 patients x number of days of hospitalization of each patient), analyzing the 13 devices chosen for this research. Concomitantly, the presence or absence of non-MDR PI was also evaluated. The presence or absence of all 13 devices was evaluated, being computed 1,579 devices in use in the collection period, which caused 233 injuries (14.9%), whose incidence was 6.1%.

Of the 292 evaluations, orotracheal tube was present in 169 (57.9%), and tracheostomy cannula in 23 (7.9%), representing 65.8% of the evaluations with patients on mechanical ventilation. In 267 (91.4%) evaluations, patients used an oximeter; in 158 (54.1%), they used an invasive blood pressure catheter; in 176 (60.3%), a device for enteral feeding; in 221 (77.7%), central venous access; and in 177 (60.6%), peripheral venous access (Table 1).

The most frequent MDR PI were: 61 (20.9%) related to the orotracheal tube and 46 (15.8%) injuries resulting from indwelling bladder catheter. An incidence of 29 (10.3%) injuries associated with pulse oximeter was found. Arterial, peripheral venous and central venous puncture devices with incidence of 25 (8.5%), 9 (3.2%) and 5 (1.8%), respectively. The fifth device with the highest incidence of injuries was chest drain, 17 (5.8%); followed by cervical collar, 16 (5.5%) (Table 2).

Table 2 – Presence of medical device-related pressure injury compared with the frequency of device use. São José, SC, Brazil, 2021.

Devices	Device use	No injury	Injury	% of incidence
	n (%)	n (%)	n (%)	
Orotracheal tube	169 (57.9)	108 (63.9)	61 (36.1)	20.9
Indwelling bladder catheter	267 (91.4)	220 (82.7)	46 (17.3)	15.8
Oximeter	292 (100)	253 (89.7)	29 (10.3)	10.3
Invasive arterial blood pressure catheter	158 (54.1)	133 (84.2)	25 (15.8)	8.5
Chest drain	27 (9.2)	10 (37)	17 (63)	5.8
Neck collar	17 (5.8)	1 (5.9)	16 (94.1)	5.5
Nasoenteral catheter	176 (60.3)	164 (93.2)	12 (6.8)	4.1
Peripheral venous catheter	177 (60.6)	165 (94.8)	9 (5.2)	3.2
Central venous catheter	226 (77.3)	220 (97.3)	6 (2.7)	1.8

Tracheostomy cannula	23 (7.9)	18 (78.3)	5 (21.7)	1.7
Nasogastric catheter	38 (13)	34 (89.5)	4 (10.5)	1.4
External fixator	13 (4.5)	10 (76.9)	3 (23.1)	1
Non-invasive ventilation mask	1 (0.3)	-	1 (100)	0.3
Total	1579(41.7)	1332(85.1)	233(14.9)	

The percentage of use of any device increased Bfrom 40.8% on the first day of evaluation to 45.5% on the eleventh day. Moreover, over the days, the incidence of MDR PI increased: on the first day, it was 3.5% and, on the eleventh day, 10.8%, as seen in Table 3.

Table 3 – Number of evaluation days compared to the use of devices and presence of injury. São José, Santa Catarina, Brazil, 2021.

Day	Device use		Injury			% of incidence
	No	Yes	No	Yes	Missing	
	n (%)	n (%)	n (%)	n (%)	n	
1	362 (59.2)	249 (40.8)	227 (91.5)	21 (8.5)	1	3.5
2	375 (61.5)	235 (38.5)	202 (86.7)	31 (13.3)	2	5.1
3	295 (59.7)	199 (40.3)	168 (85.3)	29 (14.7)	2	5.9
4	231 (57.3)	172 (42.7)	141 (82.5)	30 (17.5)	1	7.5
5	220 (58.4)	157 (41.6)	131 (84.0)	25 (16.0)	1	6.7
6	178 (57.1)	134 (42.9)	112 (84.2)	21 (15.8)	1	6.8
7	145 (56.2)	113 (43.8)	93 (83.0)	19 (17.0)	1	7.4
8	133 (57.1)	100 (42.9)	84 (84.8)	15 (15.2)	1	6.5
9	101 (55.8)	80 (44.2)	63 (79.7)	16 (20.3)	1	9.0
10	93 (55.4)	75 (44.6)	63 (85.1)	11 (14.9)	1	6.6
11	78 (54.5)	65 (45.5)	48 (76.2)	15 (23.8)	2	10.8

The cranial region was the most incident in MDR PI, taking into account the area with more inserted devices: 24 (10.45) ear injuries, 18 (7.8%) in the face, 12 (5.2%) in the lips, 12 (5.2%) in the cervical region, 8 (3.5%) in the nostrils, 6 (2.6%) in the nose and 5 (2.2%). In the gum. Patients developed more than one injury in the cranial region due to the same device, such as ear and lip, and one participant (0.4%) developed three injuries associated with the orotracheal tube.

