

Pressure injury related to surgical positioning and associated factors

Lesão por pressão decorrente do posicionamento cirúrgico e fatores associados
Úlcera por presión resultante de posicionamiento quirúrgico y factores asociados

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Pressure ulcer; Patient positioning; Perioperative nursing; Patient safety; Nursing care

Descritores

Lesão por pressão; Posicionamento do paciente; Enfermagem perioperatória; Segurança do paciente; Cuidados de enfermagem

Descriptorios

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Abstract

Objective: To analyze the occurrence of pressure injury resulting from surgical positioning and the associated factors.

Method: An observational and longitudinal study, involving 239 patients undergoing elective surgery. Data collection was performed using an instrument for sociodemographic and clinical characteristics, and a risk assessment scale for the development of injuries due to surgical positioning. Descriptive statistics and multiple binominal logistic regression were used for data analysis, and the level of significance considered was $\alpha = 0.05$.

Results: Most of the patients were adult male Caucasians. The occurrence of pressure injury resulting from surgical positioning was 37.7%, and 81 (90.0%) patients developed stage 1 pressure injury, and the most frequent sites were sacral (19; 13.9%), and right (16; 11.7%) and left (13; 9.5%) calcaneus regions. Age (adult) and those identified at higher risk according to the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning (ELPO) were predictors for occurrence of pressure injury.

Conclusion: The high incidence and associated factors (age and higher risk on the administered scale) for pressure injuries resulting from surgical positioning provide results to help understand the problem within the national scenario, and to implement interventions to reduce the patient's risk of being affected by this type of injury in the perioperative period.

Resumo

Objetivo: Analisar a ocorrência de lesão por pressão decorrente do posicionamento cirúrgico e os fatores associados.

Método: Estudo observacional, longitudinal, realizado com 239 pacientes submetidos à cirurgia eletiva. Para coleta de dados, utilizou-se instrumento de caracterização sociodemográfica e clínica e Escala de Avaliação de Risco para o Desenvolvimento de Lesões Decorrentes do Posicionamento Cirúrgico. Para a análise dos dados empregou-se estatística descritiva e regressão logística binominal múltipla e o nível de significância considerado foi $\alpha = 0,05$.

Resultados: A maioria dos pacientes era do sexo masculino, branco e adultos. A ocorrência de lesão por pressão decorrente do posicionamento cirúrgico foi de 37,7%, sendo que 81 (90,0%) pacientes apresentaram lesão por pressão estágio 1 e os locais mais frequentes de ocorrência deste tipo de lesão foram a região sacral (19; 13,9%) e calcâneos direito (16; 11,7%) e esquerdo (13; 9,5%). A idade (adulto) e o risco maior conforme escore da Escala de Avaliação de Risco para o Desenvolvimento de Lesões Decorrentes do Posicionamento Cirúrgico foram preditores para a ocorrência de lesão por pressão.

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Conflicts of interest: nothing to declare.

Conclusão: A elevada ocorrência e os fatores associados (idade e risco maior na escala aplicada) para lesão por pressão decorrente do posicionamento cirúrgico foram resultados evidenciados que podem auxiliar na compreensão da problemática no cenário nacional, e para a implementação de intervenções com o propósito de reduzir o risco do paciente de ser acometido por este tipo de lesão no perioperatório.

Resumen

Objetivo: Analizar la incidencia de úlcera por presión resultante del posicionamiento quirúrgico y los factores asociados.

Métodos: Estudio observacional, longitudinal, realizado con 239 pacientes sometidos a cirugía electiva. Para la recolección de datos, se utilizó un instrumento de caracterización sociodemográfica y clínica y la Escala de Evaluación de Riesgo para la Aparición de Úlceras Resultantes del Posicionamiento Quirúrgico. Para el análisis de datos se usó estadística descriptiva y regresión logística binominal múltiple y el nivel de significación considerado fue $\alpha = 0,05$.

