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Risk assessment for the development of surgical positioning injuries in teaching hospitals in Brazil

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Abstract

Background: Injuries resulting from surgical positioning are preventable, yet they remain prevalent, causing temporary or permanent harm, extending hospital stays, and increasing the risk of hospital-acquired infections. Identifying patients at risk for these injuries is critical. This study aimed to assess the risk of developing surgical positioning injuries in orthopedic surgeries within teaching hospitals.

Methods: This cross-sectional study was conducted between February and July 2023 in two teaching hospitals in Brazil. It involved a convenience sample of 147 patients who underwent orthopedic surgery. The study used the Risk Assessment Scale for the Development of Injuries Due to Surgical Positioning. Data analysis was performed using SPSS software, version 21, with the Chi-squared test applied to assess significance at the 0.05 level.

Results: Most participants were male (51.70%), with a mean (±SD) age of 54.52±20.34 years. Of the total sample, 85% were at low risk of developing injuries. Women were three times more likely to be at high risk (OR=3.39, 95% CI=1.24 to 9.24). The presence of comorbidities increased the likelihood of high risk approximately sixfold (OR=5.56, 95% CI=2.06 to 15.57). Spinal anesthesia increased the likelihood of high risk fourfold (OR=4.08, 95% CI=1.14 to 14.53).

Conclusion: Identifying risk factors allows for a more targeted approach to preventing surgical positioning injuries. Incorporating this knowledge into the development of institutional protocols is essential for improving patient safety and outcomes.

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Highlights

What is current knowledge?

Medication use and gender can influence the risk of injury due to surgical positioning.

What is new here?

A possible relation was observed between spinal anesthesia and a high risk of injury due to surgical positioning.

Introduction

Safe surgery is one of the World Health Organization's goals, involving a process aimed at promoting and expanding discussions among peers. In the operating room (OR), the nursing team plays a participatory leadership role, facilitating patient-centered care through communication with team members, patients, family members, and hospital managers. To ensure this care is both continuous and safe, healthcare services must implement effective risk management practices and correctly utilize technologies, processes, and human resources, recognizing that errors and harm have multifactorial origins (1).

The OR is considered a critical area within the hospital environment, representing a setting that exposes patients to various risk factors (1). The nurse's role in the OR involves planning and implementing nursing interventions aimed at minimizing or preventing complications resulting from the anesthesia-surgical procedure (2,3). Therefore, it is the nurse's responsibility to participate in the surgical positioning of the patient, taking into account the risks of developing injuries related to surgical positioning.

Pressure injuries (PIs) resulting from surgical positioning are skin lesions that develop due to factors associated with the surgical procedure, particularly when there is inadequate prevention during surgical positioning. Risk factors include prolonged surgical time, pressure on the skin, friction, shear, moisture, and heat, all of which are influenced by the patient's nutritional status, age, and comorbidities (4). These injuries can be prevented through actions such as proper positioning, the use of support surfaces, and the presence of a trained professional for assessment (5).

From this perspective, several factors can lead to the development of surgical positioning-related injuries. For instance, long periods of immobilization are particularly significant as they increase the patient's risk of reduced body temperature, which in turn raises the likelihood of developing injuries. Thus, preventing surgical positioning-related injuries remains a challenge in clinical practice, despite technological advances (3). A study conducted in Minas Gerais, Brazil, reported a 37.7% incidence of injuries resulting from surgical positioning (6), while another study in Rio Grande do Sul, Brazil, identified a 19.05% prevalence of high risk for the development of these injuries. Both studies emphasize the importance of identifying the risk factors for these injuries, which can be temporary or permanent, affecting the patient's self-image, prolonging hospitalization, and increasing the risk of hospital-acquired infections (7).

Among surgical specialties, orthopedics stands out with a higher incidence of injuries (8). In addition to involving long-duration surgeries, this specialty often treats elderly patients, making advanced age a significant risk factor for developing surgical positioning-related injuries, as indicated by the risk assessment scale for PIs (9).

In Brazil, according to the Patient Safety and Quality in Health Services Bulletin No. 20, covering the period from January to December 2018, 103,275 incidents were reported by Patient Safety Centers, 19,297 of which were related to PIs. During this period, PIs accounted for the third most reported type of event in Brazilian health services, with 10,438 (54%) being classified as stage II PIs. In addition, approximately 2,387 "never events" were reported, the majority of which were stage III (72%) and stage IV (21.8%) PIs (10).