Other MDR PI identified were: 60 (26.1%) in hands and fingers, 39 (17%) in thighs, 18 (7.8%) in the chest, 12 (5.2%) in cervical, 5 (2.2%) in glans, 2 (0.9%) in the abdominal region, 1 (0.4%) in the labia. Devices such as the cervical collar (which generated injuries in the thoracic and cervical regions) triggered injuries in two different sites in 8 (3.5%) patients (Table 4).

Regarding the stage of the injuries, 144 (63.3%) were stage 1, 41 (17.9%), stage 2.

There were 26 (11.4%) injuries in the mucous membrane, therefore, non-staging. There were no injuries in stage 4 or suspected deep tissue injuries in the period of this research. Table 4 shows the sites of the injuries observed.

Table 4 – Description of devices in relation to pressure injury sites. São José, Santa Catarina, Brazil, 2021.

Device (n)	Site/Region	n (%)
Orotracheal tube (n=61)	Face	17 (27.9)
	Face/lip	1 (1.6)
	Gum	5 (8.2)
	Lip	11 (18.0)
	Ear	23 (37.7)
	Ear/Face/Lip	1 (1.6)
	Ear/Lip	3 (4.9)
Tracheostomy cannula (n=5)	Cervical	5 (100.0)
Non-invasive ventilation mask (n=1)	Face	1 (100.0)
Nasogastric catheter (n=4)	Nose	4 (100.0)
Nasoenteral catheter (n=13)	Lip	1 (7.7)
	Nostril	8 (61.5)
	Nose	2 (15.4)
Peripheral venous catheter (n=9)	Hand	9 (100.0)
Indwelling bladder catheter (n=46)	Abdomen	2 (4.3)
	Thigh	34 (73.9)
	Thigh/Glans	1 (2.2)
	Glans	5 (10.9)
	Big lips	1 (2.2)
	Inguinal	3 (6.5)
External Fixator (n=3)	Thigh	3 (100.0)
Oximeter (n=29)	Hand	28 (96.6)
	Ear	1 (3.4)
Chest drain (n=18)	Chest	18 (100)
Invasive arterial blood pressure catheter, (n=25)	Thigh	2 (8.0)
	Hand	23 (92.0)
Neck Collar (n=16)	Cervical	7 (43.8)
	Cervical/Chin	7 (43.8)
	Cervical/Chest	1 (6.3)
	Ear/Cervical	1 (6.3)

Variables such as Braden scale, water balance, blood transfusion, peripheral perfusion and use of sedatives were also evaluated during the study. Table 5 shows the average of these variables on the first day of hospitalization in four groups: 27 (57.4%) patients who did not present injury, 3 (6.4%) who presented PI, 15 (31.9%) with MDR PI and 2 (4.3%) who presented double PI and MDR PI (Table 5).

Participants who developed double injury had a Braden score considered high risk

for developing PI, that is, less than or equal to 11 on the first day of hospitalization. Participants who did not develop injury or developed MDR PI had a Braden score considered moderate risk for PI development. In addition, patients using vasoactive drugs developed more MDR PI compared to the group that did not use. For the other variables, no statistically significant associations were observed (Table 5).

Table 5 – Descriptive analysis of data obtained on the 1st day of hospitalization compared to patients without injury, with pressure injury and with medical device-related pressure injury. São José, Santa Catarina, Brazil, 2021.

