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Incidence and Predictors of Postoperative Pain in Pediatric Patients Underwent Ophthalmological Surgery at Hawassa University Comprehensive Specialized Hospital : A Prospective Cohort Study

Mengistu Yinges Kebede*, Alemlanch Mebrat A, Aschalew B, Oliyad E, Gudeta T, Kurabachew Mengistu K, Minda Abebe S and Tajera Tageza I

Department of Anesthesia and Anesthesiology, College of Medicine and Health Science, Hawassa University, Hawassa, Ethiopia

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***Corresponding author**:Mengistu Yinges Kebede, Department of Anesthesia and Anesthesiology, College of Medicine and Health Science, Hawassa University, Hawassa, Ethiopia

Abstract

Background: Postoperative pain is a type of acute pain that occurs after surgical procedures. Although there have been studies on the incidence, predictors, and management of postoperative pain in the paediatric population, there is insufficient data about post-operative ophthalmic paediatric patients.

Methods: A prospective cohort study was conducted among paediatrics (N = 130) who underwent ophthalmologic surgery at Hawassa University Specialized Hospital from January 8 to April 8, 2024. Participants who fulfilled inclusion criteria were included in the study by using a consecutive sampling technique. Data was collected using pretested questionnaires and analyzed using SPSS version 26. The result was summarized by using both descriptive and inferential statistics. Descriptive statistics were summarized by tables and figures. Logistic regression was used for the analysis technique to see the association between the independent variable and the dependent variable. A variable with a p-value of 0.2 at bivariate analysis entered into multivariable analysis, and a p-value less than 0.05 in multivariable analysis was used to declare statistical significance.

Results: In this study, the overall incidence of postoperative pain in paediatric ophthalmic surgical patients was 69.2% within 24 hours after surgery. Age (AOR = 3.672, 95% CI: 1.119–12.049), urgency of surgery (AOR = 4.441, 95% CI: 1.317-14.975), anxiety (AOR = 9.820, 95% CI: 3.348–28.807), and type of surgery (AOR = 0.097, 95% CI: 0.010–0.961) were significantly associated with postoperative pain.

Conclusion and Recommendation: Based on our study findings, the incidence of pain in paediatric ophthalmic surgery was high compared with other related studies. This shows that the problem needs attention, and awareness should be created regarding the predictors. Therefore, health care providers should target those predictors to minimize the incidence of postoperative pain.

Keywords: Paediatric; Ophthalmologic; Postoperative Pain; Incidence; Predictors

Abbreviations: IASP: International Association for the Study of Pain; ASA: American Society of Anesthesiologists; FLACC: Face, Leg, Activity, Crying, Consolability; HUCSH: Hawassa University Comprehensive Specialized Hospital; MYPAS-SF: Modified Yale Preoperative Anxiety Scale, Short Form; SPSS: Statistical Package for Social Sciences; VIF: Variance Inflation Factor; TV: Tolerance Value; IRB: Institutional Review Board

Introduction

According to the International Association for the Study of Pain (IASP), pain is defined as 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage [1]. Postoperative pain is one of the most prevalent complications following surgery, and more than 47% of surgical patients endure postoperative discomfort worldwide which is substantially more common in developing countries when compared to developed countries [2]. Although not specifically focused on the ophthalmic paediatric population, a previous study conducted in Ethiopia on paediatric postoperative pain in 2020 found that 74.2% of children experienced mild to severe pain within the first 48 hours following surgery [3]. Postoperative pain is a form of acute pain that occurs as a result of surgical intervention, triggered by an inflammatory response and the activation of afferent neuronal cells; it is a frequently overlooked and undertreated issue among the pediatric population [4,5]. Postoperative pain is associated with different adverse outcomes

for both children and their families, forinstance, it may cause poor wound healing, delayed recovery, prolong hospital stay, increase the risk of rehospitalization, prolonged opioid use and persistent pain and thereby increase healthcare costs and lead to patient dissatisfaction [6,7].

