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Research Article

Prevalence and associated factors of acute postoperative pain in adult surgical patients: A prospective study

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ABSTRACT

Background: Pain, as defined by the International Association for the Study of Pain, is an unpleasant sensory and emotional experience associated with, or resembling, that is associated with actual or potential tissue damage. In Ethiopia, where healthcare facilities and offerings are expanding to handle countless patients requiring surgical intervention, managing acute postoperative pain is a serious concern.
Objectives: To assess the prevalence of acute postoperative pain and associated factors after elective surgery among adult patients at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, 2023
Methodology: This is an institution-based cross-sectional study. A structured data collection format was used to collect data from 219 participants. Bivariable and multivariable logistic regression analyses described the association between independent and dependent variables.
Results: Of 219 patients, 180 (82.2 %) had acute postoperative pain. The prevalence of moderate to severe pain was 34.24 %. Preoperative anxiety, the use of intraoperative analgesics, and duration of surgery were the main factors associated with the prevalence of acute postoperative pain.
Conclusion: Our study revealed that the overall prevalence of postoperative pain was relatively low in the study area. This suggests that the attention given to postoperative pain recognition and management is better than that in other areas. However, the finding of a significant gap in managing postoperative pain underscores the need for further improvements in pain management practices. This should motivate us to commit to change, particularly in the identified areas of concern, such as preoperative anxiety, use of intraoperative analgesics, and duration of surgery.

1. Introduction

Postoperative pain is an acute condition arising from tissue damage incurred during surgical interventions, such as skin incision, tissue separation, handling, and traction [1]. Acute pain, as defined by the International Association for the Study of Pain (IASP), is a sudden, sharp pain that alerts individuals to potential bodily harm or disease. It typically arises from injuries, surgical interventions, illnesses, trauma, or invasive medical procedures, ranging from minutes to less than six months [2]. Effective postoperative pain management remains a significant challenge for surgeons and anesthesiologists, particularly in resource-limited settings [3].

The prevalence of moderate-to-severe postoperative pain exhibits geographic variability, with rates ranging from 14 % to 55 % in Western countries. The prevalence is most pronounced on the day of surgery[4, 5]. Data on the prevalence of postoperative pain in resource-limited settings are scarce. In a study by Eshete MT et al., the prevalence of postoperative Ethiopia was 88.2 %, and 58.4 % of these patients were inadequately treated [6]. Despite advancements in analgesic therapies, regional anesthesia techniques, and the establishment of specialized pain management services, inadequate postoperative pain control persists in even the most technologically advanced healthcare settings [7].

Postoperative pain is associated with a multitude of adverse outcomes, including an increased risk of thromboembolic events, respiratory complications, anxiety, sleep disturbances, and prolonged hospitalization. Moreover, persistent pain can develop, imposing a

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substantial burden on patients, healthcare providers, and the community while also escalating healthcare costs [8–10]. A 2019 large-scale study revealed a strong association between the severity of postoperative pain and the prevalence of postoperative complications, emphasizing the critical role of effective pain management in postoperative care [11].

Several factors have been identified as potential predictors of postoperative pain in Western populations, including pre-existing pain conditions, anxiety levels, younger age, female sex, and the specific type of surgical procedure performed [12,13]. Identifying these factors early and timely intervention reduces postoperative pain and the associated complications.

Despite advancements in pain management, moderate-to-severe acute pain persists following elective surgical procedures, constituting a significant public health issue. The availability of adequate resources, including training, infrastructure, and medical expertise, for effective pain management varies worldwide [2,14,15].

There is still a lack of data regarding the actual prevalence of postoperative pain and associated factors across different surgical procedures, particularly in low- and middle-income countries such as ours. Hence, this study aimed to determine the prevalence of acute postoperative pain and identify potential risk factors. In doing so, we aimed to stratify patients with these risk factors and develop a strategy to intervene early and improve postoperative care.

