

# Risk evaluation for injuries due to surgical positioning in cardiac surgery

*Avaliação de risco para lesões decorrentes do posicionamento cirúrgico em cirurgias cardíacas*

*Evaluación del riesgo de lesiones resultantes del posicionamiento quirúrgico en cirugía cardíaca*

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**ABSTRACT: Objective:** To assess the risk levels resulting from surgical positioning in patients undergoing cardiac surgery. **Method:** This is an observational, cross-sectional, documentary, descriptive study carried out in a philanthropic hospital in Salvador, state of Bahia, Brazil. The sample consisted of 258 patients who underwent heart surgery between January 2018 and January 2019. A form with sociodemographic and clinical variables and the Risk Assessment Scale for the Development of Injuries Due to Surgical Positioning (ELPO) were used. Data were analyzed quantitatively, using tables with absolute and relative frequencies. **Results:** Among the patients, 59.7% were men; 53.1% were submitted to coronary artery bypass grafting; 69.8% were classified as stage 3 according to the American Society of Anesthesiologists (ASA III); 68.2% had higher body mass index; all patients were submitted to general anesthesia and positioned in the supine position, with the limbs in anatomical position; 63.2% had over 4 hours of duration of surgery; all used viscoelastic mattress and pads; and 60.5% had vascular disease. The ELPO score showed 90.7% of patients at low risk of developing positioning injuries. **Conclusion:** According to the ELPO evaluation, patients were at low risk of developing skin injury during cardiac surgeries, a result attributed to the use of a viscoelastic polymer mattress on the operating tables.

**Keywords:** Patient positioning. Surgical procedures, operative. Pressure ulcer. Risk factors. Operating room nursing.

**RESUMO: Objetivo:** Avaliar os níveis de risco decorrentes do posicionamento cirúrgico em pacientes submetidos a cirurgias cardíacas. **Método:** Estudo observacional, transversal, documental, descritivo, realizado em um hospital filantrópico em Salvador, Bahia. A amostra foi composta de 258 pacientes que se submeteram a cirurgias cardíacas entre janeiro de 2018 e janeiro de 2019. Utilizou-se um formulário com variáveis sociodemográficas, clínicas e a Escala de Avaliação de Risco para Desenvolvimento de Lesões Decorrentes do Posicionamento Cirúrgico (ELPO). Os dados foram analisados quantitativamente, utilizando-se tabelas com frequências absolutas e relativas. **Resultados:** Dos pacientes, 59,7% eram do sexo masculino; 53,1% foram submetidos à revascularização do miocárdio; 69,8% foram classificados como grau 3 segundo a *American Society of Anesthesiologists* (ASA III); 68,2% tinham índice de massa corporal alterado para mais; todos os pacientes foram submetidos a anestesia geral e posicionados em supina, com os membros em posição anatômica; 63,2% tiveram tempo de cirurgia acima de 4 horas; todos utilizaram colchão de visco elástico e coxins; 60,5% exibiam doença vascular. A pontuação da ELPO revelou 90,7% dos pacientes com baixo risco de desenvolver lesões por posicionamento. **Conclusão:** Segundo avaliação por meio da ELPO, os pacientes apresentaram baixo risco para lesão de pele durante as cirurgias cardíacas, resultado atribuído ao uso de colchão de polímero viscoelástico nas mesas cirúrgicas.

**Palavras-chave:** Posicionamento do paciente. Procedimentos cirúrgicos operatórios. Lesão por pressão. Fatores de risco. Enfermagem de centro cirúrgico.

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**RESUMEN:** **Objetivo:** Evaluar los niveles de riesgo derivados del posicionamiento quirúrgico en pacientes sometidos a cirugía cardíaca. **Método:** Estudio observacional, transversal, documental, descriptivo, realizado en un hospital filantrópico de Salvador, Bahía. La muestra estuvo conformada por 258 pacientes que se sometieron a cirugía cardíaca entre enero de 2018 y enero de 2019. Se utilizó un formulario con variables sociodemográficas, clínicas y la Escala de Evaluación de Riesgo para el Desarrollo de Lesiones Procedentes del Posicionamiento Quirúrgico (ELPO). Los datos fueron analizados cuantitativamente, utilizando tablas con frecuencias absolutas y relativas. **Resultados:** 59,7% de pacientes del sexo masculino; 53,1% fueron sometidos a revascularización miocárdica; 69,8% ASA III; 68,2% con índice de masa corporal cambiado a más; todos los pacientes sometidos a anestesia general y posicionados en decúbito supino, con los miembros en posición anatómica; 63,2% con tiempo de cirugía mayor a 4 horas; todos usaron colchones y cojines viscoelásticos; 60,5% tenían enfermedad vascular. La puntuación ELPO mostró un 90,7% de pacientes con bajo riesgo de desarrollar lesiones de posicionamiento. **Conclusión:** De acuerdo con una evaluación utilizando la ELPO, los pacientes tenían un bajo riesgo de lesiones en la piel durante las cirugías cardíacas, resultado atribuido al uso de un colchón de polímero viscoelástico en las mesas quirúrgicas.