Incidence rates of PIs due to surgical positioning vary depending on the study location, ranging from lower rates of 10.1% to higher rates of 77% in Brazil, with rates of 13% reported in the United States (6). In Denmark, PIs are a significant issue, with a prevalence of 13–43%, costing around 174,500,000 euros per year (11). In Africa, the prevalence of PIs is approximately 11% (12). These figures indicate that the prevalence of this issue varies by location and should be considered individually when making decisions. Nonetheless, it remains a problem that can incur significant costs for institutions and should not be overlooked.

Studies indicate that patients identified as high risk according to the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning (ELPO), as well as adult patients, have a higher likelihood of developing injuries related to surgical positioning. Therefore, careful attention and immediate interventions are necessary for patients assessed as high risk according to the ELPO scale (6).

Surgical positioning-related injuries can have significant consequences in the hospital environment, negatively affecting patient outcomes and sometimes prolonging hospital stays, which increases exposure to the inherent risks of the hospital setting. From this perspective, evaluating the predisposing and causative factors associated with these injuries is crucial for implementing the most appropriate preventive interventions.

This study evaluated the risk of developing surgical positioning injuries in orthopedic surgeries using the ELPO scale.

Methods

This study is part of the macroproject "Risk assessment for the development of injuries resulting from surgical positioning in different hospital contexts," associated with the master's dissertation of the Graduate Program in Health Sciences at the Federal University of Piauí.

It employs a cross-sectional design with a quantitative approach, involving patients who underwent orthopedic surgery. The sample was non-probabilistic and based on convenience.

For the sample calculation, the institutions where the research was conducted were asked to provide data on the number of surgeries performed in the relevant specialties from October to November 2022. It was determined that the population comprised 230 patients who underwent elective high-complexity surgical procedures in the surgical centers of two reference hospitals in Piauí.

The sample size was calculated based on a finite population, expected proportion, desired precision, and a normal distribution for a 95% confidence level. Using a 5% sampling error and a prevalence of 37.7% (8), the estimated required sample size was 145 patients. By the end of data collection, the final sample consisted of 147 patients who underwent orthopedic surgery: 20 from the federal hospital and 127 from the state hospital (Table 1).

Table 1. Stratified values of the finite sample by proportion (Teresina, Piauí, Brazil, 2023)

Variables	N	Percentage	Sample	Total sample	Final sample
Federal Hospital (FH)	26	11.3	16.4	17	20
State Hospital (SH)	204	88.7	128.6	129	127
Total	230	100.0%	145	146	147

Source: Federal Hospital and State Hospital, in Teresina-PI (2023).

The research was conducted in the surgical centers of two large public teaching hospitals, one at the state level and the other at the federal level, both of which are high-complexity institutions located in the municipality of Teresina, in the State of Piauí, Brazil. The study included patients aged 18 years or older who were undergoing elective orthopedic surgical procedures. Patients undergoing emergency procedures, individuals under 18 years of age, those unable to sign the informed consent form, and those without a present guardian were excluded.

Data collection was carried out using a form completed by the study researchers. The form was administered to patients after consulting the surgery schedule for each day and covered various aspects: sociodemographic data (Gender, age, weight, height, and Body Mass Index [BMI]); comorbidities (Diabetes mellitus, hypertension, immune disease, kidney disease, continuous medication use, prior injury); motor assessment (Motor deficit and/or movement limitation); surgery details (Name, specialty, surgical position, type of anesthesia, and surgery duration); ELPO scale score; and devices used during surgery (Use or non-use of a support surface). The data were collected prior to surgery through oral questioning of the participants and during surgery through observation.

The ELPO scale was developed and validated for Brazil in 2014 to predict the risk of injuries resulting from surgical procedures. It provides insight into the profile of the assisted clientele and enables the surgical team to plan care in an individualized, systematic, and safe manner (13).

This scale was designed based on scientific evidence indicating the physiological implications and potential postoperative complications resulting from the patient's surgical positioning during the intraoperative period, making it the most suitable measure for assessing risk in surgical patients (13,14).