A few studies were conducted previously on the incidence and associated factors of postoperative pain after paediatric ophthalmic surgery. Those studies have concluded that postoperative pain in ophthalmic surgery and its predictors are often underestimated and neglected. Its risk is particularly high in cases involving preoperative pain, preoperative anxiety, general anaesthesia, specific types of surgery, longer surgical duration, female patients, and younger ages [8,9]. There is a common misconception in ophthalmic surgery that postoperative pain is minimal or nonexistent due to the perception that it involves less trauma compared to other types of surgery [10]. Although paediatric postoperative pain is often unavoidable, there are strategies to prevent and manage it. These strategies include the use of less invasive surgical techniques, regional anaesthesia instead of general anaesthesia, anaesthetic adjuvant, patient and parental education and preparation before surgery to reduce anxiety and stress, and routine postoperative pain assessment using age-appropriate tools [11,12]. Basic analgesias, such as paracetamol, NSAIDs, and topical local anaesthetics, can effectively manage postoperative pain in children. Their use significantly reduces the need for opioids, which are typically reserved for the intraoperative and early postoperative periods, requiring specialized personnel for continuous opioid infusion 24 hours a day [6,13,14]. Multimodal analgesia should be continued into the postoperative period, with the addition of supplemental opioids if required [15]. The gold standard pain assessment tool is self-report.

However, it is difficult to apply self-report pain assessment tools in children, since they are non-verbal [16]. Therefore, behavioral pain scales (FLACC scale) are recommended to assess postoperative pain in infants and children, which are composed of five categories, each scoring from 0 to 2, providing a total score ranging from 0 to 10. A score of 1 or above indicates the presence of pain, and a score of more than 3 points suggests the need for analgesics [6,17]. Despite the wealth of studies on the prevalence and predictors of postoperative pain among children's, there is limited data about the predictors affecting postoperative pain among ophthalmic children. Therefore, the present study was conducted to address these gaps. The aim of the study was to determine the incidence of postoperative pain in paediatric patients following ophthalmic surgery and identify predictors independently associated with its development. The objectives of this study were to assess the incidence and factors associated with postoperative pain in paediatric patients undergoing ophthalmological surgery at Hawassa University Comprehensive Specialised Hospital from January 8 to April 8, 2024.

Methods and Materials

Study Design, Setting, and Population

The study was conducted at Hawassa University Comprehensive Specialised Hospital. In the Sidama region in southern Ethiopia. The study was a prospective cohort study conducted from January 8 to April 8, 2024. The study included all patients who underwent ophalamic surgical procedures during the study period and met all inclusion criteria.

Source Population

All paediatric patients who underwent ophthalmologic surgery at Hawassa University Comprehensive Specialised Hospital.

Study Population

All paediatric patients who underwent ophthalmologic surgery at Hawassa University Comprehensive Specialised Hospital and fulfilled the inclusion criteria during the study period.

Inclusion and Exclusion Criteria

Inclusion Criteria: All paediatric patients aged between 2/12 and 14 years who underwent elective and emergency ophthalmological surgery.

Exclusion Criteria: Patients who have pre-existing cognitive dysfunction and are critically ill, patients with chronic pain, and ASA > II.

Study Variable

Dependent Variable: Postoperative pain.

Independent Variables: The independent variables included in this study were sex, age, ASA classification, urgency of surgery, preoperative anxiety, preoperative pain, history of preoperative analgesia, type of surgery, type of anaesthesia, duration of surgery, type of intraoperative analgesia given, and postoperative analgesia.

Sample Size and Sampling Technique

Sample Size Calculation

The sample size was calculated by using a single proportion formula with a confidence interval of 95% and a margin of error of 0.05. There was no similar study conducted previously on this title and study participants. Therefore, we have used a population proportion (P) value of 50%.

Where n is the sample size .

Z is the statistic corresponding to the level of confidence.