Resultados: La mayoría de los pacientes era de sexo masculino, blanco y adulto. La incidencia de úlcera por presión resultante del posicionamiento quirúrgico fue del 37,7 %, en el que 81 (90,0 %) pacientes presentaron úlcera por presión de estado 1 y los lugares más frecuentes de incidencia de este tipo de lesión fueron la región sacra (19; 13,9 %) y calcáneo derecho (16; 11,7 %) e izquierdo (13; 9,5 %). La edad (adulto) y el riesgo mayor, según la puntuación de la Escala de Evaluación de Riesgo para la Aparición de Úlceras Resultantes del Posicionamiento Quirúrgico, fueron predictores de los casos de úlcera por presión.

Conclusión: La elevada incidencia y los factores asociados (edad y riesgo mayor en la escala aplicada) de úlceras por presión resultantes del posicionamiento quirúrgico fueron resultados evidenciados que pueden ayudar a comprender la problemática en el escenario nacional y a implementar intervenciones con el objetivo de reducir el riesgo de que el paciente presente este tipo de úlcera en el perioperatorio.

Introduction

Annually, approximately 310 million surgical procedures are performed around the world; furthermore, there is a significant increase each year.⁽¹⁾ Surgical and/or anesthetic complications are among the most frequent preventable adverse events, and pressure injuries (PI) resulting from surgical positioning are prominent.⁽²⁾

Studies describe different PI occurrence rates related to surgical positioning, 13% in the United States⁽³⁾ and in Brazil, 10.1%,⁽⁴⁾ 21.7%⁽⁵⁾ and 77%.⁽⁶⁾ The treatment of PI is associated with high costs. In a Brazilian study, results showed that the more severe the injury, the higher the treatment cost, with an average value of US\$11,9 in stages 2, 3, 4, and non-classifiable injury.⁽⁷⁾

Patient assessment for identification of PI resulting from positioning must be performed in nursing clinical practice, even after discharge from the post-anesthesia recovery room, because the injuries may appear between 72 hours and five days after the procedure.⁽⁸⁾

Several risk factors are associated with the development of PI, and the surgical procedure increases the patient's risk as a result of decreased capillary perfusion, prolonged immobility, duration of pressure, temperature changes, among others.^(9,10)

The risk factors associated with PI due to surgical positioning are inherent to the patient and the procedure. Comorbidities, such as systemic arterial hypertension (SAH) and diabetes mellitus

(DM), age, nutritional status, body surface, and anesthetic risk according to the American Society of Anesthesiologists (ASA) classification are patient-related factors. In turn, the risks inherent to the procedure involve time, positioning, perioperative hypothermia, anesthetic agents, hemodynamic and ventilatory alterations, as well as the absence or misuse of support surfaces.^(8,11-14)

A study conducted in the United States of America (USA) had the participation of ten hospitals with nurses working in the operating room, and the findings indicated the existence of knowledge deficit on PI prevention in the perioperative period.⁽¹⁵⁾

Developing evidence on predisposing factors for the development of PI resulting from surgical positioning can contribute to the understanding of this problem in the national scenario, and to the implementation of interventions with the purpose of reducing the patient's risk of being affected by PI in the perioperative period. In this context, the objective of this study was to analyze the occurrence of PI resulting from surgical positioning, and its associated factors.