2. Methodology and materials

2.1. Study setting, period, and design

This institution-based cross-sectional study was conducted at the Tikur Anbessa Specialized Hospital from November 2023 to January 2024. All adult elective surgical patients who underwent surgical procedures and were admitted for at least 24 h postoperatively were included in the study. Individuals who were not alert enough to respond, those who could not speak, and those suffering from chronic pain before the procedure were excluded from the study.

2.1.1. Sample size determination

A single population proportion formula was used to determine the sample size. A previous study in the Public Hospitals of Addis Ababa showed that moderate to severe pain prevalence was 85.5 %.

$$N = \frac{(Z_{\alpha/2})^2 \times P(1-p)}{(d)^2}$$

Where N is the maximum sample size

Zα/2 is the standard score value for a 95 % confidence level, equal to 1.96. P: is the expected prevalence or proportion

D: is the margin of error

$= \underline{(1.96)^2} \times \underline{0.85 \text{ x } (1\text{-}0.85)} = 198$, considering a 10 % non-respondent rate.

$(0.05)^2$ The total sample size is N = 219.

2.1.1.1. Sampling techniques. Participants were chosen using a total enumeration (purposive) sampling strategy.

2.1.1.1.1. Operational definitions. **ASA Physical status:** A grading system used preoperatively to compare the severity of preexisting comorbidities in patients undergoing surgery.

- **ASA I:** An average, healthy patient
- **ASA II:** mild systemic disease without functional impairment.
- **ASA III:** A patient with severe systemic disease that results in functional limitations.
- **ASA IV:** A patient with severe systemic disease that is a constant threat to life.
- **ASA V:** A dying patient is not expected to survive, with or without surgery.
- **ASAVI:** A brain-dead patient whose organs are removed for transplantation into another patient (26).

Pain Intensity based on the Numerical Rating Scale (NRS)

- **No pain:** A score of 0 on a scale of 0 to 10
- **Mild pain:** Scores between 1-3 on a scale of 0 to 10
- **Moderate pain:** Scores between 4-6 on a scale of 0 to 10
- **Severe pain:** Scores between 7-10 on a scale of 0 to 10

Preoperative pain: Preoperative pain associated with surgical illness or injury, measured using a 10-point Numerical Rating Scale.

Acute Postoperative Pain: Pain in the postoperative period was defined as pain and score other than zero in the first 24 h.

Pain relief percentage scale

- No relief: 0 %
- Poor relief: 10 %-30 %
- Fair relief: 40 %-60 %
- Good relief: 70 %-90 %
- Complete relief: 100 %

Adult body mass index (BMI) categories

- Underweight: Less than 18.5 kg/m^2
- Normal weight: 18.5 to 24.9 kg/m^2
- Overweight: 25 to 29.9 kg/m^2
- Obesity: 30 or greater kg/m^2

The Amsterdam Preoperative Anxiety and Information Scale (APAIS) is a widely used tool to assess preoperative anxiety and the need for information in patients undergoing surgery. It consists of six items, each rated on a 5-point Likert scale.

Scoring and Interpretation:

- Anxiety Scale: Items 1, 2, 4, and 5.
- Need for Information Scale: Items 3 and 6.

None of the participants received postoperative anxiolytic therapy.

2.2. Statistical analysis

The collected data were first entered into epi-info version 7 and then transferred to SPSS version 27. Simple descriptive statistics with measures of association were implemented for data analysis using version 27 SPSS software, and the results are presented using tables, graphs, and pie charts. Bivariable and multivariable logistic regression analyses described the association between independent and dependent variables. Statistical significance was set at $P < 0.05$. Model fitness was checked by the Hosmer-Lemeshow goodness of fit test ($p = .613$). A multicollinearity test was fulfilled (VIF < 10 and tolerance > 0.1).

3. Results

3.1. Socio-demographic characteristics of participants

A total of 219 patients were included in this study. The average age of the participants was 40.6 years old, 18–85 years). Most patients were female (56.6 %), while the rest (43.4 %) were male. Most patients (72.1 %) had a normal BMI (18.5-24.9); 3.7 % were underweight, 23.3 % were overweight, and 0.9 % were obese.