**Palabras clave:** Posicionamiento del paciente. Procedimientos quirúrgicos operativos. Úlcera por presión. Factores de riesgo. Enfermería de quirófano.

## INTRODUCTION

Surgical positioning is considered a procedure of great importance for patients in surgical experience. It requires responsibility and competence of the team that works in the operating room, as the chances of compromising the individual's physical and even neurological health increase when it is not correctly observed and performed<sup>1</sup>.

Any surgical positioning results in some risk, and complications can occur in the respiratory, circulatory, integumentary, and neurological systems<sup>2</sup>.

In this sense, it is worth highlighting that the purpose of surgical positioning is to provide the best surgical exposure field, as it acts mainly to prevent complications caused by the position time to which the patient will be submitted. To do so, it is important for the team to have good communication and work with specific materials and equipment for each type of surgical positioning<sup>3</sup>.

Thus, it is paramount for patients to be systematically evaluated during the perioperative period regarding the risks of pressure ulcer, contributing to decision-making on preventive measures to be performed in the hospital setting<sup>4</sup>.

To this end, the use of validated scales for risk assessment is extremely important. They can assist in the method of the conduct of nurses together with the surgical team, in the care of the patient in the intraoperative period, in which the surgical positioning takes place, in addition to identifying factors that predispose the development of injuries and implementing parameters to improve health care<sup>5</sup>.

In an observational study aimed at evaluating and classifying patients according to the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning (*Escala de Avaliação de Risco para Desenvolvimento de Lesões Decorrentes*

*do Posicionamento Cirúrgico – ELPO*), the results showed that, of the analyzed sample, composed of 278 patients, 56.5% (157 individuals) presented high risk, with an average score of 20.09 points (standard deviation — SD=3.63), with a minimum of 13 and a maximum of 29 points. After the procedure, there was a predominance of stage I pressure ulcer in 77% (214 patients)<sup>6</sup>.

ELPO was created in Brazil and validated in 2013. It is used to assess the risk of developing injuries due to surgical positioning, seeking to expedite the decision of the professional in the rapid and easy detection of patients at high risk of developing pressure ulcers, in addition to warning professionals to the needs of additional care<sup>5</sup>.

Taking this into consideration and also that in major surgeries the risk of pressure ulcers is inherent in the duration of surgery, the aim of this study was to assess the risk levels resulting from surgical positioning in patients undergoing cardiac surgery.

## OBJECTIVE

To assess the risk of injuries due to surgical positioning, according to ELPO (version 2), in patients undergoing cardiac surgery.

## METHOD

This is an observational, cross-sectional, documentary, and descriptive study. The research was conducted at a large philanthropic hospital located in the city of Salvador, state of Bahia, Brazil. The institution consists of 16 operating rooms, of which four are intended for cardiac surgeries – the

reference area of the hospital and which reaches the highest demand on a monthly basis. The study sample consisted of 258 patients who underwent cardiac surgery from January 2018 to January 2019.

Electronic medical records of patients aged 18 years or older, of both sexes, who underwent the following major cardiac surgical procedures were included: coronary artery bypass grafting (CABG), heart valve repair and replacement, and atrial septal defect surgery (ASD). The medical records of patients who presented insufficient information were excluded. Data collection took place from August to September 2019.

A form was used for data collection, with the following sociodemographic variables: self-reported skin color, age, and sex; clinical information on surgery; classification of the American Society of Anesthesiologists (ASA); body mass index (BMI), according to the Brazilian Association for the Study of Obesity and Metabolic Syndrome (*Associação Brasileira para o Estudo da Obesidade e Síndrome Metabólica* – ABESO). Thus, patients with BMI lower than 18.5 kg/m<sup>2</sup> were considered as having low BMI (underweight); from 18.5 to 24.9 kg/m<sup>2</sup>, normal weight; and, with a BMI higher than 30.0 kg/m<sup>2</sup>, high BMI (obesity class I)<sup>7</sup>.

