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Severity and associated factors of postoperative pain in paediatric surgical patients aged 2 months–7 years at selected Addis Ababa Public Hospitals: a multicenter prospective longitudinal study

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Background: Postoperative pain is a common and distressing consequence of surgery in children. It can lead to suffering, prolonged recovery, impaired physical functioning, and even chronic pain. Effective postoperative pain management is crucial for improving patient outcomes. However, several factors hinder the accurate assessment and management of pain in children, particularly in low-income countries. This study aims to evaluate the severity of postoperative pain in paediatric patients and identify its predictors.

Materials and methods: A longitudinal study was conducted on 235 paediatric surgical patients aged 2 months–7 years in Public Hospitals of Addis Ababa from January to April 2023. The primary outcome, pain severity, was assessed at three different times using a pain assessment tool. Cochran's q-test was used to compare postoperative pain incidences. The Generalized Estimating Equation was used to determine predictor variables' effects on pain severity over time. The study demonstrated the direction of association and significance using an AOR with a 95% CI at a *P* value of 0.05.

Result: The incidence of moderate to severe postoperative pain was 36.6% at 12 h, 20% at 24 h, and 10% at 36 h. Patients with preoperative pain and preoperative anxiety were more likely to experience moderate to severe postoperative pain [adjusted odds ratio (AOR) = 3.41, CI = 1.15, 10.00 and AOR = 2.28, CI = 1.219, 4.277, respectively). Intraoperative predictors of postoperative pain severity included longer duration of surgery (AOR = 6.62, CI = 1.90, 23.00) and major surgery (AOR = 5.2, CI = 2.11, 12.88). Postoperative pain severity was reduced in patients receiving multimodal analgesia (AOR = 0.24; CI = 0.091, 0.652) and in patients assessed frequently in the postoperative period (AOR = 0.09; CI = 0.022, 0.393).

Conclusion: A significant portion of paediatric surgical patients in this study experienced high levels of postoperative pain, particularly within the first 24 h. The most influential factors affecting pain severity were postoperative pain management strategies and assessment practices.

Keywords: paediatric surgery, paediatrics, postoperative pain, severity

Introduction

Paediatrics focuses on children from birth to 18 years old, considering developmental differences[1,2]. Hospitalized paediatric patients often experience pain, which can result from injury, disease, or surgical procedures[3–5]. Pain is defined as an unpleasant sensory and emotional experience associated with tissue damage[6]. Postoperative pain, which occurs after surgery, can be categorized as mild, moderate, or severe and should be addressed[3,5,7]. Pain assessment techniques in paediatrics vary in their applicability, reliability, and validity for different age groups and types of pain[5,8,9]. Postoperative pain in paediatrics can have various consequences, including depression, insomnia, decreased

HIGHLIGHTS

- Paediatric post-surgery patients experience moderate to severe pain at 12, 24, and 36 h. Factors determining pain severity include pain assessment, management, anxiety, preoperative pain, and surgery duration. Unlike other study Analyzing postoperative outcome measurements using the Generalized Estimating Equation.
- model.
- Frequently assessed pain is lower with multimodal analgesia and minor surgery, while prolonged and major surgery, preoperative pain, and anxiety increase pain suffering.
- Proper pain management can reduce suffering; prolong hospital stays, and chronic pain, which significantly impacts children's physical and mental function and developmental skills.

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physical and mental functioning, chronic pain, and prolonged hospitalization[7,10]. This condition significantly impacts children's quality of life and hinders their developmental skills[3–5,7].

Postoperative pain in paediatric patients varies depending on the type of surgery, setting, and other factors[11]. In Togo and Rwanda, studies have shown that postoperative pain management in paediatric surgery is often inadequate, with a significant percentage of children experiencing severe pain[12,13]. Factors such as preoperative anxiety, history of preoperative pain, type of surgery, and incision length are associated with postoperative pain[14]. Inadequate pain assessment and medication administration contribute to postoperative pain in Addis Ababa[15]. Assessing and treating pain in paediatrics is challenging due to behavioural and cognitive developmental differences[5,8,9]. There are myths in some places that paediatric patients do not perceive or remember pain, leading to ignorance of children's pain[11,16–18]. Sub-Saharan African and developing countries face challenges in reducing postoperative pain in paediatrics due to limited availability of drugs, instruments, regional analgesia experts, and professional attitude[19–22].