P is the expected incidence.

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d is precision (corresponding to the effect size).

By using this formula, our total sample size would be

Z=1.96, p=50%=0.5, 1-p= (1- 0.5) and d=0.05

n = (1.96)2 (0.5) (0.5)/0.0025 = 384.16.

By applying a finite population correction formula, the final sample size was calculated as: NF = n/(1+n/N) While NF = the final sample size, n = the minimum sample size, N = total number of pediatrics with an age range of 2/12–14 years who underwent ophthalmic surgery in HUCSH in the past retrospective three months, which were 170 (from situational analysis). NF = n /1+ (n/N), NF = 384 / (1+ (384/170) = 117.8≈118 with a 10% non-response rate of 118×10%=11.8, NF=118+11.8=129.8 ≈ 130.

Sampling Technique

By using systematic random sampling, the k value (k = N/n, 170/118 = 1.44 ≈1), where N = number of paediatric ophthalmic surgeries performed at HUCSH over the past three months, n = sample size, and k = nterval, So, to achieve the required sample size, a consecutive sampling technique was employed, wherein every subject meeting the inclusion criteria was selected until the desired sample size was attained.

Methods of Data Collection, Quality, and Analysis

Data Quality Assurance and Collection Procedure

To ensure data quality, data collectors received training on the objectives and relevance of the study, as well as brief orientations on the assessment tools, before starting data collection. Information regarding the study's benefits, potential harms, and objectives was prepared in English, translated into Amharic, and explained to the study participants. Informed consent was obtained before data collected. Pain was assessed by using the FLACC scale at 2, 4, 6, 8 and 24 hr, while preoperative anxiety was assessed using the modified Yale Preoperative Anxiety Scale-short form (m-YPAS-SF) in the holding area and during introduction to the anesthesia mask. Pretest was done on 10% of patients who weren't included in the main study of the total sample size and the Cronbach's alpha value was 0.81 (81%) which reflects the internal consistency or reliability of the questionnaire.

Data Processing and Analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 26 software package. Both descriptive and inferential statistics were employed in the data analysis. Descriptive statistics were summarized by tables and figures. Logistic regression was used for the analysis technique to see the association between the independent variable and the dependent variable. A variable with a p-value of 0.2 at bivariate analysis entered into multivariable analysis, and a p-value less than 0.05 in multivariable analysis was used to declare statistical significance. The model's goodness of fit was assessed using the Hosmer-Lemeshow test. Before entering the multivariable model, the variance inflation factor (VIF) test and tolerance value (TV) were utilised to evaluate the explanatory variables for multicollinearity, ensuring that all variables had a VIF value of <10 and TV > 0.1.

Ethical Considerations

Ethical clearance and approval were obtained from the Institutional Review Board (IRB) with Ref. No. IRB/063/16. Informed consent was obtained from parents by the data collectors after providing them with a detailed explanation of the study's objectives, potential benefits, and possible risks of participation.

Operational Definition

Postoperative pain: This is a form of acute pain following surgical intervention measured by a behavioral pain scale [4].

The FLACC Scale: is a behavioral pain assessment scale used for measuring postoperative pain in children and infants with exposed bodies and limbs; the observation should last 2-5 minutes. It consists of 5 categories, including face, legs, activity, cry, and consolability, each scoring from 0 to 2 to provide a total score ranging from 0 to 10; the total score is interpreted as follows: 0 = no pain, 1-3 = mild pain, 4-6 = moderate pain, and 7-10 = severe pain [6].

Anxiety: is a feeling of fear or worry about a specific situation, as measured by MYPAS-SF.

MYPAS-SF (modified Yale Preoperative Anxiety Scale score, short form), which has 4 domains and 18 items used to assess preoperative anxiety in children. If the score is between 22.92 and 30, it indicates no anxiety, and ≥ 30 indicates anxiety [18].