As recommended in the ELPO, the following variables were considered: duration of surgery, type of anesthesia, surgical positioning, support surface, positioning of upper and lower limbs, comorbidities, and patient's age. The ELPO is a scale with seven items and five subitems, with scores ranging from 1 to 5 and a total score of 35 points. The higher the score with which the patient is classified, the greater the risk of developing injuries resulting from surgical positioning<sup>5</sup>.

The research project was approved by the Research Ethics Committee of Escola Bahiana de Medicina e Saúde Pública (EBMSP), under the Certificate of Presentation for Ethical Consideration (CAAE) No. 11515519.8.0000.5544 and Opinion No. 3.347.047. As it is a retrospective study with medical record data, there were no accessible patients to sign the Informed Consent Form.

Data were coded, typed, and processed using the Statistical Package for the Social Sciences (SPSS) software, version 21.0, of the Windows platform. Descriptive analyses (percentage indices) were performed using tables with absolute (n) and relative (%) frequencies. To analyze the association between the variables of the ELPO risk score and demographic and clinical variables, the  $\chi^2$  test was used. The adopted level of statistical significance was  $p < 0.05$ .

## RESULTS

Among the 258 patients who underwent cardiac surgeries during the study period, the self-reported black/mixed-race skin colors (227/88.0%) stood out. Regarding the age group, the 40 to 59 years (88/34.1%); 60 to 69 years (79/30.6%); and 70 to 79 years (53/20.5%) groups were noteworthy. As for sex, 154 (59.7%) were men and 104 (40.3%) were women.

The cardiac surgery that prevailed was CABG, performed in 137 patients (53.1%), followed by heart valve replacement (54/20.9%) and valve prosthesis (51/19.8%). Regarding the ASA physical status classification, there was a predominance of ASA III (180/69.8%) and, in the BMI analysis, there was a predominance of high BMI (176/68.2%). Table 1 shows the variables that characterize the patients.

Table 2 presents the evaluation of patients according to the ELPO variables. The supine surgical positioning and the anatomical position of the limbs were predominant in 258 patients (100%), respectively, considering there were cardiac surgeries. The duration of surgery that prevailed was over 4 to 6 hours in 163 cases (63.2%). Concerning the type of anesthesia, the 258 (100%) patients were submitted to general anesthesia and all used a dry viscoelastic polymer mattress, with dimensions of 117 x 52 x 1.25 cm + pads, intended for patients weighing more than 11 kg, on the operating table. A total of 156 patients (60.5%) had vascular disease, and 62 (24%) had diabetes. Table 3 presents the analysis of the association of the ELPO risk score with the demographic and clinical variables of the study patients. In this table, statistical significance can be verified in the group of older adults ( $p = 0.000$ ), obtained from the Pearson's  $\chi^2$  test.

## DISCUSSION

Positioning is one of the fundamental conditions for performing a safe and satisfactory procedure. Therefore, when positioning the patient, it is essential to be careful with the joints of the hips, upper and lower limbs, as nerve injuries can occur<sup>8</sup>. The type of positioning should be chosen according to the surgery and the needs of each patient<sup>9</sup>.

When the sample that composed this study was characterized, the predominant skin color was black/mixed-race (88.0%). The structure of the skin may vary according to color due to the stratum corneum, which in black people is more concentrated, which in turn makes the skin more resistant to irritation and more effective to external incentives<sup>10</sup>.

**Table 1.** Characterization of patients undergoing cardiac surgery (n=258).

Variables	n	%
Self-reported skin color		
Black/Mixed-race	227	88.0
White	29	11.2
Asian or Indigenous	01	0.4
Age		
Between 18 and 39 years old	27	10.5
Between 40 and 59 years old	88	34.1
Between 60 and 69 years old	79	30.6
Between 70 and 79 years old	53	20.5
Over 80 years old	11	4.3
Sex		
Men	154	59.7
Women	104	40.3
Surgery		
Coronary artery bypass grafting	137	53.1
Heart valve repair	51	19.8
Heart valve replacement (prosthesis)	54	20.9
Atrial septal defect	16	6.2
ASA classification		
ASA II	59	22.9
ASA III	180	69.8
ASA IV	19	7.9
Body mass index		
High	176	68.2
Normal weight	61	23.6
Low	04	1.6

Likewise, a study on demographic and clinical characteristics of patients with pressure ulcers carried out in Teresina (state of Piauí, Brazil) demonstrated that 60.7% of the patients were mixed-race<sup>11</sup>. However, in another study carried out in the Brazilian state of Minas Gerais<sup>6</sup>, white people prevailed. Thus, skin color is related to the predominance in each region of the country.