Access to safe paediatric surgery is a challenge in Ethiopia, where demand is increasing[23–26]. Research on paediatric postoperative pain intensity is limited, and there is a need for pain control and assessment protocols for different age groups[3,7,11]. The FLACC tool is commonly used for assessing pain in children between 2 months and 7 years. Valid pain assessment tools for neonates and infants are not applicable in this context because blood pressure usually not measured[10–16]. A study on paediatric postoperative pain intensity in sub-Saharan Africa is necessary to establish protocols and identify severity, barriers, and patient outcomes. This study aims to assess the severity and predictors of postoperative pain in paediatric patients to improve patient outcomes.

Methods

It is an institutional-based Prospective longitudinal study design conducted at three public hospitals From 5 January to 25 April 2023. This study has been registered with the Research Registration Unique Identifying Number This study is registered at research registry UIN 9418. Hyperlink https://www.researchregistry.com/browse-the-registry#home/. This study is reported according to STROCSS 2021 guideline[28].

Study area and period

The study was conducted in 3 public referral hospitals: Tikur Anbessa Specialized Hospital (TASH), Zewuditu Memorial Hospital (ZMH) and Menelik II Specialized Hospital (MSH). These hospitals were chosen based on their paediatric surgical patient load and level. (TASH) has 3 major operation theatres with 15 operation tables, while (ZMH) has 8 operation tables for surgical procedures of all age. (MSH) has 1 paediatric operation table and 7 for others. On average, 10 paediatric patients undergo elective surgery daily in 3 hospitals, resulting in 200 patients per month and 800 patients per 4 months. The study was conducted from 5 January 2023 to 25 April 2023.

Study design

Prospective longitudinal study design.

Source population

Source populations were paediatric patients undergoing surgery at Tikur Anbessa Specialized Hospital, Zewuditu Memorial Hospital and Menelik II Specialized Hospital.

Study population

Study populations were all Paediatric patients aged 2 months–7 years undergoing surgery at Tikur Anbessa Specialized Hospital, Zewuditu Memorial Hospital and Menelik II Specialized Hospital.

Variables

Dependent variable

Severity of postoperative pain.

Independent variables

Sex, Age, type of surgery, analgesia type, time since surgery, preemptive analgesia used, preoperative pain, anxiety, frequency of pain assessment, extent of surgery, and institution were independent variables.

Eligibility criteria

Inclusion criteria

Paediatric patients from 2 month to 7 years at Addis Ababa governmental hospital from 5 January 2023 to 25 April 2023.

Exclusion criteria

Patients who become critical postoperatively, Children with cognitive impairment, cardiac and respiratory congenital anomaly, day case surgery, emergency surgery, and consent refusal, Patients who have cough preoperatively and postoperatively.

Sample size

The sample size was calculated by epi info software and manually using single population proportion assumption for first objective and double population proportion assumption for the second objective. It was calculated by considering Z 1-β the desired power (80%), Z1-α/2 critical value (95%), percent of event in unexposed, percent of event in exposed, ratio of subjects in unexposed to exposed, margin of error (5%) and frequency of outcome. Percent of events and frequency of outcomes were taken from different studies which have similarity in scope with this study objective (Table 1). The total number of desired study subjects to identify true risk after adding 10% non-response rate is 254 by taking the largest of the listed sample sizes.

Sampling procedures

The study calculated the required sample size for each PH using a formula: $\frac{sample\ size}{population\ size} \times$ hospital size. TASH had 127 participants, ZMH had 51, and MSH had 76. The study stratifies age groups based on homogeneity within and heterogeneity between groups using validated pain assessment tools. Age groups from birth to 2 months are homogeneous, assessed using the CRIES tool. Age groups from 2 months to 7 years are strata 2, and those above 7 years is strata 3 since assessed by numerical rating scale (NSR) the study take only strata 2.