Methods

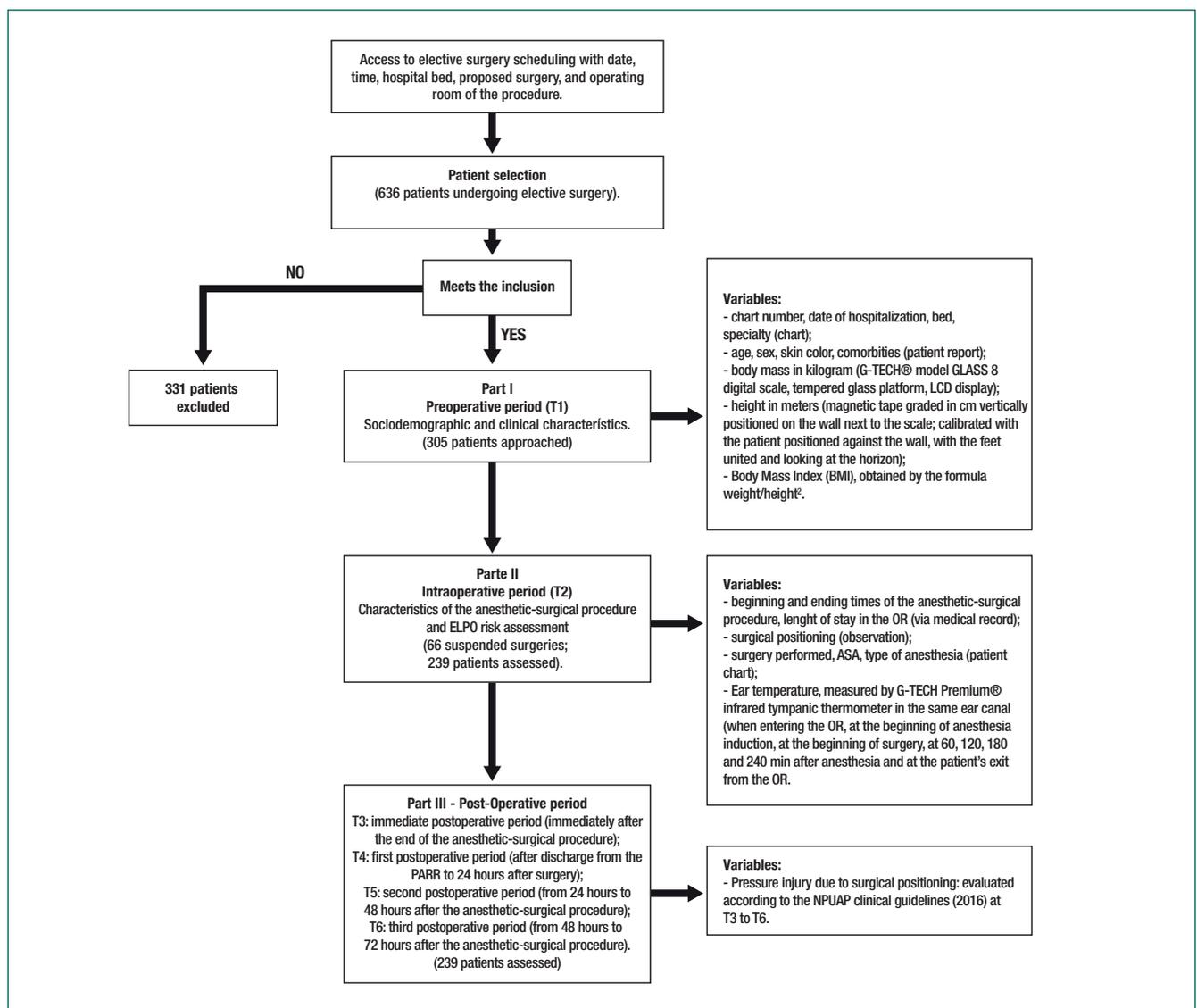
This was a longitudinal observational study, conducted from January to March of 2018, in a highly complex and large teaching hospital, considered one of the largest service providers by the Unified

Health System (UHS), in Minas Gerais state in Brazil. The hospital has 505 beds and serves different specialties, including medical, surgical, pediatrics, and gynecology. The surgical center has 12 operating rooms, where an average of 900 surgeries/month are performed, except for the obstetric surgeries that are conducted in the Obstetric Center, which has five rooms.

Patients undergoing elective surgery for any surgical specialty, aged 18 years or older and any gender were included, and excluded those with PI before admission to the operating room. For the

occurrence of injuries resulting from surgical positioning, 50% was considered for the sample calculation, with an accuracy of 5%, and a 95% confidence interval was used for the finite population of 600 surgeries, resulting in a sample of 235 patients. The patient recruitment process was of a non-probabilistic type, and the data collection occurred in the perioperative period (Figure 1).

In the immediate preoperative period, the researchers collected data regarding the sociodemographic and clinical characteristics in the hospital unit in the intraoperative period, the patient was



ELPO - Risk Assessment Scale for the Development of Injuries due to Surgical Positioning; PARR - post-anesthesia recovery room; NPUAP - National Pressure Ulcer Advisory Panel

Figure 1. Diagram used for the data collection procedure of surgical patients (n=239)

monitored from the time of admission to the operating room (OR) to transfer to the post-anesthesia recovery room (PARR), and data were collected from the anesthetic-surgical procedure, after administering the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning (ELPO).⁽⁵⁾ In the postoperative period, to identify PI, the researchers inspected the entire extent of the patient's skin using inspection and palpation, at four different times (T3, T4, T5, and T6), with reference to the following parameters: color change, sensitivity, temperature, consistency, thickness, and shape of the skin or mucosa.