Still on the demographic and clinical characteristics of patients with pressure ulcers, a study<sup>11</sup> highlighted greater evidence in the age group between 18 and 49 years (39.3%). In another research<sup>12</sup>, this same outcome occurred in the age group of 40 to 59 years (39.69%). These findings are consistent with the age groups of the sample evaluated in the present study, in which most patients were 40 to 59 years old

**Table 2.** Evaluation of patients undergoing cardiac surgeries (n=258), according to variables of the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning.

Variables	n	%
Positioning type		
Supine	258	100.0
Duration of surgery		
Over 2 to 4 hours	37	14.3
Over 4 to 6 hours	163	63.2
Over 6 hours	58	22.5
Type of anesthesia		
General	258	100.0
Support surface		
Viscoelastic table mattress + pads	258	100.0
Position of the limbs		
Anatomical position	258	100.0
Comorbidities		
Vascular disease	156	60.5
Diabetes	62	24.0
Obesity or malnutrition	40	15.5

(34.1%) and 60 to 69 years old (30.6%). Furthermore, a study indicates that age influences the risk of developing pressure ulcer, but it should not be an isolated criterion of evaluation<sup>13</sup>.

In the present study, 59.7% of the patients were men. In a study carried out aiming at evaluating the incidence of injuries in cardiac surgeries, 67% of the evaluated patients were also men. Nevertheless, other investigations show that sex is not a significant independent factor for greater risk of injury development. This finding is part of a sum of factors that increase the risk of developing injuries<sup>14</sup>.

Another noteworthy characteristic of the sample concerns anesthetic risk, with 69.8% of individuals classified as ASA III. A study<sup>15</sup> showed that patients with ASA III are at greater risk of developing injuries.

In the analyzed sample, 176 patients (68.2%) had high BMI. A study reports that patients with BMI lower than 18.5 kg/m<sup>2</sup> and higher than 25 kg/m<sup>2</sup>, i.e., underweight and overweight, increase shear and friction<sup>8</sup>. Another research<sup>16</sup> corroborates the results obtained in the present study, in which BMI was a predisposing factor for the occurrence of pressure ulcer, being higher than 30 kg/m<sup>2</sup>.

Regarding the ELPO variables, it was demonstrated that, considering that the surgical approach predominantly occurs through the anterior region of the chest, the supine position

**Table 3.** Bivariate analysis associating the score of the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning with the demographic and clinical variables of patients undergoing cardiac surgery (n=258).

Variables	ELPO risk score		$\chi^2$ *
	High risk	Low risk	
	n	n	
<b>Sex</b>			
Men	16	138	0.464
Women	08	96	
<b>Age</b>			
Older adult	24	119	0.000
Adult	00	115	
<b>Skin color</b>			
Black and mixed-race	21	206	0.895
White, Yellow, and Indigenous	03	27	
<b>Body mass index</b>			
High/Low	01	60	0.015
Normal weight	22	158	
<b>ASA</b>			
III and IV	22	177	0.075
II	02	57	
<b>Surgery type</b>			
Coronary artery bypass grafting	18	119	0.024
Heart valve prosthesis and atrial septal defect (ASD)	06	115	

ELPO: Risk Assessment Scale for the Development of Injuries due to Surgical Positioning; ASA: American Society of Anesthesiologists; \* $\chi^2$ : Pearson's chi-square test. (p>0.05).

was used in all procedures. Consequently, 100% of the patients had their limbs in anatomical position. The supine position is the most anatomical; nonetheless, patients in the supine position may develop pressure ulcers at the points where the body is in contact with the surface such as the occiput, olecranon, scapula, sacrum, coccyx, and calcaneus<sup>2</sup>.

Positioning injuries occur three times more frequently in patients undergoing surgeries lasting over 2 hours<sup>6</sup>. Regarding the surgical time, in this study, 163 procedures (63.2%) lasted between 4 and 6 hours. Thus, the patients in the studied sample are at greater risk of developing injuries in terms of the duration of surgery.

Regarding the variable "type of anesthesia," studies on pressure ulcers and risk factors demonstrated that general anesthesia reduces sensitivity due to long periods of

immobilization, causing exposure to pressure, which leads to anoxia, tissue necrosis and, consequently, skin injury<sup>4</sup>. This is the most widely used technique in major surgeries, with longer duration, and resulted in the incidence of 85.7<sup>17</sup> and 75%<sup>17</sup>, in line with the results of this study, which included major cardiac surgeries performed with general anesthesia.