Table 1

Sample size for first and second objectives

(A) For the first objective (severity of postoperative pain)

Population size	Frequency of outcome	Margin of error	Sample size	Total sample size after adding 10% non-response rate = (1/1 – 0.1) × SS	Reference
568	50%	5	229	254	[12]
568	37%	5	220	244	[25]
568	22%	5	180	199	[26]

(B) For the second objective (factors affecting postoperative pain level)

Variables	Ratio of unexposed to exposed	% Of outcome in unexposed	% Of outcome in exposed	Sample size	Total sample size after adding 10% non-response rate = (1/1 – 0.1) × SS[a]	Reference
Preop[b] anxiety	1	30%	49.4	198	220	[13]
Preop pain	1	23%	54.1%	88	98	[13]
Neuro surgery	1	38%	58.8	182	202	[13]

[a]SS, sample size.

[b]Preop = to preoperational.

Manual sample size calculation done[29].

Each consecutive surgical patient's aged 2 months–7 years were selected from hospital daily operation schedules.

Data collection procedures

The study involved trained nurses and anaesthesia professionals collecting data on preoperative, intraoperative, and postoperative exposure variables. Six data collectors were involved, three preoperatively and three postoperatively. The exposure status was determined through anaesthesia record sheets, observation, and direct questioning. The questionnaire used literature variables. Pain levels were assessed using the FLACC scale, while preoperative anxiety was assessed using the modified[30] Yale Preoperative Anxiety Scale-short form (m-YPAS-SF). Data were collected in the holding area after obtaining consent. Inter-rater reliability for pain and anxiety was found to be good to excellent. Confidentiality was maintained throughout the research.

Outcome measurement

The FLACC scale which is widely used tool for children between 2 month and 7 years[3,31,32] was used to ascertain the level of postoperative pain. The outcome data was collected by other trained data collector who didn't know the exposure status of the patients at 12, 24, and 36 h.

Data analysis procedures

The data were collected using EpiData 3.1 software. For analysis, the primary outcome, pain severity, was categorized into two binary outcomes: mild to moderate pain and above-mild pain. The data were then exported to Stata/MP15 for longitudinal data analysis, accounting for repeated measurements from the same individuals. The Generalized Estimating Equation (GEE) was employed to evaluate the marginal effects of independent variables on postoperative pain, while Cochran's q-test was used to compare the incidence of postoperative pain between measurements. An autoregressive working correlation structure was selected to account for the dependency of observations within the same subject.

The multivariable analysis included variables with a *P* value less than 0.25, and the GEE was robust to multicollinearity. Adjusted odds ratio (AOR) with a 95% CI and *P* value less than 0.05 was used to show the effect of determinant factors on the outcome variable. Descriptive and analytical statistics were presented using tables and graphs. The best fitting working correlation structure was selected based on the smallest QIC from different structures.

Data quality management

Pretest on pain assessment tools on 5% of study populations done in PH1. The tool's inter-rater reliability was confirmed by three different raters, and content and face validity were ensured by advisors and experts. The investigator supervised data collection.

Result

Participant characteristics

The planed sample size were 254 paediatric postoperative patients but The final sample included 235 participants after excluding 19 participants who lost to follow-up. Each patient underwent 3 postoperative observations at different time points. Ninety-nine (42%) were females and 136 (58%) were males. General anaesthesia with endotracheal tube or laryngeal mask airway is the anaesthesia type for majority of the surgery (91.6%) (Table 2).

Trends of preoperative, intraoperative, and postoperative analgesics usage

The most common preoperative analgesic agent is Paracetamol suppository in 80%. Fentanyl commonly used for intraoperative analgesia in 76.5% of participants followed by multimodal and Paracetamol products (39%). Ketamine and Dexamethasone are also given intraoperatively but not primarily for the purpose of analgesia. Caudal epidural is the most widely used regional analgesia 35%, followed by local infiltration. Peripheral nerve blocks and spinal anaesthesia are rarely used during the intraoperative period (Table 3).

Table 2

Characteristics of paediatric patients undergoing surgery at selected public referral hospitals (TASH, ZMH and MSH), January 2023–April 2023

Category ($n=235$)	Frequency (percentage), *n* (%)
Age	
2 months–2 years	128 (54.45)
2–5 years	53 (22.55)
5–7 years	54 (22.97)
Participants per Hospital	
TASH 1	128 (54.47)
ZMH2	49 (20.85)
MSP 3	58 (24.68)
Sex	
Male	136 (57.87)
Female	99 (42.13)
Type of surgery	
Urologic surgery	55 (23.40)
GI (gastrointestinal) surgery	66 (28.09)
Orthopaedic surgery	29 (12.34)
Cardiothoracic surgery (CTS)	19 (8.09)
Ear, nose and throat surgery (ENT)	24 (10.21)
Neuro surgery	42 (17.84)
Type of sole anaesthesia	
General anaesthesia with endotracheal tube or LMA	214 (91.6)
Sedation	18 (7.66)
Regional anaesthesia	3 (1.28)

LMA, laryngeal mask airway;MSH, Menelik II specialized Hospital; TASH, Tikur Anbessa Specialized Hospital; ZMH, Zewditu memorial Hospital.