The ELPO is recommended for use during patient positioning on the surgical table and comprises seven assessment items, with scores ranging from 7 to 35 points: the higher the score, the greater the risk of the patient developing positioning-related injuries. The scale analyzes seven factors: type of surgical position, time of surgery, type of anesthesia, support surface, position of limbs, comorbidities, and age of the patient. Each aspect scores between 1 and 5 points. Classification into high or low risk helps healthcare professionals identify patients requiring more caution and observation during positioning to prevent associated complications (14).

Data collection occurred from February to July 2023, during morning and afternoon shifts. Patient monitoring extended from the perioperative period to the post-anesthetic recovery room to assess the risk of injury development using the ELPO scale. The collected data were tabulated and entered into SPSS software version 21.00. Statistical analysis was performed using the Chi-Square Test with Yates correction, and the Odds Ratio effect size was calculated using Logistic Regression, adopting a 0.05 significance level.

Results

The results indicated that 147 respondents (51.70%) were male, and the mean age of all participants was 54.52 years (SD = 20.34, range: 18 to 102). As shown in Table 2, the majority of the patients (55.78%) fell within the age range of 20 to 59 years, and the mean BMI was 26.02 ± 4.49 kg/m². Additionally, the majority of surgeries were performed in the afternoon shift (58.50%).

Table 2. Patients profile for elective orthopedic surgery (Teresina, Piauí, Brazil, 2023)

Continues variables	Mean±SD
Age range	54.52±20.34
Weight (kg)	67.43±12.37
Height (m)	1.61±0.10
BMI (kg/m²)	26.02±4.49
Categorical variables	**N (Percentage)**
Gender	
Female	71 (48,3)
Male	76 (51.7)
Age group	
≤ 19 years	3 (2.0)
20-59 years	82 (55.8)
≥ 60 years	62 (42.2)
BMI class	
Underweight	3 (2.1)
Eutrophic	65 (45.5)
Overweight	51 (35.7)
Obese	24 (16.8)
Shift	
Morning	61 (41.5)
Afternoon	86 (58.5)
Location	
State Hospital	127 (86.4)
Federal Hospital	20 (13.6)

The mean score of risk according to the ELPO scale during the intraoperative period was 17.12, with a standard deviation of 2.52. Additionally, 85% (n=125) of the patients were classified as low risk for developing injuries, while 15% (n=22) were classified as high risk. Regarding the duration of surgery, 53.7% (n=79) lasted up to two hours, 45.6% (n=67) lasted between two and four hours, and 0.7% (n=1) exceeded four hours.

Continuous medication use (Such as medication to control diabetes and hypertension) was reported in 46.9% (n=69) of the patients, while 53.1% (n=78) did not use any medication. The occurrence of prior injury before surgical intervention was 12.9% (n=19) among the patients, with the majority (87.1%, n=128) having intact skin. Additionally, 15% (n=22) of the patients had some motor deficit and/or movement limitation, while 85% (n=125) did not present any deficits.

It was observed that among patients classified as high risk for developing injuries, 72.7% (n=16) were women, whereas only 27.3% (n=6) were men, indicating that women are three times more likely to have a high risk, as confirmed by Table 3.

Among the patients, 53.74% (n=79) denied having comorbidities. Among the remaining 46.26% (n=68), 38.09% (n=56) had systemic arterial hypertension, which was the most frequent condition; followed by diabetes mellitus, affecting 15.65% (n=23) of the patients; and 16.33% (n=24) had other comorbidities, such as heart disease, hypothyroidism, and cancer.

A higher frequency of spinal anesthesia was observed, applied in 64.62% (n=95) of the patients, followed by nerve block, which occurred in 31.97% (n=47) of the patients. A nerve block could occur with or without sedation; the latter was recorded in 50.34% (n=74) of the patients. General anesthesia was used in 9.52% (n=14) of the patients, as shown in Table 4.

It is noteworthy that some surgeries required reassessment by the anesthesiologist, given the possibility of the patient requiring additional anesthesia beyond the first one applied; thus, the same patient could undergo more than one or two types of anesthesia.