Results

Socio-Demographic Characteristics and Perioperative Condition of the Participants

A total of 130 study participants were included in this study. In terms of socio-demographic factors, the majority of the participants were male (67, 51.5%). Among the study participants, the largest age group comprised children between 6 and 14 years old, 53 (40.8%), while 9 (6.9%) of the patients were between 2 months and 1 year old (Table 1).

The majority of the participants were undergone elective surgery 93 (71.5%), while the rest 37 (28.5%) had emergency surgery. Seventy-four (56.9%) of study participants experienced preoperative anxiety. Among participants that experienced preoperative anxiety, 63% experienced postoperative pain. Most of the study participants did not have preoperative pain 110 (84.6%) and not take preoperative analgesia 113 (86.9%) (Table 2).

Among the study participants, 85 (65.4%) received general anaesthesia with a laryngeal mask airway (LMA), and the most common intraoperative analgesic agent administered was paracetamol suppository, given to 63 (48.5%) patients. The majority of patients did not receive postoperative analgesia, accounting for 113 (86.9%) cases (Table 3).

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Table 1: Sociodemographic characteristics of study participants undergoing ophthalmic surgery at HUCSH in 2024 (n = 130).

Variables	Category	Frequency (%) (N=130)	Postoperative Pain	
			No	Yes
Sex	Male	67(51.5)	25	42
	Female	63 (48.5)	15	48
Age in year	2/12/2001	9 (6.9)	2	7
	3-Jan	25 (19.2)	5	20
	6-Mar	43 (33.1)	10	33
	14-Jun	53 (40.8)	23	30
ASA	ASA I	126 (96.9)	38	88
	ASA II	4 (3.1)	2	2

Table 2: Preoperative factors among the participants at HUCSH in 2024 (N = 130).

Variables	Category	Frequency (%) (N=130)	Postoperative Pain	
			No	Yes
Urgency of Surgery	Elective	93(71.5)	32	61
	Emergency	37(28.5)	8	29
Preoperative Anxiety	No	56(43.1)	29	27
	Yes	74(56.9)	11	63
Preoperative Pain	No	110(84.6)	32	78
	Yes	20(15.4)	8	12
Preoperative Analgesia Med History	Yes	17(13.1)	6	11
	No	113(86.9)	34	79

Table 3: Intraoperative and postoperative factors of the participants at HUCSH in 2024 (n = 130).

Variables	Category	Frequency (N=130)	Percentage (%)
Type of surgery	Strabismus surgery	16	12.3
	Cataract	15	11.5
	Corneal tear repair	40	30.8
	Other	59	45.4
Types of anesthesia	GA with ETT	18	13.8
	GA with LMA	85	65.4
	Sedation	27	20.8
Duration of surgery	<120 minutes	119	91.5
	≥120 minutes	11	8.5
Type of intraoperative analgesia	Paracetamol	63	48.5
	Tramadol	10	7.7
	Fentanyl	15	11.5
	Ketamine	10	7.7
	Other	32	24.6
Type of postoperative analgesia	Not used	113	86.9
	Tramadol	5	3.8
	Paracetamol	12	9.2

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In our study, we followed the study participants until they experienced postoperative pain, with a maximum follow-up time of 24 hours. Based on this study, the incidence of postoperative pain was higher during the middle of the postoperative period, with approximately 33% occurring at 4 hours, followed by 27% at 6 hours (Figure 1 and 2).