Table 3

Types of analgesics used for perioperative pain management of paediatric surgical patients at selected public referral Hospitals, January 2023–April 2023

Category ($n=235$)	Frequency (percentage), *n* (%)
Preoperative analgesia used	
Paracetamol suppository	17 (7.23)
Fentanyl	2 (0.85)
Intraoperative analgesia used	
Fentanyl	183 (76.59)
Morphine	5 (2.12)
Paracetamol (Iv or suppository)	92 (39.14)
Ketamine	103 (43.82)
Dexamethasone	85 (36.17)
Iv Lidocaine	62 (26.38)
Only opioids	66 (28.09)
Only Paracetamol (Iv or Suppository)	9 (3.83)
Only regional analgesia	10 (4.26)
Multimodal analgesia	148 (62.8)
Intraoperative regional analgesia used	
Local infiltration	36 (15.32)
Intercostal nerve block	4 (1.70)
Caudal epidural	85 (36.17)
Spinal anaesthesia	2 (0.85)
Not used	108 (45.96)
Postoperative analgesia used over the repeated measurements ($n=705$)	
Only opioids (fentanyl or morphine)	26 (3.68)
Only paracetamol (Iv, syrup, Po or suppository)	375 (53.19)
Only NSAIDs (diclofenac or ibuprofen syrup)	33 (4.68)
Non-pharmacological method	12 (5.1)
Multimodal	271 (38.44)

NSAIDs,Nonsteroidal anti-inflammatory drugs.

Postoperative pain assessment, analgesia administration and record practice

Majority of patients were assessed for pain once at each 12 h. Interval. On average, 59%, 20% and 18% were assessed 1, 2 and more than 2 times, respectively. Nearly 4.5% of patients were not assessed for pain. Postoperative analgesia was administered correctly in 83% of patients, but only 58% record it at each time interval (Table 4).

Severity of postoperative pain

The crude incidence of postoperative pain in paediatric surgical patients is 67%, 55%, and 41% at 12, 24 and 36 h, respectively (Table 5). Moderate to severe pain occurs in 36.6%, 20%, and 10% of patients at 12, 24, and 36 h. (Fig. 1). The average incidence of moderate to severe pain is 22.41% over three repeated measurements However, by Cochran's q-test, the magnitude of postoperative pain is significantly different between each time measurements ($P=0.00$).

Factors associated with postoperative pain

This study analyzed postoperative pain severity in paediatric patients using the GEE model. The findings revealed that preoperative pain and preoperative anxiety were significant predictors of postoperative pain, with increased odds of developing postoperative pain (AOR = 3.41, CI = 1.15, 10.00 and AOR = 2.28, CI = 1.219, 4.277, respectively). However, other factors did not significantly impact postoperative pain severity after 12 h (Table 6).

Postoperative pain after 12 h. is primarily predicted by surgery duration and extent, with major surgeries having higher odds of pain 5.2 times and 6.2 times higher when surgery duration exceeds 2 h. (Table 6).

Postoperative factors affecting postoperative pain severity after 12 h. include surgery time, analgesia type, and frequency of

Table 4

Postoperative pain assessment, analgesia administration and record practice of paediatric surgical patients at selected public referral hospitals, over the three time measurements January 2023–April 2023

Category ($n=705$)	Frequency (percentage), *n* (%)
Pain assessment frequency	
None	31 (4.40)
One time	401 (58.88)
Two time	144 (20.43)
Three and above	129 (18.30)
Analgesia given based on order	
Yes	588 (83.40)
No	117 (16.60)
Analgesia given recorded	
Yes	413 (58.58)
No	292 (41.42)
Pain assessment tool used	
Yes	56 (7.9)
No	647 (91.77)