Variable		No injury (n=27; 57.4%)	PI (n=3; 6.4%)	MDR PI (n=15; 31.9%)
Braden Score	mean (SD)	12.93 (3.65)	9.33 (1.53)	12.60 (3.78)
	P50 [P25, P75]	12.0 [9.0; 16.0]	9.0 [8.0; 11.0]	13.0 [9.0; 14.0]
Water Balance	mean (SD)	540 (2.088)	183 (660)	442 (1.162)
	P50 [P25, P75]	-100 [-500; 1.340]	50 [-400; 900]	-100 [-400;1.400]
Hematocrit (%)	mean (SD)	33.81 (6.41)	37.67 (4.93)	33.67 (7.01)
	P50 [P25, P75]	36.0 [29.0; 39.0]	40.0 [32.0; 41.0]	36.0 [29.0;38.0]
Platelets	mean (SD)	238.9 (120.0)	241.0 (41.9)	207.9 (105.7)
	P50 [P25, P75]	221 [163; 290]	222 [212; 289]	222 [105; 291]
GCS	mean (SD)	14.71 (0.47)	15.00 (0.00)	14.38 (1.41)
	P50 [P25, P75]	15.0 [14.0; 15.0]	15.0 [15.0; 15.0]	15.0 [14.5; 15.0]
RASS	mean (SD)	-4.92 (0.28)	-4.50 (0.71)	-4.57 (0.79)
	P50 [P25, P75]	-5.0 [-5.0; 5.0]	-4.5 [-5.0; 4.0]	-5.0 [-5.0;4.0]
		n (%)	n (%)	n (%)
Transfusion	No	25 (92.6)	3 (100)	13 (86.7)
	Yes	2 (7.4)	0 (0)	2 (13.3)
Peripheral perfusion	<2	19 (70.4)	3 (100)	9 (60)
	>2	8 (29.6)	0 (0)	6 (40)
Vasoactive drugs	No	14 (51.9)	1 (33.3)	3 (20)
	Yes	13 (48.1)	2 (66.7)	12 (80)
Sedatives	No	14 (51.9)	1 (33.3)	8 (53.3)
	Yes	13 (48.1)	2 (66.7)	7 (46.7)
Nutritional support	No	17 (63)	2 (66.7)	13 (86.7)
	Yes	10 (37)	1 (33.3)	2 (13.3)

GCS: Glasgow coma scale; PI: Pressure Injury; MDR PI: Medical Device-Related Pressure Injury; RASS: Simplified Acute Physiology Score III

Discussion

Males and 32 females. Mean age was 55 years, white race 68 (73.1%). Regarding the predominant comorbidities, 45 (48.4%) corresponded to hypertension, 26 (28%) diabetes mellitus and 51 (54.8%) non-smokers. The mean BMI was 26.9±8.9. According to the RASS,

72 (77.4%) patients were sedated, ranging from -5 to -3. On the Braden scale, the mean value was 10.5, hematocrit 30.7 8.5, SAPS 3 64.4 13.3 and use of vasoactive drugs 57 (61.3).[10]

In this study, there was a considerably lower incidence rate (6.14%) than that found in the international literature (14%). Taking into account the scarcity of national studies that seek to assess the incidence of MDR PI in adult ICU, the comparative analysis with national data is difficult, due to socio-cultural aspects and access to health of the Brazilian population. A study conducted in Brazil in a pediatric context presented an incidence of 21.8%.[11]

A systematic review that included 29 articles indicated combined estimates of incidence (adults 14%, children 9%) and prevalence (adults 11%, children 8%) in 126,150 patients from 14 countries.[12] In a study conducted in ICU in Brazil, a prevalence of 62.4% was observed, a value considerably above the international average found.[10]

Causes of MDR PI include the use of neurosurgical assistance devices, including neck collar (7.5%); use of orthopedic aid devices, including splint and gypsum (6.6%); antiembolic sock and sequential compression device (22.5%); intravenous and arterial catheterization (5.3%); Foley catheter (1.8%); nasogastric intubation (17.6%); measurement of oxygen saturation for patient monitoring (7.0%); use of nasal cannula (11.9%); non-invasive ventilation masks, such as a positive pressure respirator (15.9%); and endotracheal intubation, including the use of nasotracheal and endotracheal catheters (4.0%).[3]