The ELPO is a validated scale, developed in Brazil, which evaluates the risk for development of injuries resulting from surgical positioning. It consists of seven items (length of surgery, type of anesthesia, surgical positioning, surface support, positioning of upper and lower limbs, comorbidities, and patient age), on a five-point Likert scale, with a total score ranging from 7-35. The higher the score, the higher the risk of the patient developing a PI. For risk stratification, the authors of the scale determined cutoff points: a patient with a score of <19 is classified at lower risk, and with >20 points at higher risk for injury.⁽⁵⁾

For PI classification, a clinical guideline recommended by the National Pressure Ulcer Advisory Panel (NPUAP) was adopted. The injuries were classified in stages 1, 2, 3, 4, not classifiable, deep tissue, related to medical devices, and in mucous membranes.⁽¹⁶⁾

The data were double entered and analyzed using the SPSS Statistics software. The quantitative variables were analyzed by means of position measurements (mean and median) and variability (amplitudes and standard deviation), and categorical variables by absolute and relative frequency distribution. For the simultaneous analysis of the influence of predictor variables (age group, self-reported color, sex, body mass index, and hypothermia) on the occurrence of injury, the multiple binomial logistic regression model was used. The significance level used was $\alpha=0.05$.

The study was conducted in accordance with resolution 466/12 of the National Health Council. The project was approved by the Research Ethics Committee, with opinion number 1,824,868.

Results

During the period of study, 636 patients had undergone elective surgical interventions in the study hospital. Of these, 239 met the inclusion criteria, and 397 were excluded for different reasons: patients with PI (n=5), refusal to participate in the study (n=2), <18 years of age (n=98), operationalization of the research (n=144), referral to the operating room before contacting the researchers (n=82) and patients with suspended or canceled surgeries, even after being included in the study (n=66).

The following specialties had a higher frequency of elective surgeries: general surgery (25; 10.5%), head and neck (25; 10.5%), urology (24; 10.0%), and otolaryngology (20; 8.4%).

The characteristics of the patients showed that 124 (51.9%) were male, 133 (55.6%) were Caucasian, and 152 (63.6%) were adult, with a mean age of 52.44 years, minimum of 19, and maximum of 83 years. Comorbidities were found in 135 (56.4%) patients, 57 (23.8%) of those with hypertension and vascular disease, 51 (21.3%) with obesity or malnutrition, and 22 (49.2%) with diabetes mellitus (DM).

Regarding the patient's body composition, the mean weight was 75.3 kg (SD=21.1), and mean height 1.65m (SD=0.09). The mean body mass index (BMI) was 27.35 kg/m² (SD=6.9) and most patients (142; 59.4%) had indexes outside the recommended values of normality.

Most patients were classified as ASA II as to physical status (147; 61.55) and underwent conventional surgical access (204; 85.4%). There was a predominance of patients who received general anesthesia (109; 45.3%). The mean length of stay of the patient in the operating room (admission to departure to exit) was 3h 50m (SD=1h49m), with a minimum of 50m and maximum of 11h, while the mean time of the surgical anesthesia procedure was 3h22m (SD=1h45m), minimum of 34m and maximum of 10h10m. The supine position (171; 71.5%) and standard operating table (210; 87.9%) were used in most surgical procedures. Of the 239 patients enrolled, 39 (16.3%) underwent an anesthetic-surgical procedure without the use of any type of support surface.

Regarding the patient's body temperature, hypothermia was present in some of the patients when entering the OR (64; 26.8%), and at the end of the procedure, 161 patients (67.4%) had this condition. The mean auricular temperature at the time of anesthetic induction was 36.1°C (SD=0.3), with a gradual decrease up to 180 minutes after induction, reaching a mean of 35.2°C (SD=0.9).