Table 5

Incidence of postoperative pain at 12, 24 and 36 h from all paediatric surgical patients at selected public referral hospitals, January 2023–April 2023

	Crude incidence at each time of measurement					
Postoperative pain severity	**At 12 h**	**95% CI**	**At 24 h**	**95% CI**	**At 36 h**	**95% CI**
Mild pain	32.3%	0.26–0.38	36.6%	0.30–0.42	30.64	0.25–0.36
Moderate pain	25.5%	0.20–0.34	17.5	0.13–0.22	10.2%	0.07–0.15
Severe pain	9.36%	0.06–0.14	1.28%	0.01–0.034	0.43%	0.001–0.03

pain assessment. Multimodal analgesia reduces pain by 0.24 times, while time elapsed by 12 h. reduces pain odds by 0.92 times (Table 6).

Discussion

The incidence of moderate to severe pain in studied hospitals is 36.6%, 20% and 10% at 12, 24 and 36 h. respectively. Many guidelines recommend pain above mild to be treated[5]. A study in Rwanda shows above half of paediatric surgical patients had severe postoperative pain in the first 48 h.[13]. This is higher than the result of this study the difference might be because of sample size and age category difference. Similar study conducted in University of Gondar, indicates that the overall prevalence of moderate to severe pain within the first 24 h. is 40% with different study design[14]. A study in Togo showed a higher pain score of 46% at 24 h, which differs from this study, in which the pain score was higher at 12 h. This may be due to the tools used and the study design[12].

Several studies have identified intraoperative and postoperative pain assessment and management practices as the most crucial factors influencing postoperative pain severity[34], a finding consistent with this study. Pain management protocols, standardized pain assessment tools, and regular pain assessment and management are essential for minimizing postoperative pain in paediatric patients[38–40]. In this study, patients who underwent frequent pain assessments experienced a significant reduction in postoperative pain. Finding a consistent pain assessment tool suitable for all paediatric age groups and achieving accurate pain assessment in paediatrics remains a global challenge[3,5]. Developed countries have explored alternative approaches and technologies, such as mobile apps and computers, to improve pain assessment accuracy[22,41,42]. In many sub-Saharan countries, pain assessment is often neglected[19]. The studied hospitals demonstrate notable pain assessment initiatives in comparison.

Postoperative pain management is crucial for reducing severity but in lower-income countries, factors like drug availability, cost, and health professionals' empathy, knowledge, and attitude can hinder its effectiveness[13,14,38]. For example, in the studied hospitals ketorolac and rectal diclofenac were not available and IV Paracetamol is too costly for most of patients. These drugs are recommended by The European Society for Pediatric Anesthesiology (ESPA) for minor to moderate surgeries to be routinely used as a base line treatment postoperatively[11]. Caudal analgesia and local infiltration at the wound site were practiced for intraoperative and postoperative analgesia but their effect wear off after 12 h. Peripheral nerve blocks which have longer duration of action greater than 12 h[20,38,43,44] were used rarely. Peripheral nerve blocks are commonly performed in Western countries for various paediatrics surgeries with rare complications[45–47]. However, in studied hospitals, the availability of equipment like nerve stimulator, ultrasounds, and the shortage of paediatric nerve block experts, contributes to lower practice.

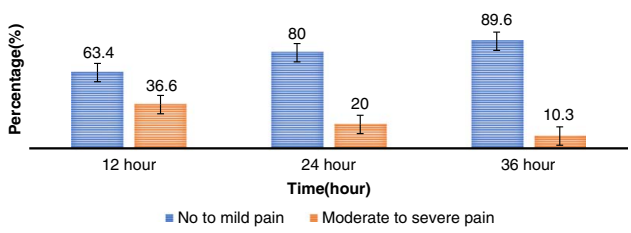

Figure 1. Postoperative pain level of paediatric surgical patients at selected Public referral Hospitals at each time measurements.

Research from Italy and the Brain Pain Study Group has shown that multimodal analgesia significantly reduces postoperative pain levels, with varying effectiveness depending on the combination of drugs used[27,35]. Similarly, this study found that patients who received multimodal analgesia experienced a substantial decrease in postoperative pain severity, with a nearly 0.24-fold reduction compared to those who received a single analgesic agent. Postoperative pain management often involves using paracetamol and NSAIDs to minimize opioid use[48]. In the hospitals studied, most patients receiving multimodal analgesia received a combination of ibuprofen syrup and paracetamol, consistent with global guidelines. Several studies recommend the use of tramadol, ketamine, and dexamethasone as part of multimodal analgesia postoperatively, along with fentanyl to manage breakthrough postoperative pain in children[38,49,50].