3.2. Preoperative factors

Of the 219 patients, 98(44.7 %) experienced preoperative pain. Among those with preoperative pain, 65 (29.8 %) had mild pain, 26 (11.9 %) had moderate pain, and 7 (3.2 %) had severe pain. 82(83.7 %) received analgesics preoperatively. Most participants were ASA 1 (38.8 %) and ASA 2 (58 %). The remaining seven (3.2 %) patients were ASA 3. One hundred and fifty-nine (72.6 %) participants had no history of previous surgery.194 (88.6 %) participants did not receive preoperative information about postoperative pain management (Table 1).

Of the 219 patients, 108 (49.3 %) had preoperative anxiety. Among those who had preoperative anxiety, only 8 (7.4 %) received anxiolytic.

3.3. Intraoperative factors

Of the 219 participants, 35 (16 %) underwent obstetric surgery, 1 (0.5 %) underwent cardiac surgery, and the rest fell into ten surgical disciplines. Most procedures (38.4 %) were completed within two to three hours, whereas (8.7 %) lasted for more than four hours (Table 2).

The number of participants with incision length <10 cm was 173 (79 %), while the number of participants with incision length >10 cm was 46 (21 %). The duration of anesthesia for most of the procedures was 82 (37.4), which was between two and three hours, while 33 (15.1 %) lasted for more than four hours. Of the 219 participants, 54.3 % received GA, 42.5 % received CNBs, and the rest received sedation with or without local anesthesia and PNBs (Fig. 1).

The most commonly used intraoperative analgesics were opioids alone (45.2 %), and Opioids with PCM and regional analgesic techniques were used in 18.3 % of patients. No systemic analgesics were administered intraoperatively in 35.6 % of the patients.

3.4. Prevalence of acute postoperative pain

Among 219 participants, 180 (82.2 %) developed acute postoperative pain. The remaining 39 patients (17.8 %) did not develop acute postoperative pain.

3.5. Severity of acute postoperative pain

We asked 219 participants about the pain they experienced in the first 24 h. 47.9 % reported Mild Pain, 31.9 % reported Moderate Pain, 17.8 % reported No Pain, and Severe Pain (2.3 %) Out of the 180 patients who developed acute postoperative pain, 45.7 % reported they received good relief, 22.4 % reported they received complete relief, 18.7 % reported receiving fair relief, 10.0 % reported receiving poor relief whereas 3.2 % reported they did not receive any pain relief within the first 24 h postoperatively (Fig. 2).

Table 1
Preoperative factors.

Variable	Response	Frequency	Percent
Did you have preoperative Pain?	Yes	98	44.7
	No	121	55.3
If yes, the level of preoperative pain on NRS	1-3	65	29.8
	4-6	26	11.9
	7-10	7	3.2
Did you take Analgesics preoperatively?	Yes	82	83.7
	No	16	16.3
ASA PS	1	85	38.8
	2	127	58.0
	3	7	3.2
Do you have a history of previous surgery?	Yes	60	27.4
	No	159	72.6
Did you have preoperative information about Postoperative pain management?	Yes	25	11.4
	No	194	88.6
Did you have preoperative Anxiety?	Yes	108	49.3
	No	111	50.7
If yes, did you take anxiolytics?	`Yes	8 100	7.4
	No		92.6

NRS- Numerical Rating Scale, ASA PS- American Society of Anesthesiologists Physical Status Classification System

Table 2
Intraoperative factors.

Variable	Response	Frequency	Percent
Type of Surgery	Cardiac	1	0.5
	Chest	15	6.8
	Endocrine	10	4.6
	ENT	25	11.4
	GI	31	14.2
	Gynecology	11	5.0
	Maxillofacial	10	4.6
	Neurosurgery	12	5.5
	Obstetrics	35	16.0
	Orthopedics	31	14.2
	Urology	29	13.2
	Vascular	9	4.1
Incision size	<10 cm	173	79
	>10 cm	46	21
Duration of Surgery	<1 h	68	31.1
	1-2 h	48	21.9
	2-3 h	84	38.4
	>4 h	19	8.7
Duration of Anesthesia	<1 h	62	28.3
	1-2 h	42	19.2
	2-3 h	82	37.4
	>4 h	33	15.1