The ELPO assessment was performed in the intraoperative period, and repeated when changes in positioning, anesthetic technique, and time of surgery were observed. The distribution of ELPO component items is demonstrated in table 1.

Regarding the risk for the development of injuries due to positioning, the mean score was 19.3 points (SD=3.3), with a minimum of 12 and maximum of 29 points. Individuals who presented subsequent PI had a mean ELPO score of 19.71 points, while those who did not have a PI had a mean ELPO score of 19.16. Using the cutoff point recommended by the scale authors, 48.5% of patients presented higher risk and 51.5% lower risk. This classification was used for regression analysis.

Among the participants, 90 (37.7%) presented 137 PI resulting from surgical positioning in the postoperative period. Of these injuries, 121 (88.3%) emerged in the immediate postoperative period, 13 (9.5%) on the first postoperative day, one (0.7%) on the second day, and two (1.5%) on the third day. Regarding the NPUAP classification, 81 (90.0%) patients were classified as stage 1 pressure injury, four (4.4%) as stage 2, one (1.2%) had deep tissue injury, and four (4.4%) had injuries on membranes and mucous membranes. Regarding the number of these lesions, 57 (63.3%) patients had only one injury, and 33 (36.7%) two to four injuries; the most frequent sites were sacral (19; 13.9%) and right (16; 11.7%) and left (13; 9.5%) calcaneus.

The occurrence of PI due to surgical positioning was greater for patients classified as having higher risk (42.2%), according to ELPO, when compared to those with lower risk (33.3%).

When analyzing the influence of risk for injury, according to ELPO, and the predictor variables on the occurrence of injury by means of logistic regression (age group, self-reported skin color, sex, body

Table 1. Distribution of patients who underwent elective surgeries (n= 239), according to the items on the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning

Items/ELPO	n(%)
Type of surgical position	
Supine	171(71.5)
Lateral	27(11.3)
Trendelenburg	27(11.3)
Prone	6(2.5)
Lithotomy	8(3.3)
Surgery time (hours)	
≤ 1	4(1.7)
1 to ≤ 2	50(20.9)
>2 to <4	95(39.7)
> 4 to <6	67(28.0)
>6	23(9.6)
Type of anesthesia	
Sedation	3(1.3)
Regional	75(31.4)
General	109(45.6)
General + Regional	52(21.8)
Type of support surface	
Foam mattress + foam pads	18(7.5)
Foam mattress + cotton pads	182(76.2)
No use of support surfaces; rigid supports without padding; narrow leg supports	39(16.3)
Surgical limb positioning	
Anatomic position	72(30.1)
Opening of upper limbs <90°	112(46.9)
Knees raised <90°, and opening of lower limbs < 90°, or neck without sternal alignment	16(6.7)
Knees raised >90° or opening of lower limbs >90°	13(5.4)
Knees raised >90° and opening of lower limbs >90°, or opening of upper limbs >90°	26(10.9)
Comorbidities	
No comorbidities	104(43.5)
Vascular disease	57(23.8)
Diabetes mellitus	22(9.2)
Obesity or malnutrition	51(21.3)
Previously diagnosed pressure injury, neuropathy, or deep vein thrombosis	5(2.1)
Age of patient (years)	
18 - 39	59(24.7)
40 - 59	94(39.3)
60 - 69	54(22.6)
70 - 79	24(10)
>80	8(3.3)

*ELPO - Risk Assessment Scale for the Development of Injuries due to Surgical Positioning

mass index and hypothermia), the results of the age group variables and the risk for injury showed statistically significant differences and predictors for occurrence of PI due to surgical positioning (Table 2).

The possibility of developing PI due to surgical positioning was increased by 2.16 times when the patient was an adult. According to the ELPO risk assessment, patients classified as being at higher risk had 1.79 times a higher chance of developing the injury.