It was found that patients using medication continuously had six times greater odds of falling into the high-risk category for injury development than those not on continuous medication. Patients with diabetes mellitus and systemic arterial hypertension had seven and five times greater odds of being at high risk for injury development, respectively. Additionally, patients who underwent spinal anesthesia had four times greater odds of being classified as high risk.

Protective devices were used in 50.3% (n=74) of surgeries, revealing that approximately half (49.7%, n=73) of the surgeries occurred without any type of protective device (Such as cushions, foam, or protective dressings). The specific type of orthopedic surgery was not investigated.

Table 3. Association between the ELPO scale and the social, anthropometric, and clinical profiles of patients undergoing elective orthopedic surgery (Teresina, Piauí, Brazil, 2023)

Variables	Low Risk (7 to 19 points) N (Percentage)	High risk (20 to 35 points) N (Percentage)	P-value Chi-square test	OR (CI 95%)
Gender				
Female	55 (44.0)	16 (72.7)	0.013 *	3.394 (1.245-9.249)
Male	70 (56.0)	6 (27.3)		
Age range				
≤ 19 years	3 (2.4)	0 (0.0)	0.078	9.432(0.397- 15.942)
20-59 years	74 (59.2)	8 (36.4)		
≥ 60 years	48 (38.4)	14 (63.6)		
BMI classification				
Underweight	2 (1.7)	1 (4.5)		
Normal weight	57 (47.1)	8 (36.4)	0.695	5.271 (0.427 – 9.524)
Obesity	42 (34.7)	9 (40.9)		
Obesidade	20 (16.5)	4 (18.2)		
Continuous medication use				
Yes	51 (40.8)	18 (81.8)	0.0001 *	6.529 (2.087-20.429)
No	74 (59.2)	4 (18.2)		
Prior injury				
Yes	17 (13.6)	2 (9.1)	0.561	3.543 (0.154 – 8.432)
No	108 (86.4)	20 (90.9)		
Motor deficit and/or movement limitation				
Yes	18 (14.4)	4 (18.2)	0.647	2.965 (0.326 – 5.765)
No	107 (85.6)	18 (81.8)		

* Statically significant

Table 4. Association between the ELPO scale, comorbidities, and anesthesia of patients undergoing elective orthopedic surgical procedures (Teresina, Piauí, Brazil, 2023)

Variables	Low risk: 7 - 19 points N (Percentage)	High risk: 20 - 35 points N (Percentage)	P-value Chi-square test	OR (CI 95%)
Diabetes mellitus				
Yes	13 (10.4)	10 (45.5)	0.0001 *	7.179 (2.597-19.848)
No (Reference)	112 (89.6)	12 (54.5)		
Systemic arterial hypertension				
Yes	40 (32.0)	16 (72.7)	0.0001 *	5.667 (2.062-15.570)
No (Reference)	85 (68.0)	6 (27.3)		
No comorbidities				
Yes	75 (60.0)	4 (18.2)	0.0001 *	0.148 (0.047-0.464)
No (Reference)	50 (40.0)	18 (81.8)		
Others				
Yes	21 (16.8)	3 (13.6)	0.711	0.678 (0.254 – 1.543)
No	104 (83.2)	19 (86.4)		
General anesthesia				
Yes	12 (9.6)	2 (9.1)	0.941	2.385 (0.983 – 4.532)
No	113 (90.4)	20 (90.9)		
Spinal anesthesia				
Yes	76 (60.8)	19 (86.4)	0.021 *	4.083 (1.147-14.533)
No (Reference)	49 (39.2)	3 (13.6)		
Blockade				
Yes	45 (36.0)	2 (9.1)	0.013 *	0.178 (0.040-0.796)
No (Reference)	80 (64.0)	20 (90.9)		
Sedation				
Yes	58 (46.4)	16 (72.7)	0.023 *	3.080 (1.131-8.390)
No (Reference)	67 (53.6)	6 (27.3)		

* Statically significant

Discussion

Nurses play both administrative and assistive roles in the OR and must plan and implement interventions to prevent complications arising from the anesthesia-surgical procedure (15). Among the interventions performed in the OR, surgical positioning stands out, as it directly impacts the execution of the surgical procedure. Additionally, the use of protective devices influences the contact surface with bony prominences and the pressure exerted on them, which may contribute to the development of injuries resulting from surgical positioning.