ENT-ear, Nose, and Throat, GI-gastroenterology

3.6. Factors associated with acute postoperative pain

This study included 219 patients; 180 (82.2 %) developed acute postoperative pain. Initially, all independent variables were entered into a bi-variable logistic regression model to determine the factors associated with the development of acute postoperative pain. In the bi-variable logistic regression model, variables with a p-value less than 0.25 were selected as candidate variables. Finally, a step-down method of multivariate logistic regression was performed for the variables of Age, Sex, History of previous surgery, Presence of Preoperative anxiety, use of anxiolytics preoperatively, intraoperative use of Analgesics, Incision size and duration of surgery. A" p-value" of less than 0.05 was considered statistically significant and presented with 95 % CI and AOR (Tables 3, and 4).

This study demonstrated that preoperative anxiety and duration of surgery were the main factors associated with the prevalence of acute postoperative pain. In this study, participants who had preoperative anxiety were 4.2 times more likely to develop acute postoperative pain as compared to those who did not have preoperative anxiety (AOR = 6.162,95 %CI = 1.915-19.831, p = 0.002).

Participants who took anxiolytics preoperatively were 85.5 % less likely (AOR: .145; 95 % CI: .022- .970, p = 0.046) to develop acute postoperative pain as compared to those who did not took anxiolytics preoperatively.

Patients with a duration of surgery of 2-4 h were 4.529 times more likely to develop acute postoperative pain as compared to those with a duration of surgery <1 h (AOR = 4.529,95 %CI = 1.234- 16.621, p = 0.023)

3.7. Variability of postoperative pain among surgical specialties

While the overall prevalence is high, there are notable variations across different types of surgery (Table 3)

Highest post-operative pain rate: Cardiac, Vascular, and Chest surgeries demonstrated the highest prevalence of post-operative pain, with rates reaching 100 %.