As for the variable "support surface used in the positioning of surgical patients," all patients in this study used a dry viscoelastic polymer mattress, with dimensions of 117 x 52 x 1.25 cm + pads, valid for patients over 11 kg. These devices benefit patients, mainly those who undergo surgeries lasting more than 2 hours, as are the cases discussed in this research<sup>18</sup>. At the institution where the present study was conducted, all operating tables contain mattresses with dry viscoelastic polymers.

Concerning the variable "comorbidities," diabetes mellitus is a risk factor for the occurrence of pressure ulcer, as its pathophysiology results in decreased blood flow, causing tissue perfusion and impaired healing due to the difficulty of replacing endothelial cells. As a result, the patient is more likely to develop injuries<sup>17</sup>. In the studied sample, 24% of the patients were diabetic.

Vascular diseases are also considered comorbidities that may increase the risk of injury due to surgical positioning. In this study, 60.5% of patients had vascular disease, a common diagnosis among patients who undergo heart surgery. This risk increases whenever it is associated with other comorbidities and, especially, with advanced age (52.4%)<sup>16</sup>.

Despite the predominance of 90.7% concerning the low risk for injury due to surgical positioning, according to the results obtained in this study with the application of the ELPO scale, the characterization of patients points to the need for greater attention to patients undergoing major cardiac surgeries, in accordance with evidence pointed out in the literature. Among them, the authors highlight those of a study carried out aiming at verifying the incidence of injuries during the intraoperative period of cardiac surgeries, in which 19.2% of the patients presented stage I lesions<sup>19</sup>. In another study, 90.5% of ASA II and III patients presented postoperative injuries<sup>16</sup>. Regarding the type of general anesthesia, two studies obtained a higher incidence of injury (87<sup>16</sup> and 75%<sup>17</sup>).

Another aspect worth mentioning concerns the value of statistical significance, obtained when verifying the association between demographic and clinical variables, and the ELPO risk score of patients undergoing cardiac surgery (Table 3). There was a higher risk for the development of pressure ulcer due to surgical positioning in the group of older adults,

which showed a statistically significant difference ( $p=0.000$ ). In another study, it was found that the variable “age” was significantly associated with the risk for injury due to surgical positioning ( $p=0.013$ ); patients aged 46 years or older had a 3.5 times higher prevalence of risk classification when compared with those of younger age<sup>20</sup>.

The conditions provided by the service should also be considered, such as the use of viscoelastic polymer mattress on the operating tables of all rooms, which favorably contributes to the attribution of scores considered to be of low risk. These devices are manufactured for pressure redistribution and act to control shear force<sup>9</sup>. In this sense, a research<sup>5</sup> indicated that the nonuse of the support surface in the intraoperative period increases the risk of pressure ulcer.

As a limitation of this study, the collection of data in only one health service can be pointed out; it is worth highlighting that this is not the reality of most institutions that perform cardiac surgeries, especially in public services, due to the economic, political, and social factors faced in the country. Thus, this aspect can be considered a limiting factor of the research for generalizations.

## CONCLUSION

Of the 258 patients who underwent major cardiac surgeries, evaluated for the risk of injuries resulting from surgical positioning, only 9.3% had a high-risk score, greater than 20 points, and 90.7% were classified as having low risk.

However, the variables related to the duration of surgeries, type of anesthesia, and comorbidities are noteworthy, for which a predominance of high percentages was observed, namely: surgical time over 4 to 6 hours (63.2%); general

anesthesia (100.0%); presence of vascular disease (60.5%) and diabetes (24.0%). Scientific evidence points to the need for greater attention, on the part of the multidisciplinary team working in the operating room, to the high risk for the development of perioperative positioning injuries.

Furthermore, it is extremely important to develop further studies on the addressed topic, considering that the favorable conditions provided by the institution where the present research was conducted, such as the use of viscoelastic polymer mattress on the operating tables of all operating rooms, unlikely reflect the reality of most hospitals, thus constituting a limiting factor of great relevance for generalizations.

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## CONFLICT OF INTERESTS

There are no conflicts of interests.

## AUTHOR'S CONTRIBUTIONS

LSS: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Writing — original draft. MGS: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing — original draft. DNS: Supervision, Validation, Visualization, Writing – review & editing. AT: Supervision, Validation, Visualization, Writing – review & editing.

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