



Cross-sectional Study



# Magnitude of position-related soft tissue injuries and associated factors among elective adult surgical patients at Tikur anbessa specialized hospital, Addis ababa, Ethiopia

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## ARTICLE INFO

## Keywords:

Position related  
Soft tissue injury  
Surgical patients  
Acute postoperative

## ABSTRACT

**Background:** Position-related soft tissue injuries are the cause of additional suffering for surgical patients, and increase treatment costs. Though its prevalence is underreported, its consequences range from acute mild injuries to lifelong disabilities.

**Objective:** To assess magnitude and associated factors of position-related soft tissue injuries among elective adult surgical patients at Tikur Anbessa Specialized Hospital, Addis Ababa.

**Method:** An institutional-based cross-sectional study design was conducted among 292 elective adult surgical patients at Tikur Anbessa specialized hospital from January 1, 2021, to May 30, 2021. A systematic random sampling technique was used and data was collected by pre-tested questionnaire through data retrieval from chart and patients observation in the post anesthesia care unit. Both bi-variable and multi-variable logistic regression analysis were done to evaluate the association between dependent and independent variables. The level of statistical significance was decided at p-value less than 0.05.

**Results:** The magnitude of position-related soft tissue injuries in our study was 9.6%. The lower Body Mass Index AOR = 6.12; 95%CI: (1.02–16.3), surgical duration more than 4 h AOR = 5.04; 95%CI:(1.19–21.2) and lateral position AOR = 8.01; 95% CI: (1.2–30.5) were found to be independently associated with position related soft tissue injury.

**Conclusion:** Our study found that the magnitude of position-related soft tissue injury was high. Surgical teams must develop the local protocol or adopt protocol to prevent the position-related soft tissue injury and factors associated should be identified a head of surgery.

## 1. Introduction

Surgical positioning is the act of putting a patient in a specific physical position during surgery, to maintain the patient's safety while simplifying access to the surgical site. Usually a patient must be placed in an unnatural position to gain access to the specific procedure location [1].

When a patient is positioned for surgical procedure, the position to use is determined on the basis of surgery type, the surgeon's choice and the anesthetist's comfort for ease access to the airway, venous and arterial lines. The operation theatre staffs must keep the patient on a safe position by aligning the body of the patient adequately on the operation

room table to reduce the degree of skin and other soft tissue injuries [2, 3].

Surgical and/or anesthetic complications are among the most often avoidable adverse events, and soft tissue injuries resulting from surgical positioning are remarkable [4]. Position-related soft tissue injuries happen when extrinsic pressure comes greater than the normal capillary filling pressure of approximately 32 mm Hg. Pressure injury is directly related to the duration surgical procedures. Particularly, the total duration of surgery is related to the development of position related soft tissue injury. For every 30 min surgery that lasts beyond 4 h, the risk for a position related soft tissue injury increases by approximately 33%. Some evidences of studies suggest varieties of position-related soft tissue

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<https://doi.org/10.1016/j.amsu.2022.104592>

Received 24 July 2022; Received in revised form 30 August 2022; Accepted 4 September 2022

Available online 13 September 2022

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injuries occurrence rates related to surgical positioning to be 13% in the USA, 10.1% and 21.7% in Brazil [5–7].

The patient under anesthesia and surgery doesn't complain about his/her discomfort and pain due to anesthesia and may not also get early recognition from the operating theatre team which makes him/her highly susceptible for developing position-related soft tissue injuries. Once the patient developed position-related soft tissue injury, it might be either short term or may further result in long term disability. Unnecessary treatment costs, exposure to infection, delayed discharge from hospital are additional risks posed by the development of position-related soft tissue injury. Immobility during surgery, anesthesia technique, surgery duration, and patient clinical status of having comorbidities, sex and age are believed to be contributing to development of positioning related soft tissue injuries [8–11].

As intraoperative patient positioning has its own implication on patients' physiological responses and also results in soft tissue damage due to continuous pressure applied on body surface, anesthetists have an almost equal responsibility to provide appropriate care for patients undergoing anesthesia and surgical procedures [12]. The increase of occurrence posed additional suffering for affected patients, increase the time spent in hospital, and involve additional un-necessary treatment costs, for materials and personnel to treat the injury and also patient dissatisfaction to health service given in the health facilities, especially in the operation theatres [13]. As far as our knowledge and searching literatures, there were no available data in the study area on the problem, and therefore, the present study tried to identify the magnitude and associated factors of position-related soft tissue injuries.