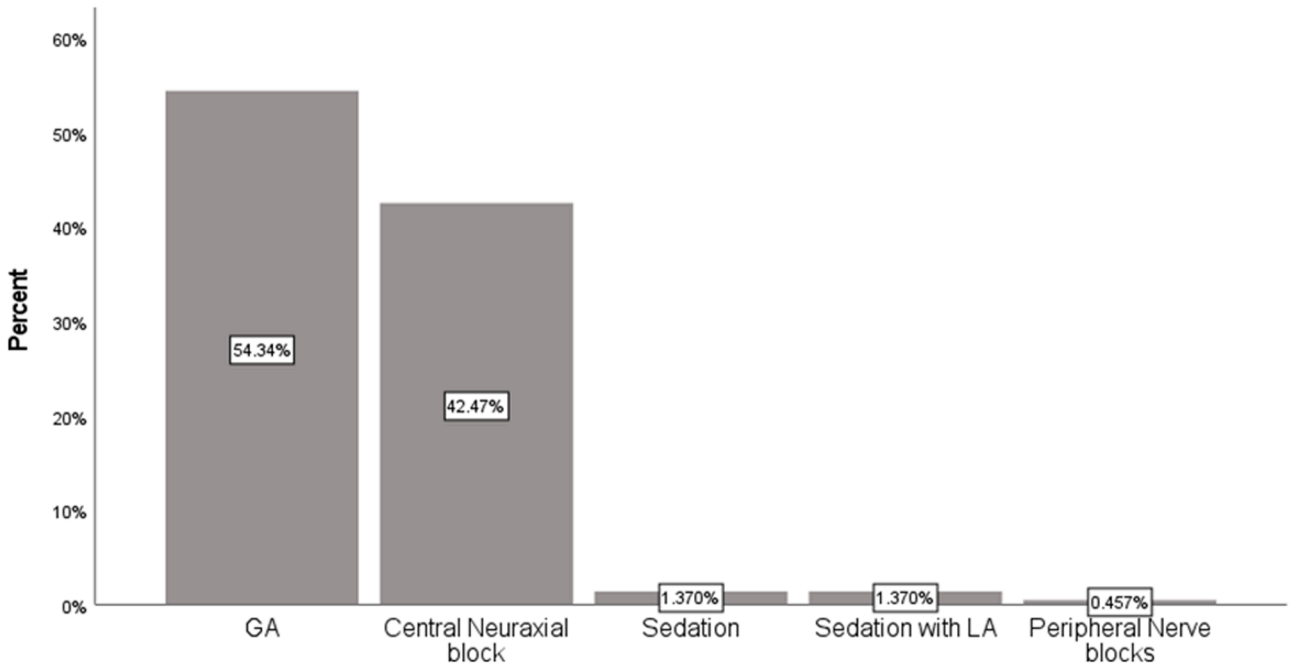

Fig. 1. Types of anesthesia given for study participants who underwent elective surgical procedures in AAU, TASH (n = 219).

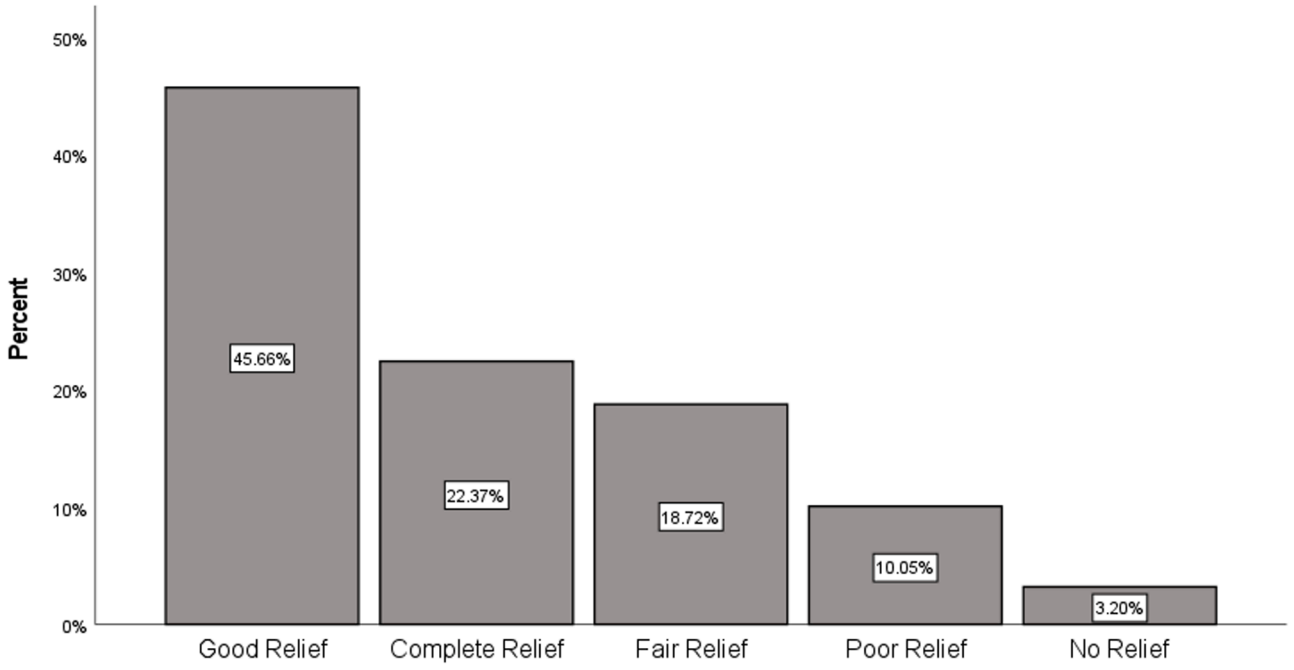

Fig. 2. Report of pain relief received within the 1st 24hrs by the study participants who underwent elective surgical procedures in AAU, TASH (n = 219**).**

Lower postoperative pain rate: Obstetrics and Endocrine surgeries had relatively lower rates of pain, with 62.9 % and 70 %, respectively.