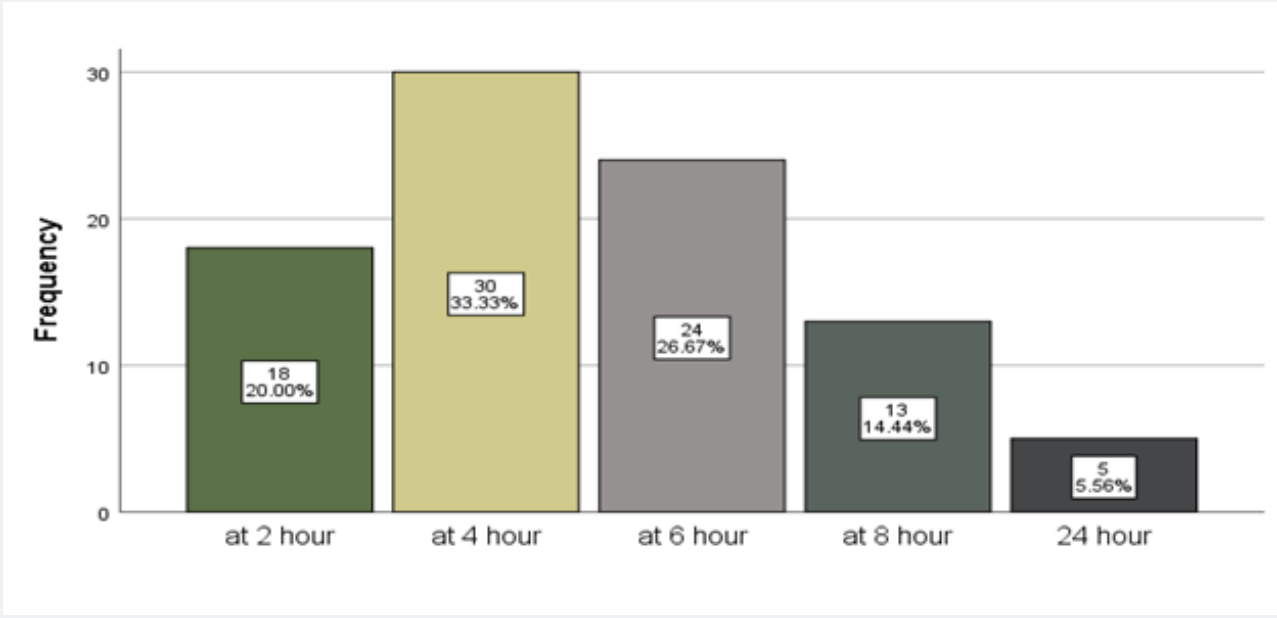

Figure 1: Bar chart showing the incidence of postoperative pain at each follow-up time.