Table 2. Influence of sociodemographic and clinical variables and risk score of the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning in the occurrence of pressure injury resulting from surgical positioning

Variables	Pressure injury due to surgical positioning		
	Odds ratio (95% CI*)	Adjusted odds ratio (95% IC*)	p-value†
Age group	1.70 (0.97 – 2.98)	2.16 (1.17 – 3.98)	0.01
Self reported skin color	1.54 (0.90 – 2.62)	1.35 (0.77 – 2.37)	0.28
Sex	1.02 (0.60 – 1.72)	0.96 (0.54 – 1.70)	0.9
BMI classification‡	0.66 (0.38 – 1.12)	0.60 (0.34 – 1.06)	0.08
Hypothermia (Taur 60min)	1.54 (0.88 – 2.70)	1.37 (0.75 – 2.50)	0.3
Risk for injury (ELPO) §	1.46 (0.86 – 2.47)	1.79 (1.00 – 3.20)	0.04

CI - 95% confidence interval; †p - logistic regression, significance level; §BMI - Body Mass Index; || ELPO - Risk Assessment Scale for the Development of Injuries due to Surgical Positioning; Dichotomous variables - age group (adult or older people-reference category); self-reported skin color (white or non-white-reference category); sex (male or female-reference category); BMI classification (altered or eutrophic-reference category); hypothermia (yes or no-reference category); risk for injury (higher risk or lower risk-reference category)

Discussion

The majority of patients in the study were males with comorbidities. The comorbidities interfere with the risk for development of PI due to surgical positioning. The most frequent diseases in this study were SAH and DM, which were also present in the results of different studies conducted with surgical patients, contributing to the increased risk or incidence of this type of injury.^(6,9,17-20)

An integrative review showed a relationship between body composition and occurrence of PI, with divergences between older people and adults.⁽²¹⁾ A recent study demonstrates the need for research to evaluate bio-impedance as a risk factor for the development of PI.⁽²²⁾

In this study, most patients were classified as ASA II. In a retrospective control case study, conducted with the participation of 4,652 surgical patients, the results showed a predominance of patients classified as ASA IV (48.1%) in the group that presented PI.⁽²³⁾

The time of the anesthetic-surgical procedure in this research was similar to the data of two studies, one performed in China⁽²⁴⁾ and the other in the USA.⁽²³⁾ A meta-analysis, also conducted with patients undergoing elective surgeries, demonstrated that the duration of surgery is an important risk factor for the development of PI.⁽²⁵⁾

Results of a cohort study, conducted with 297 surgical patients in Taiwan, indicated that the type

of surgical position (supine) and the type of anesthesia (general) were associated with the development of PI.⁽¹⁸⁾

Surgical positioning is considered a risk factor for the development of PI.⁽¹⁸⁾ In this study, the surgical procedure position most frequently adopted was dorsal or supine. In a retrospective study with 22 patients conducted in Ohio (USA), the results showed this position to be one of the predisposing factors for development of PI in the intraoperative period.⁽²⁰⁾

In the hospital where this study was conducted, the actions to prevent PI due to surgical positioning are accomplished according to the nursing team's assessment regarding the patient's conditions and surgical wound size. There is no care protocol implemented in the unit for prevention of this type of injury and, for the nursing team, guidelines are provided by means of training classes. The devices adopted as a measure of PI prevention are pads, mostly cotton pads. Foam cushions are available, however, in small quantities.

In this study, 39 patients did not have any type of support surface for PI prevention due to surgical positioning. Supporting surfaces are artifacts designed to distribute pressure, control shear or friction forces on tissue, maintain the microclimate, or to perform other therapeutic functions.^(11,26) The authors of an integrative review identified gaps in knowledge about the most effective support surfaces to avoid PI due to surgical positioning, and higher incidence of these injuries was seen in patients who did not have support surfaces, and a lower incidence was noted in patients who had polyurethane or air mattresses.⁽¹¹⁾

Perioperative hypothermia is associated with an increased risk of infection and surgical wound complications.⁽²⁷⁾ An interview to identify knowledge about perioperative hypothermia was conducted with 324 nurses, members of the Association of periOperative Registered Nurses (AORN), and only 33.6% of these professionals reported PI as a complication.⁽²⁸⁾

All surgical patients present a risk of developing PI as a result of the complex combination of intrinsic factors and the anesthetic-surgical proce-

ture. Early identification of risk factors is an important step for implementing preventive measures that could reduce the occurrence of injuries due to surgical positioning.⁽¹⁴⁾