## 2. Materials and methods

### 2.1. Study design, setting and population

An institutional-based cross-sectional study was conducted from January 1 to May 30, 2021, at TASH, Addis Ababa, Ethiopia. This study included all adult patients who had undergone elective surgery during the study period. Patients those with pre-existing soft tissue injury were not participated in the study. This work is reported in line with STROCSS criteria from [www.strocsguideline.com](http://www.strocsguideline.com) [14].

### 2.2. Sample size and sampling technique

Sample size was determined using the finite population correction formula. Since no related study was found in Ethiopia and Africa, the  $P = 0.5$  was used for calculation of sample size, 95% level of significance, 5% margin of error and 10% for incomplete or as contingency data was used as parameters. Thus the sample size was 384 and adding 10% for non-response rate, the final sample size became 422. However, the total number of target population in the study period was less than 10,000 ( $N = 850$ ), so we considered the population correction formula to get the representative sample size.

Thus, the 292 patients who underwent elective surgical procedures was planned to participate in this study. Systematic random sampling method was used. The situational analysis was done for 3 months before the start of the study, and an average of 850 elective surgery were found to be done. Hence  $K$  was determined using formula:  $K = N/n$ ; where,  $n =$  total sample size,  $N =$  population per 3 months. So,  $K = 850/292 \approx 3$ . Therefore, the sampling interval was three and the random start was selected using the lottery method from the daily schedule list.

### 2.3. Study variables

**Dependent Variables:** Position-related soft tissue injury (Yes/No).

**Independent Variables:** Socio-demographic factors, preoperative clinical characteristics, surgical factors and anesthetic related factors.

### 2.4. Data collection process

A planned structured questionnaire was used to collect data. Questionnaires were adopted from existing kinds of literatures [15]. It was collected by four data collectors with two assigned supervisors. Data collection was started at preoperative, continued intraoperative and ended at the recovery room. Presence and absence of chronic disease history retrieved from patient chart, the type of position employed and positioning tools/aids used were recorded during intraoperative time. At the end of the surgery, the patient was re-examined and recorded for any soft tissue injuries in the immediate postoperative time, reviewing of all dependent body parts of the patients based on the positioning used for surgical procedure.

### 2.5. Data quality control

Addis Ababa University Institutional review board and the applicable executives of TASH approved the study. The study was conducted according to the ethical standards ratified by the 1964 Declaration of Helsinki and its amendments. We assured quality of data before, during after collection of data. Data collectors were trained on each section included in the study tools, objective, relevance of study and right of respondents. Pretest of the questionnaire was done on a 5% of the sample size to check data collection tool validity. Informed consent was obtained by data collectors prior to start of data collection. During data collection, regular supervision and follow up was made and the principal Investigator cross-checked for completeness and clarity of the collected data daily using multiple imputation method before analysis of the data on SPSS.

### 2.6. Data processing and analysis

At the end of each day of data collection, data completeness was checked to verify correctness and enable retrieval of any missing information. Data were coded, edited and entered to EPI Info version 7 software and exported to SPSS software version 26. Descriptive statistics were used to summarize data, tables and figures for displaying results. Bi-variable and multivariable logistic regression analysis were done to identify presence of associations between outcome and predictor variables using binary logistic regression model, and odds ratio with 95% confidence intervals was used to determine the degree of association between outcome and predictor variables. Variables with a p-value less than 0.25 in the bi-variable logistic regression analysis were selected for multivariable analysis. All the statistical tests were performed at a 5% significance level.

## 3. Results

### 3.1. Socio-demographic and clinical characteristics

A total of two hundred ninety-two study participants were involved in the study as all the data were complete. Among all study participants, 133 patients (45.5%) were age group between 18 and 44 years. The minimum age was 18 and maximum 81 with a mean age of  $47.1 \pm 15.7$ . Further details are displayed in [Table 1](#) below.

### 3.2. Anesthetic and surgical characteristics of the participants

Of the total 292 patients, greater than half of the patients operated under general anesthesia, 168(58%), the remaining 124(42%) procedures underwent regional anesthesia. The most frequently used type of position for surgical procedures was supine 152(52.4%) and mostly used positioning aids were arm board and pillow under dependent areas. Most of surgery 201 (68.8%) were under went within 4 h duration and 31.2% were done within >4 h duration.

**Table 1**

Socio demographic and preoperative clinical characteristics of elective surgical patients who underwent elective surgery at TASH from January 1, 2021 to May 30, 2021.