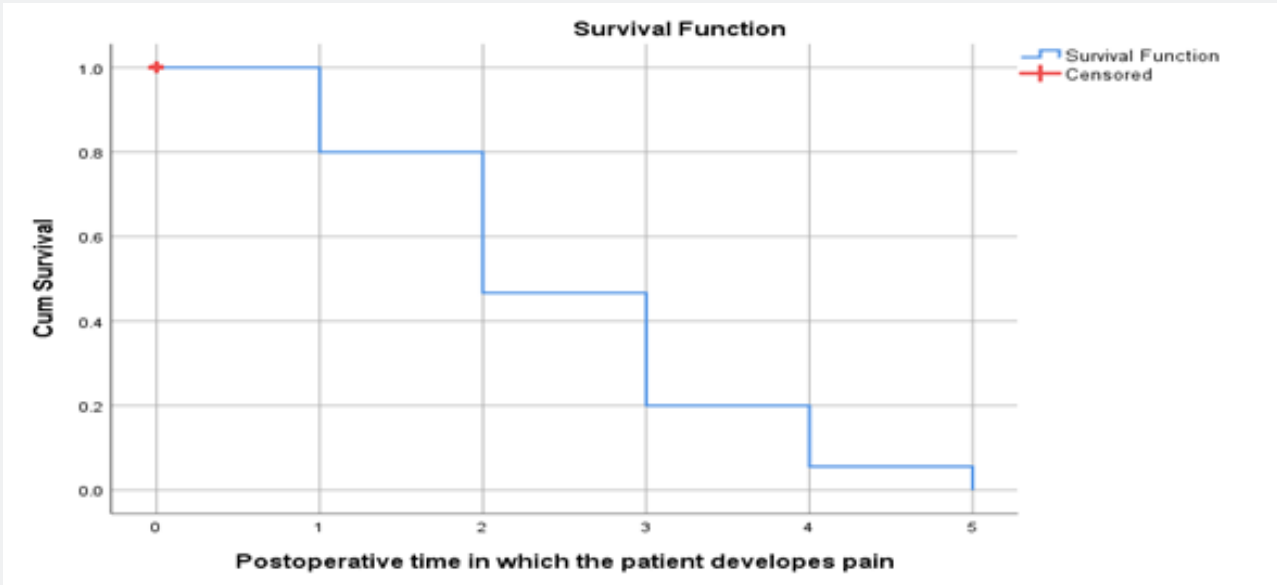

Figure 2: Kaplan-Meir survival curve (time to event carving) for time to develop postoperative pain.

Incidence of postoperative pain

The overall incidence of postoperative pain after ophthalmic surgery was 69.2% (995%CI: 60.8, 76.9) within 24 hours after surgery (Figure 3).

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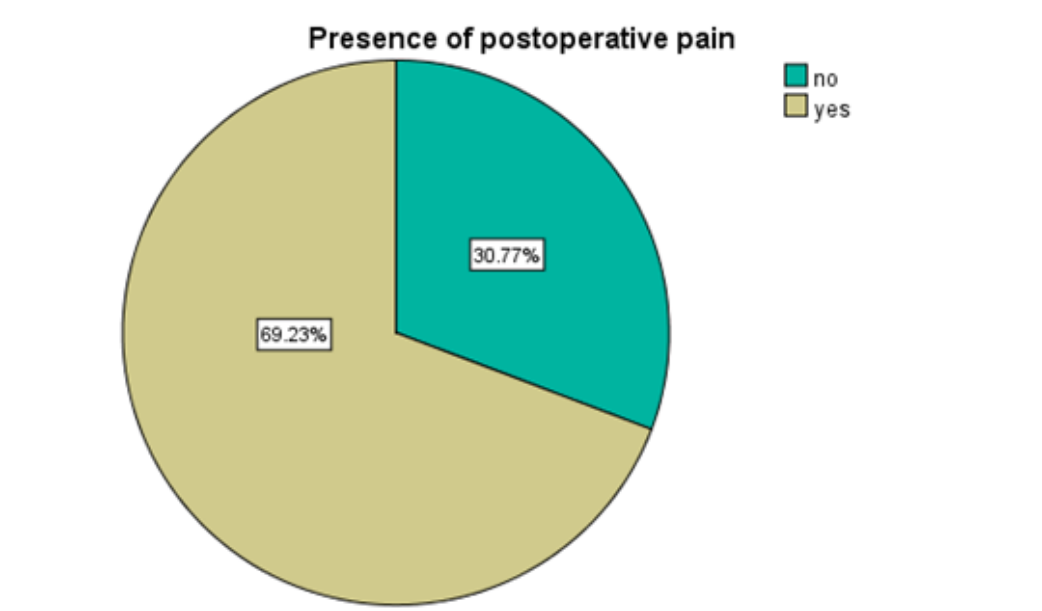

Figure 3: Incidence of postoperative pain in paediatric patients who underwent ophthalmologic surgery at HUCSH in 2024.

Predictors of postoperative pain

The bivariate analysis for this study revealed associations between age, sex, urgency of surgery, anxiety, type of surgery, and type of intraoperative analgesia with the incidence of postoperative pain in ophthalmic surgery. Multivariable logistic regression analysis in this study identified independent factors associated with postoperative pain in paediatric patients aged 3-6 years (AOR: 3.672, 95% CI: 1.119–12.049) more likely to have postoperative pain than other age groups. Similarly, paediatric patients who had anxiety during the preoperative period were 9.82 times more likely to have postoperative pain than those who were not anxious (AOR: 9.820, 95% CI: .34828.807). It also revealed that the likelihood of having post-operative pain was 4.44 times higher among patients undergoing emergency surgery than elective surgery (AOR: 4.441, 95% CI: 1.317-14.975). The study also revealed that the likelihood of having post-operative pain was 0.097 times (AOR: 0.097, 95% CI: 0.010-0.961) lower among patients who underwent minor surgery as compared to major surgeries (Table 4).