The postoperative nursing team plays a critical role in the identification of PI and in the communication of such an event, so that the perioperative team adopts risk assessment tools specific to surgical patients.⁽²⁹⁾

In a study with 278 patients who had elective surgery in the interior of Minas Gerais state, aimed at evaluating patients according to PI, different results were obtained than in the present study: most patients presented high scores with the administration of the scale.⁽⁶⁾

In a study conducted in southern Minas Gerais to validate ELPO, with 115 patients undergoing surgical procedures of any surgical specialty, the results showed a higher mean score of ELPO for patients who developed PI when compared to patients who did not develop this type of injury, and obtained a lower mean score, with a statistically significant difference.⁽⁵⁾

In this study, the occurrence of PI was 37.7%. In the national literature, the values identified were 21.7%⁽⁵⁾ e 77%⁽⁶⁾ and in international studies, the occurrence of this type of injury was 1.7%⁽¹⁷⁾ 9.8%⁽¹⁸⁾ e 18.9%⁽¹⁹⁾.

In the analyzed sample there was a predominance of male patients and stage 1 PI. In a systematic review with meta-analysis, the results also indicated stage 1 to be the most prevalent injury, however the occurrence of this type of injury was higher in women in the postoperative period.⁽¹⁹⁾

The results of this study showed that a higher risk, according to the ELPO, and adult age increased the chance of PI occurrence due to surgical positioning. Corroborating these data, in a recent study in Recife with 154 patients who had elective surgeries, the authors observed that among the patients who presented skin injuries due to surgical positioning, the majority were classified as higher risk by the ELPO.⁽³⁰⁾

Regarding age, in a prospective Portuguese study with 172 surgical patients, the results also indicated that PI occurred more frequently in adult patients

in the age group between 45 and 64 years (52.4%).⁽³¹⁾ In a prospective study with 148 patients, the results demonstrated a higher occurrence of PI in the age group between 38 and 58 years (40.6%).⁽³¹⁾ In the perioperative period, there is evidence that the older surgical patient presents a higher risk of developing this type of injury, due to the decreased skin thickness, muscle mass, and subcutaneous fat on the bony prominences.^(3,33) Therefore, age should not be an isolated parameter of investigation of PI resulting from surgical positioning.

The factors contributing to the occurrence of PI due to surgical positioning are numerous, indicating that risk assessment is necessary, with consequent standardization of protocols and availability of support surfaces appropriate to the characteristics of patients and the procedures being performed.⁽²⁶⁾

In nursing, the implementation of evidence-based practice can promote quality, event-free care.⁽³⁴⁾ There is evidence indicating that the barriers demonstrated by nurses to the use of research findings in practice are associated with increased occurrence of PI.^(34,35)

Nurses are responsible for planning and implementing actions that promote patient safety and consequent improvement in health care. It is expected that these results will alert professionals and stimulate the search for evidence to adopt strategies to reduce the occurrence of PI due to surgical positioning, and help in care planning, as a shortage of professionals is prevalent in most institutions.

The limitation of this study is the non-assessment of neuromuscular injuries, which are also related to injury resulting from surgical positioning; however, this was not the objective of the study. This limitation did not compromise the reliability of the results of this investigation.

Conclusion

In this study, the occurrence of PI due to surgical positioning was 37.7%. Being an adult and being classified as having a higher risk by the ELPO scale were factors associated with the development of this type of injury. It is expected that the results of the

research will contribute to the understanding of this problem within the national scenario, and to the implementation of interventions with the purpose of reducing the patient's risk of being affected by this type of injury in the perioperative period.

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Collaborations

Buso FDS cooperated with the study design, data collection, analysis and interpretation, and article writing. Ferreira MBG cooperated with the study design, data analysis and interpretation, article writing, relevant critical review of the intellectual content, and final approval of the version to be published. Felix MMS contributed with the study design, data collection, analysis and interpretation, article writing, and final approval of the version to be published. Galvão CM contributed with the article writing, relevant critical review of the intellectual content, and final approval of the version to be published. Barichello E contributed with the article writing, relevant critical review of the intellectual content, and final approval of the version to be published. Barbosa MH participated in the study design, data analysis and interpretation, relevant critical review of the intellectual content, and final approval of the version to be published.

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