Studies indicate that patients with preoperative anxiety are more likely to experience postoperative acute pain.[51,52]. Patients having preoperative anxiety have higher postoperative pain incident (AOR = 2.28) which is comparable with other studies like a study in Gondar University Hospital, patients with preoperative anxiety are 2.24 times more likely to develop postoperative moderate to severe pain than the control.

Several studies suggest that non-pharmacological management techniques and parental involvement can effectively reduce anxiety levels[10]. Non-pharmacological interventions such as distractions, relaxation, play therapy, music therapy, and other methods have been shown to decrease anxiety, improve pain control, and enhance patient cooperation[37,51,53]. However, these techniques were not adequately implemented in the studied hospitals, which may have contributed to higher anxiety-related postoperative pain levels. Consistent with previous findings, this study found a significant association between preoperative pain and postoperative pain[14,54]. While some studies have

Table 6

Predictors of postoperative pain in pediatric surgical patients at selected public referral hospitals, January 2023–April 2023

Variables $n=705$	Category	No to mild pain	Moderate to severe pain	COR	*P*	AOR (95% CI)	*P*
Pain assessment frequency	No	20	11	1	1	1	1
	One time	303	98	0.40	0.054	0.13 (0.037, 0.46)	0.002**
	Two times	111	33	0.32	0.026	0.11 (0.028, 0.45)	0.002**
	Above two	113	16	0.13	0.001	0.09 (0.022, 0.39)	0.001**
Type of surgery	Urologic	133	32	1		1	1
	GI	145	53	1.57	0.193	0.66 (0.28, 1.53)	0.341
	Orthopaedics	60	27	1.95	0.109	2.28 (0.79, 6.59)	0.125
	CTS	43	14	1.51	0.402	1.50 (0.47, 4.79)	0.488
	ENT	59	13	1.00	0.995	1.09 (0.35, 3.36)	0.883
	Neuro	107	19	0.754	0.520	0.59 (0.19, 1.82)	0.362
Preemptive analgesia	No	493	149	1	1	1	1
	Yes	54	9	0.53	0.22	0.60 (0.15, 2.40)	0.477
Preoperative pain	No	514	131	1	1	1	1
	Yes	33	27	3.1	0.003	3.41 (1.15, 10.0)	0.026*
Preoperative anxiety	No	397	95	1	1	1	1
	Yes	150	63	3.5	0.000	2.28(1.21, 4.27)	0.01*
ASA	One	357	90	1	1	1	1
	Two	169	50	1.14	0.618	1.07 (0.55, 2.07)	0.83
	Three	21	18	2.81	0.028	2.05 (0.60, 6.95)	0.25
Movement	No	499	153	1	1	1	1
	Yes	48	5	0.19	0.015	0.33 (0.08, 1.34)	0.122
Time since surgery	—	—	—	0.935	0.000	0.92 (0.90, 0.94)	0.000**
Duration of surgery in hour	Below 1 h	189	15	1	1	1	1
	1–3 h	269	82	4.03	0.000	3.43 (1.15, 10.1)	0.026*
	Above 3 h	89	61	8.6	0.000	6.62 (1.90, 23.0)	0.003**
Extent of surgery	Minor to moderate	258	18	1	1	1	1
	Major	289	140	6.9	0.000	5.2 (2.11, 12.88)	0.000**
Postoperative analgesia used	Others	43	16	1	1	1	1
	Paracetamol	284	91	0.76	0.446	0.81 (0.34, 1.94)	0.638
	Multimodal	220	51	0.353	0.006	0.24 (0.09, 0.652)	0.005**

AOR, adjusted odds ratio; ASA, American Society of Anesthesiologists; COR, Crude odds ratio; CTS, cardiothoracic surgery; ENT, ear, nose and throat surgery; GI, gastrointestinal.
*Significant.
**Very significant.

demonstrated the effectiveness of preemptive analgesia using Dipyrone and paracetamol in reducing postoperative pain, particularly in tonsillectomy patients[4,55,56], this study did not observe such an effect. However, since the outcome was measured at 12 h intervals, it is possible that the short-acting effects of preemptive analgesia had diminished by this time, making it difficult to definitively determine its impact on pain reduction.