Considering the distribution of MDR PI by body location, corroborating the findings in this study, the highest frequency was in the head and neck region (62.3%).[14] The injuries were more present in the regions of the nose (26.8%) and mouth (15.9%) of patients.[15] Another author revealed 32.6% of nose injuries, 14.1% in legs, 8.8% in forehead (frontal region), 8.8% in arms, 8.4% in hands (including fingers), 6.2% in ear, 5.3% in cheek, 5.3% in heels, 3.5% in mouth, 3.1% in neck (including chest), 2.6% in buttocks and 1.3% in back.[9] Respiratory masks and cervical collars are located in regions with limited subcutaneous tissue and pressures, located in vulnerable areas of the face, such as the bridge of the nose, chin and cheeks.[16]

Regarding the stage of MDR PI, the most found in the literature were stage 2 (32.9% and 42.6%, 54.9%), followed by stage 1 (31.3% and 37.9%, 3.9%). [3,9,16] All studies follow the classification established by the NPUAP, which defines the staging of injuries according to

the compromised tissues.[1]

Hypoxia is one of the most important mechanisms of injury, caused by the pressure exerted by a surface or device on the skin, when the external pressure exceeds normal pressure, depending on the intensity and duration, and, in addition to ischemia, can provoke tissue necrosis. The degree of tissue impairment and tissue tolerance vary according to individual characteristics, affected by microclimate, nutrition, perfusion and comorbidities.[1]

The pathophysiology of injuries is complex and multifactorial, associating extrinsic and intrinsic factors, which consist of the individual characteristics of each patient, such as age, nutrition, hydration, level of consciousness, tissue perfusion changes, immobility, obesity and severity of the disease. Recently, the term microclimate has been adopted to describe local tissue temperature and humidity (relative humidity) at the body interface and support or contact surface in the case of medical devices.[9]

Taking into account the risk factors for the development of MDR PI in the injury group, there were more men and cases of hospitalization due to surgical interventions, and the length of stay in the intensive care unit was longer. The time of use of devices and sedatives was longer in the group that developed injury. In addition, the MDR PI group had a higher SAPS III than the non-occurrence group; however, serum albumin, protein, hematocrit and hemoglobin level were low. The Braden scale at admission and discharge were lower.[17] In relation to smoking, the development of PI among smokers was higher in relation to non-smokers. Smoking is an important risk factor for the emergence of PI due to the change in vascular response.[18]

The risk of incidence of MDR PI was 5.79 times higher and 5.54 times higher in coma patients than those with Glasgow 15 or 14. Although the Braden scale is not a specific scale to assess risk of injury by medical device, it was sensitive in the evaluation, since lower scores on the scale were associated with greater development of MDR PI.[10] The Braden score showed specificity (56%) and sensitivity (92%).[19]

Although not statistically significant, authors suggest increased risk in male patients, advanced age, connected to the ventilator, using anticoagulants, sedatives and lower levels of hemoglobin.[9] As associated comorbidities, there was a higher prevalence of MDR PI in patients with respiratory problems, mostly overweight. Patients who developed MDR PI were less likely to survive.[6]

A limitation of the study concerns the reduced number of participants and investigation in an intensive care unit, with its characteristics and peculiarities, with direct influence on the number of patients monitored due to the Covid-19 pandemic, without possibility to generalize the data. Moreover, there is bias due to the presence of the researcher in the sector, which may influence changes in common habits in the team, which may have masked the effective appearance of the formation of medical device-related pressure injuries.

Furthermore, additional research is necessary to identify the incidence in order to propose strategies to increase the risk assessment of medical device-related pressure injuries and their records. Providing this information will enable effective strategies to prevent this type of injury in the future.

Conclusion

This study showed an incidence of 6.1% of MDR PI in the patients evaluated, and the device most commonly associated with the injury was the orotracheal tube. The cranial region was the most affected, and stage 1 injuries were the most frequent. No significant differences were observed between the clinical characteristics of the patients regarding the reason for hospitalization, age, sex, race and BMI. It is important to establish preventive measures to reduce the incidence of MDR PI in the intensive care environment.

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Scientific Editor: Tânia Solange Bosi de Souza Magnago

Associated Editor: Rhanna Emanuela Fontenele Lima de Carvalho

How to cite this article

Reisdorfer N, Nascimento ERP, Lazzari DD, Echevarría-Guanilo ME, Galetto SG, Malfussi LBH. Incidence of medical device-related pressure injuries in an adult intensive care unit. Rev. Enferm. UFSM. 2023 [Access at: Year Month Day]; vol.13, e32: 1-16. DOI: https://doi.org/10.5902/2179769274377