Moderate postoperative rate: Most other specialties, such as GI, Gynecology, Maxillofacial, Neurosurgery, Orthopedics, and Urology, had moderate pain prevalence rates ranging from 70 % to 90 %.

4. Discussion

According to data from throughout the world, postoperative pain appears to be undermanaged despite the adoption of new standards, guidelines, and educational initiatives.

Postoperative pain has been poorly studied in developing countries. Most patients have a high prevalence of postoperative pain with unfavorable relief.

This study aimed to assess the prevalence of acute postoperative pains and associated factors after elective surgery among adult patients at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

The study revealed that the prevalence of acute postoperative pain was 82.2 % in the first 24 h postoperatively. Of these, 3.24 % of patients had no pain relief within the first 24 h, while 22.37 % had complete pain relief within the first 24 h of the postoperative period. Preoperative anxiety and duration of surgery were the main factors associated with the prevalence of acute postoperative pain. Our finding of acute postoperative pain is higher than a study done in Tanzania, which reported

Table 3
Types of surgery and postoperative pain.

		Acute post-op pain		Prevalence of acute post-op pain
		No	Yes	
Type of surgery	Cardiac	0	1	100.0
	Chest	1	14	93.3
	Endocrine	3	7	70.0
	ENT	5	20	80.0
	GI	2	29	93.5
	Gynecology	1	10	90.9
	Maxillofacial	2	8	80.0
	Neurosurgery	2	10	83.3
	Obstetrics	13	22	62.9
	Orthopedics	4	27	87.1
	Urology	6	23	79.3
	Vascular	0	9	100.0
Total		39	180	82.19

ENT-ear, nose, throat, GI-gastroenterology.

Table 4
Factors associated with acute postoperative pain.

Variables	Categories	Prevalence of Postoperative Pain		p Value	AOR (95 % CI)
		Yes	No		
Sex	F	96	28	0.429	0.674(.254-1.791)
	M	84	11		
Previous Surgery	No	135	24	0.798	0.886(.350-2.245)
	Yes	45	15		
Preoperative Anxiety	Yes	82	29	**0.004**	**4.241 (1.578-11.396)** *
	No	98	10		
Took anxiolytics preoperatively.	Yes	5	3	**0.046**	**0.145 (.022-.970)** *
	No	175	36		
Type of Anesthesia	Central Neuraxial block	70	23		
	GA	106	13	0.998	
	Peripheral Nerve blocks	0	1	0.999	
	Sedation	2	1	0.998	
	Sedation with LA	2	1	0.998	
Intraoperative Analgesics	Opioids	86	13		
	Opioids + Paracetamol	28	1	0.156	5.333 (0.527-53.931)
	Opioids + Paracetamol +Epidural	7	1	0.435	.317(.018-5.668)
	Opioids + Paracetamol + PNBS	1	1	.427	.251(.008-7.613)
	Opioids + PNBs	1	0	1.000	
	PNBs	2	0	1.000	
	CNBC	55	23	.998	
Incision size	>10 cm	44	2	0.130	3.925(.667-23.085)
	<10 cm	136	37		
Duration of Surgery	<1 h	45	23		
	1-2 h	43	5	0.076	2.935(.892-9.656)
	2-4 h	78	6	**0.023**	**4.529 (1.234-16.621)** *
	>4 h	14	5	0.203	0.312(.052-1.876)

70 % [16].

The prevalence of moderate to severe pain was 34.24 %. This finding is lower than that of most previous studies in Ethiopia, except for one study conducted in Mekelle (30.5 %) [17]. Another relatively comparable study was conducted in Saint Paul's Hospital Millennium Medical College (SPHMMC), which reported that moderate to severe pain was 49.7 %.[18] Most studies in Ethiopia revealed a higher prevalence than this study [14,15,19–21]. For instance,69.5 % and 75.8 % of studies were conducted at the University of Gondar Comprehensive Specialized Hospital (UGCSH) %, [21] . Gondar and Debre Tabor Comprehensive Specialized Hospitals accounted for 70.5 % and 85.5 %, respectively [14,20]. Hawassa University Comprehensive Specialized Hospital 89.8 % [15]. Public Hospitals of Addis Ababa 85.5 % [19]. This variation may be due to differences in infrastructure, postoperative pain management protocol, sample sizes, and pain assessment times. In this study, most patients were interviewed in the first 24 h after surgery, ranging from 6 h to 4 days in other studies. In addition, 22.7 % and 45.66 % of participants in this study received complete and good pain relief within the first 24 h of the postoperative period, respectively.