Table 4: Results of bivariable and multivariable binary logistic regression analysis for predictors of postoperative pain among participants who underwent ophthalmologic surgery at HUCSH in 2024.

Variables	Category	Outcome (Postop Pain)		COR(95% CI	P-Value	AOR(95% CI	P-Value
		No	Yes				
Sex	Male	25	42	1		1	
	Female	15	48	1.905(0.889-4.083)	0.098	1.964(0.710-5.437)	0.194
Age	2/12/2001	2	7	2.683(0.509-14.151)	0.245	3.678(0.397-34.091)	0.252
	3-Jan	5	20	3.067(1.000-9.403)	0.05	3.786(0.924-15.506)	0.064
	6-Mar	10	33	2.530(1.037-6.173)	0.041	3.672(1.119-12.049)	0.032*
	>6	23	30	1		1	
Urgency of surgery	Elective	32	61	1		1	
	Emergency	8	29	1.902(0.779-4.640)	0.158	4.441(1.317-14.975)	0.016*

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Anxiety	No	29	27	1		1	
	Yes	11	63	6.152(2.689-14.074)	0	9.820(3.348-28.807)	0.000*
Types of procedure	Strabismus surgery	1	15	1		1	
	Cataract surgery	4	11	0.183(0.018-1.876)	0.153	0.542(0.039-7.443)	0.647
	Corneal tear repair	14	26	0.124(0.015-1.038)	0.054	0.097(0.009-1.018)	0.052
	Other(EUA, foreign body and Stitch removal)	21	38	0.121(0.015-.978)	0.048	0.097(0.010-0.961)	0.046*
Types of intraoperative analgesia	Paracetamol	15	48	2.189(0.879-5.456)	0.093	2.630(0.776-8.922)	0.121
	Tramadol	2	8	2.737(0.499-15.019)	0.246	7.267(0.746-70.798)	0.088
	Fentanyl	7	8	0.782(0.227-2.690)	0.696	0.824(0.164-4.128)	0.814
	Ketamine	3	7	1.596(0.347-7.339)	0.548	1.263(0.189-8.415)	0.809
	Other(multimodal)	13	19	1		1	

*- Significant p-value. 1- Reference Group.

Discussion

Postoperative pain is a type of acute pain following surgical intervention [4]. Ophthalmic surgery is widely believed to cause little or no postoperative pain because it involves less extensive trauma compared with other types of surgery. Therefore, pain after ophthalmic surgery has been neglected, and little has been documented about the development of pain and factors associated with POP after ophthalmic surgery [19,20].

Incidence of Postoperative Pain

This study aims to assess the incidence of POP and identify key factors independently associated with the development of such pain following paediatric ophthalmic surgery. This prospective cohort study found that the incidence of postoperative pain among paediatric patients who underwent ophthalmologic surgery was 69.2% (95% CI: 60.8, 76.9). This finding is in line with a study conducted by HJ Paik et al. in Korea (62.5%). They demonstrated that child pain has been poorly managed and called for the need for a systematic, integrated pain management protocol with non-pharmacological and pharmacological management to reduce postopeative pain in paediatrics following eye surgery [21].

Our study finding is higher than a study done by Ducloyer et al. in France. The study reported a postoperative incidence of 27% in patients undergoing strabismus surgery and 9% in those undergoing other procedures [22].