The type of surgical procedure was not found to be a significant determinant of postoperative pain, but the extent and duration of surgery were (AOR of 5.2 and 6.62, respectively). These findings align with previous studies, such as one conducted at Gondor University Hospital, which found that patients with incisions larger than 10 cm had a 3.9 times higher pain level than those with incisions smaller than 5 cm[14]. While some studies suggest that sex influences postoperative pain levels, with males experiencing higher pain due to a stronger neuroendocrine response, others indicate the opposite[57,58]. In this study, sex did not play a role in postoperative pain severity. Consistent with other studies, the highest incidence of pain occurred within the first 24 h, decreasing by 0.92 times after 12 h.

Conclusion

The incidence of moderate to severe pain is high in studied hospitals. The availability of consistent pain assessment tools, low emphasis towards pain management and assessment, limitation in resource and shortage of experts are undeniable reasons. Frequency of pain assessment, documentation and pain management practice needs high improvement to reduce postoperative pain. This study contributes to postoperative pain management knowledge in resource-poor areas, serving as a foundation for further research on pain severity and predictors in neonates and infants.

Limitation of study

The study measures outcome variables at specific time intervals, doesn't consider pain levels in between, and doesn't include all paediatric surgical patients. As strength it's a multicenter study.

Ethical approval

Ethical approval for this study (protocol number; Anes/1/2022/2023/) provided by Addis Ababa University, institute review board, Addis Ababa, Ethiopia, on 13 December, 2022. In addition, ethical clearance was obtained from Addis Ababa Public Health Research and Emergency Management Directorate.

Operational definitions

- Postoperative pain: A pain perceived due to surgical intervention in the post-surgery and explained as no pain, mild pain, moderate pain and severe pain.
- Severity of postoperative pain: The FLACC scale which ranging from 0 to 10 for intensity, score of 0 indicate no pain; 1–3 mild pain; 4–6 moderate pain; 7–10 severe pain as used in many pain studies[27,33–35].
- Preoperative anxiety: The assessment of anxiety was made through direct observation using the 'modified Yale Preoperative Anxiety Scale-short form (m-YPAS-SF)'.
- ASA Physical Status Classification: It is used to assess patient's pre-anaesthesia conditions to estimate the perioperative risks which have 1–6 Grades, ASA 1 healthy nonsmoking whereas ASA 5 is a brain-dead patient.
- Extent of surgery: Major surgery involves large incisions and trauma to tissues such as; craniotomy, thoracotomy, bowel resection. Moderate surgery is less invasive, such as inguinal hernia repair and tonsillectomy. Minor surgical procedures are minimally invasive with small incisions and superficial procedures performed laparoscopically[36]. In this study, moderate and minor surgeries are merged during analysis.
- Multimodal analgesia: is the use of more than one group of analgesic agent targeting different receptors along the pain pathway with the goal of improving analgesia while reducing adverse effects[4,37].

Consent

The study also obtained written informed consent from the study participants parents, guardians and hospitals which is prepared based on the IJS Patient Consent form. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request".

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Author contribution

All authors contributed to conceptualization, data curation, formal analysis, methodology, validation, writing, review, and editing; in addition, the first author contributed to the original draft. Also, all authors read and approved the revised manuscript for publication. F.M.R.: as a primary investigator he developed the proposal, trained the data collectors, analyzed the data and wrote the result and interpreted the result. E.M.: as a team member he developed the proposal, trained the data collectors, analyzed the data and wrote the result and interpreted the result, overall he leads the research team. S.J.M.: as a team member he developed the proposal, trained the data collectors, analyzed the data and wrote the result and interpreted the result and corresponding author.

Conflicts of interest disclosure

The authors declare there is no competing interest in this work.

Research registration unique identifying number (UIN)

1. Name of the registry: Research Registration.
2. This research registered in Research registration with Unique Identifying number UIN 9418; Hyperlink https://www.researchregistry.com/browse-the-registry#home/.

Guarantor

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Availability of data and materials

Data and materials will be shared upon reasonable request.

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