We found that preoperative anxiety (p-value 0.04), taking anxiolytic preoperatively (p-value 0.046), and duration of surgery 2-4 h (p-value 0.023) were significantly associated with acute post-operative pain. Preoperative anxiety is significantly associated with postoperative pain. A study of Public Hospitals in Addis Ababa. Supports this result [19].

This study showed no association between incision size and acute postoperative pain, consistent with a study by M. Beirer et al. [22].

Unlike other studies that showed a significant association between incision size and acute postoperative pain, we did not find any significant association between incision size and acute postoperative pain.[19,23,24]. This difference might be due to the effectiveness of perioperative pain management in our study.

In contrast to other studies, our study did not show an association between intraoperative use of analgesics and postoperative pain. [18–20,25,26] . The American Pain Society and Guidelines also support this association.[27].

This study also found a significant association between the prevalence of acute postoperative pain and surgery duration, as reported in a study done in Gondar.[21]. These findings are corroborated by several other studies conducted in Ethiopia and worldwide. [2,28–34].

Our study did not find any association between gender and acute postoperative pain, which is in line with a study by Couceiro et al. that revealed there was no significant association between gender and postoperative pain [35]. However, other studies showed that females have a higher prevalence of acute postoperative pain [36,37]. Sex hormones have been thought to influence the way pain is felt, and it is believed that differences in pain sensitivity between males and females may contribute to higher levels of pain experienced by females.

4.1. Limitations and strengths of the study

This study was conducted in a single government Tertiary hospital in Addis Ababa, which has several Anesthesiologists and Anesthesiology, Critical Care, and Pain Medicine Residents who are involved in the perioperative care of surgical patients, including providing inpatient Acute Pain Services (APS). Hence, the results may not represent the entire country, especially non-tertiary institutions. Since the study is cross-sectional, it isn't easy to establish the cause-and-effect relationship. Study participants were adult elective surgical inpatients, and the results might not apply to pediatric patients, emergency, or out-of-OR surgical patients.

Since this study is done only in one institution, it is difficult to generalize for the entire population. We recommend expanding this study to a multicenter setting with higher sample sizes to increase the study's generalizability. The authors also believe that increasing the sample size in future prospective studies is important for doing subgroup analysis based on surgical approaches and types of surgery.

5. Conclusions

Evidence from the study revealed that the overall prevalence of postoperative pain was relatively higher compared to studies done in Western countries and lower in the study area compared to previous studies done in the country. This reflects that attention given to post-operative pain management is better when compared to others, but there is still a significant gap in managing postoperative pain. It also demonstrated that Preoperative anxiety and duration of surgery were the main factors associated with the prevalence of acute postoperative pain.

CRediT authorship contribution statement

Eyob Asefa Bekele: Writing – original draft, Methodology, Formal analysis, Conceptualization. **Tseganesh Berhanu Tulu:** Writing – original draft, Formal analysis. **Yonathan Abebe Bulto:** Validation, Methodology, Formal analysis, Conceptualization. **Gebeyehu Tessema Azibte:** Writing – review & editing, Supervision, Software, Data curation. **Waltengus Birhanu:** Writing – review & editing, Validation, Software, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article.

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Not applicable.

Ethics approval statement

The study was conducted by the Declaration of Helsinki and approved by the Institutional Review Board of Addis Ababa University, College of Medicine and Health Sciences.

Patient consent statement

Informed consent was obtained from all subjects involved in the study.

Permission to reproduce material from other sources- not applicable.

Clinical trial registration

Not applicable.

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