Given the various intrinsic and extrinsic factors affecting the patient, it is appropriate to assess the patient's social profile. In a study by Shapifour et al. (2016) (16), it was found that the prevalence of postoperative pressure injury is high across the population, with a higher prevalence in women compared to men. Similarly, the present study observed a higher prevalence of high risk among women compared to men, with women being up to three times more likely to be at high risk. Therefore, increased attention is necessary for women undergoing surgical procedures, particularly those of long duration.

Continuous medication use, such as for controlling hypertension and diabetes, significantly increases the odds of developing postoperative pressure injury, with patients facing six times higher odds. The most frequent conditions associated with increased risk were systemic arterial hypertension and diabetes mellitus, each presenting five and seven times higher odds of being at high risk, respectively.

These results align with findings from a similar study conducted at a teaching hospital in Minas Gerais, where it was identified that comorbidities interfered with the risk of developing injuries resulting from surgical positioning, with the same diseases being the most prevalent in that study (8). Spinal anesthesia can cause complications such as arterial hypotension, post-dural puncture headache, and nerve injuries (17). Although no direct associations between spinal anesthesia and the risk of developing surgical positioning-related injuries were found in the literature, this study observed that patients undergoing spinal anesthesia had four times higher odds of being classified as high risk, indicating the need for further research on this topic. Additionally, there was a prevalence of this type of anesthesia in the surveyed institutions, at 64.62% (n=95), whereas another study observed a predominance of general anesthesia (18).

To improve patient safety, interventions aimed at preventing injuries are crucial, particularly those associated with pressure relief during and after the

patient's stay on the surgical table (19). This study found low utilization of protective devices during surgery, with 49.7% (n=73) of surgeries not using any such devices, which help reduce pressure on the skin. Compared to rigid surfaces like traditional surgical mattresses, the lack of protective devices increases the risk of developing injuries from surgical positioning and causes discomfort for the patient during the postoperative period. For more precise and effective care, incorporating the use of protective devices into the surgical routine is fundamental.

Among the limitations of this study were frequent surgery cancellations, service interruptions, and communication difficulties with some members of the surgical teams. In light of these challenges, further investigations, studies, and various strategies are recommended to implement interventions aimed at reducing complications and improving the quality of patient care during the perioperative period.

Conclusion

It was found that women had a higher risk of developing positioning-related surgical injuries more frequently than men. Individuals on continuous medication, those with comorbidities such as diabetes and hypertension, and patients who underwent spinal anesthesia also showed a higher risk of developing these injuries.

This study allowed for the assessment of the risk of developing injuries from surgical positioning in patients undergoing orthopedic surgical procedures at two teaching hospitals. Using the ELPO scale, risk factors such as gender, continuous medication use, comorbidities, and type of anesthesia were identified, enabling a more adequate and personalized approach to preventing injuries from surgical positioning. Incorporating knowledge of these factors, along with the development of institutional protocols that facilitate the adoption of protective measures, is essential for improving patient safety and postoperative outcomes. This underscores the need for a greater focus among nursing professionals and the anesthesia team on the importance of using protective devices.

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Ethical statement

The research received approval from the Ethics and Research Committee of the University Hospital of the Federal University of Piauí and the Ethics and Research Committee of Getúlio Vargas Hospital, with opinion numbers 5,865,023 and 5,913,361, respectively.

Conflicts of interest

The authors declare that they have no competing interests.

Author contributions

LBA contributed to the conception and design of the work, acquisition, analysis, and interpretation of data for the work, and drafting the work. MZ de AM has made substantial contributions to the conception and design of the work, to the acquisition, analysis, and interpretation of data for the work, and drafting the work. AMR dos S has made substantial contributions to the design of the work. OMAB has made substantial contributions to the design of the work. PV de SB has made substantial contributions to the conception of the work. SVNB has made substantial contributions to the conception and design of the work, to the acquisition, analysis, and interpretation of data for the work, and drafting the work. LMC has made substantial contributions to the acquisition, analysis, and interpretation of data for the work. ALSA has made substantial contributions to the acquisition, analysis, and interpretation of data for the work. All the authors critically reviewed the work for important intellectual content; provided final approval of the version to be published; and agreed to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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