Variables	Category	Frequency (n)	Percent (%)
Gender	Male	148	50.7
	Female	144	49.3
Age (year)	18–44	133	45.5
	45–64	102	34.9
	≥65	57	19.5
BMI (kg/m <sup>2</sup> )	<18.5	54	18.5
	18.5–24.9	198	67.8
	25–29.9	29	9.9
	≥30	15	5.1
Co – existing disease	Yes <sup>a</sup>	117	40.1
	No	175	59.9

<sup>a</sup> Diabetics mellitus, hypertensive, renal diseases, liver diseases, and anemia.

### 3.3. Magnitude of position related soft tissue injuries

Among total study participants, it was observed that 28 (9.6%) patients were developed position-related soft tissue injuries. Of the 28 position-related soft tissue injuries, 18(64%) occurred during general anesthesia, and 10 (36%) occurred under regional anesthesia. Among 28 total positioning-related soft tissue injuries occurred, 37% of these were developed under lateral position followed by 36%, 16% and 11% under prone, lithotomy and supine positions, respectively.

### 3.4. Factors associated with position-related soft tissue injuries

On multi-variable logistic regression analysis, we excluded variables which did not fit for the model using P-value >0.25 and multivariable analysis was performed for those variables including duration of surgery, body mass index, positioning aids use and type of position were associated with position related soft tissue injury at p-value < 0.05. Of the interesting findings, study participants for whom positioning in lateral position had 8 times odds of developing position-related soft tissue injury (AOR(95%CI) 8.01; 1.2–30.56) in contrast to those participants for whom positioning in supine as displayed in the [Table 2](#) below.

## 4. Discussion

According to our study, of 292 study participants, there was 9.6% overall magnitude of position related soft tissue injury (95%CI: 6.2–13.6). When analyzing multi-variable model of analysis, body mass index, type of position, duration of surgery and non-use of positioning

aids were independently associated with development of position related soft tissue injury.

Our study finding is higher than the study conducted in the Indian Krishna Institute of medical science. They conducted the study on elective urologic surgery to assess the incidence of position-related injuries among 292 patients. They found that the overall incidence of position-related injury was 2.1% [15]. The reason for this difference may be the difference with study subjects included in the study. They included only urologic surgical cases and in our case, study subjects were from different surgical specialties.

Another retrospective study done by Bithal; et al. in Riyadh, Saudi Arabia found that the incidence of positioning injury was 14.7% [16]. The study was done retrospectively to determine incidence of position related skin injuries among spine surgery patients operated under prone position. The difference might be estimated to be due to the difference in study period, types of surgical procedures included in the study, sample size variation and quality of intra-operative utilization of pressure relieving materials.

A one year systematic review by Mills et al. in University of Virginia, USA, to determine incidence of positioning injuries among 334 elective urologic patients found 6.6% of positioning related injuries [17]. The finding of this study not compared with our study result as they studied only minimally invasive surgical procedures and nerve injury was the main finding they reported, which was not covered in our study due to lack of equipment and specialist to identify the problem.

Ali et al. conducted a descriptive cross-sectional studied in the Iran in 2020, found that the magnitude of postoperative position related skin damage was 7.6% [18]. This finding is in line with our finding even if their study included only neurosurgical cases and type of position assessed was only prone position and their sample size was also smaller than ours. This may be the reason why our finding is somewhat greater than their result. Another one year prospective observational study done in Portugal on 172 elective patients of different surgical specialties reported the incidence of positioning injuries to be 12.2% [19]. This finding is in line with our study finding.

The finding of our study confirmed that type of position (lateral and prone) was significantly associated with development of position related soft tissue injury. It is in line with study conducted in Taipei, Taiwan University Hospital [20] to assess incidence and associated factors of position related soft tissue injury during surgical procedures in the post anesthesia care unit immediately at the end of surgery. The result of their study showed that incidence of position related soft tissue injury assessed at immediate post-operative period was 9.8% and prone and lateral positions were independently associated with development of position related soft tissue injury. Our study also found out that lying on prone position for surgery was 4.4 times more likely at risk of developing position related pressure injury as opposed to supine position.

Body Mass Index is another factor associated with position related

**Table 2**

Result of multivariable analysis of factors associated with position related soft tissue injury assessed at TASH, 2021.