This discrepancy could be due to differences in the study population, unstandardized pain management, or a or a lack of strong opioids. According to a study conducted in Canada, the incidence of postoperative pain was initially found to be 47.3% and 21% after the implementation of an evidence-based perioperative care bundle, which is lower than our study findings [23]. The difference may be due to variations in inclusion criteria, application of the ERAS protocol, and individual care bundle implementation. Another study done in India found that 12%, 24%, 40%, and 28% of patients experienced postoperative pain at 30 minutes, 2 hours, 6 hours, and 24 hours after surgery, respectively [24].

This result is lower than our study findings. The discrepancy may be due to the usage of more effective pain management techniques, such as peribulbar blocks, In this study, the incidence of post-operative pain was higher than in a study conducted in Addis Ababa, where the incidence of postoperative pain was 36.6% at 12 h, 20% at 24 h, and 10% at 36 h, and also in a study done in Gondar (40.5%) [25,26]. The discrepancy might be due to differences in surgical types, the availability of strong opioids, and the fact that the fact that they might have used nerve blocks.

Predictors of Postoperative Pain

Our findings showed age as a predictor of POP. Participants aged between 3-6 years were 3.7 times more likely to develop postoperative pain compared to those older than 6 years [AOR=3.672, 95%CI: (1.119-12.049)]. This study finding is in line with the study conducted in Ethiopia at Gambella General Hospital [27]. However, the study was conducted in adult population. Our study result revealed that; the occurrence of postoperative pain did not have a statistically significant correlation with sex of children. Studies done in Brazil and Canada also found no significant association was observed among these variables, they suggest that while girls are not more about their POP experience

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than boys, they do report more unpleasantness from their pain experience or display less pain tolerance than boys [28,29].

Related to preoperative factors, our findings indicated that preoperative anxiety was a significant predictor of POP. Patients who experienced anxiety were 9.8 times more likely to have POP compared to those without anxiety [AOR=9.820, 95%CI: (3.348-28.807)]. In line with this finding, several earlier studies reported preoperative anxiety as a significant factor contributing to POP (Addis Ababa), [25], Gondar [30] Singapore [31], Colombia [32].

Urgency of the surgery was one of the one of the other preoperative predictors of POP in the present study. This study revealed that participants who underwent emergency ophthalmic surgery were 4.4 times more likely to develop postoperative pain compared to those who underwent elective surgery [AOR=4.441, 95%CI: (1.317-14.975)]. This finding is consistent with the study conducted in South Africa [33].

From the intraoperative-related factors examined, the type of surgical procedure was found to be significantly associated with postoperative pain. Specifically, this study revealed that patients who underwent procedures other than strabismus surgery were less likely to develop postoperative pain compared to those who underwent strabismus surgery [AOR = 0.097, 95% CI: 0.010-0.961]. This finding is consistent with the results reported in a previous study conducted in Taiwan [34], France [22] and Canada [23].

Strengths and Limitations of the Study

Since there is not sufficient data on this research title, the findings will serve as an important source of information for local and global stakeholders as well as for researchers, and it is a prospective follow-up study, which is important to minimize recall bias. As a limitation, the study was conducted in a single centre, which may be difficult to generalize, and we utilized a consecutive non-probability sampling technique, which can increase the potential for selection bias.

Conclusion and Recommendations

The incidence of postoperative pain within 24 hours after pediatric ophthalmic surgical procedures was high. The key predictors found to be significantly associated with postoperative pain in this study were patient age, urgency of the surgery, preoperative anxiety levels, and the type of surgical procedure performed. As a recommendation, health professionals and healthcare institutions should heighten awareness of this issue and aim to enhance clinicians' knowledge and preparedness in managing postoperative pain. This may involve providing targeted and regular training as well as ensuring adequate resources are available to deliver comprehensive, multimodal pain management strategies.

Ethics Approval and Publication Consent: Ethical clearance to conduct the research was obtained from the Ethical Review Committee of the School of Medicine, College of Medicine and Health Sciences, Hawassa University.

Data Availability Statement: All data generated or analyzed during this study are included in this article.

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