Variables	Category	Soft tissue injury		COR, 95%CI	AOR, 95%CI	P-value
		Yes (N, %)	No (N, %)			
Body mass Index (kg/m <sup>2</sup> )	<18.5	12(22.2)	42(77.8)	3.26; 1.05–10.23	6.12; 1.02–16.3	<b>0.001</b>
	18.5–24.9	1(5.6)	187(94.4)	0.25; .013–3.87	0.34; 0.14–5.23	.064
	25–29.9	1(4)	24(96%)	1.4; .34–3.76	.52 .062–3.6	.28
	≥30	4(26.7)	11(73.3)	1	1	
Co-existing Disease	Yes	18(15.4)	99(84.6)	3.0; 1.35–6.5	15.0; .80–27.4	.075
	No	10(5.7)	165(94.3)	1	1	
Position type	Supine	4(2.6)	148(97.4)	1	1	
	Lateral	11(21)	41(79)	7.22; 2.34–22.30	8.01; 1.2–30.56	<b>.002 **</b>
	Lithotomy	3(7)	39(93)	2.23; .52–9.94	2.13; .186–24.28	.643
	Prone	10(21.7)	36(78.3)	8.22; 2.64–25.5	4.48; 1.2–27.40	<b>.05</b>
Duration of surgery	<1 h	3(4.3)	66(95.7)	1	1	
	1–4 h	6(4.5)	126(95.5)	1.05; .25–4.32	1.615; .14–18.8	.62
	> 4 h	19(21)	72(79)	5.80; 1.64–20.5	5.04; 1.19–21.2	<b>.02**</b>

\*\* Statistically significant P < 0.05; COR = Crude Odds Ratio; AOR = Adjusted Odds Ratio 1 = reference group; CI= Confidence interval.

soft tissue injury and BMI <18.5Kg/m<sup>2</sup> is shown an independent risk factor in our study. In our study, 18.5% of study participants were underweight. This finding is in agreement with a cross sectional survey done by Van Gilder and colleagues [21]. Menezes et al. found position related injury was significantly associated with BMI >30Kg/m<sup>2</sup> and not with BMI < 18.5Kg/m<sup>2</sup>. The difference may be from difference in patient body distributions and genetic differences of patients.

Duration of surgery is one of the risk factors associated with development of positioning-related soft tissue injury. In our study, surgery duration greater than 4 h was seen to be strongly associated with position-related soft tissue injury. This finding is supported by the systematic review done by Haisely et al. in Denmark in 2019 [22]. This again is supported by a number of studies done earlier [23]. The reason could be explained in such that as the duration of persistent pressure applied on the localized tissue prolongs, there is limited blood supply to the area which may finally result in tissue ischemia, necrosis and skin damage.

## 5. Conclusion and recommendation

Magnitude of position related soft tissue injury in this study was high related to the previously reported findings in literatures. Being underweight or malnutrition, prolong surgical duration, using lateral or prone position for surgical exposure were identified as significantly associated factors with high position-related soft tissue injury.

The **Anesthesia and surgical teams** should enhance provision of precaution for high risk patients. Preoperative risk assessment to identify and care for higher risk patients to prevent position related soft tissue injury during surgical procedures should be mandatory. Patients those undergo surgical procedures that lasts greater than 4 h, and those indicated for lateral and prone position should be identified before surgery and all the necessary precaution should be taken.

## 6. Strength and limitation of the study

### - Strength of the study

Although the findings should be interpreted with caution, this study tried to report magnitude of position related soft tissue injury in the immediate postoperative time prospectively which will make the study to be used as a baseline for further Institutional and nationwide study.

### - Limitation of the study

- ❖ Representative samples are small in some subgroups. This might have effect on the outcome variable; hence, the finding of this study should be interpreted with these limitations.
- ❖ Since there was no exact cut off point or agreement on how to identify presence of soft tissue injury during data collection, our finding could be affected by subjective decisions.

### Data availability

All data generated or analyzed during this study are included in this article.

### Disclosure

No financial and publication issues to disclose.

### Sources of funding

Addis ababa university funded for data collectors.

### Ethical approval

Ethical approval was given by Addis Ababa university ethical review

board/ANES 23/13.

### Consent

The written and signed consent was obtain from the patients.

### Author contribution

TD, BB Develop proposal, conduct the study and writing the paper.  
BB, BT, MW Contribute in study design, data interpretation and paper writing.

### Registration of research studies

1. Name of the registry:
2. Unique Identifying number or registration ID:
3. Hyperlink to your specific registration (must be publicly accessible and will be checked):

### Guarantor

All authors.

### Declaration of competing interest

All authors declare that they have no conflicts of interest.

### Acknowledgments

All authors would like to thank Addis Ababa University supervisors, data collectors, and study participants.

### Abbreviations

AOR: Adjusted odds ratio, ASA: American Society of Anesthesiologists, BMI: Body Mass Index, COR = Crude Odds Ratio; PACU: Post Anesthesia Care Unit, POD: Postoperative Days, TASH: Tikur Anbessa Specialized Hospital.

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