HAWASSA UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCES DEPARTMENT OF ANESTHESIA AND ANESTHESIOLOGY

INCIDENCE AND PREDICTORS OF POSTOPERATIVE PAIN AMONG PEDIATRIC SURGICAL PATIENTS AT HAWASSA UNIVERSITY COMPREHENSIVE SPECIALIZED HOSPITAL, 2023, A PROSPECTIVE COHORT STUDY

INVESTIGATOR: ENDESHAW WALE (MSC STUDENT IN ADVANCED CLINICAL ANESTHESIA)

ADVISORS:

1. **GETU ATARO (MSC., MHPE, ASST. PROF)**
2. **YESUF AHMED (BSC, MSC IN ANESTHESIA)**

NOVEMBER, 2023

HAWASSA, ETHIOPIA

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A RESEARCH TO BE SUBMITTED TO: - HAWASSA UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCE, DEPARTMENT OF ANESTHESIA AND ANESTHESIOLOGY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTER OF SCIENCE (MSC) IN ADVANCED CLINICAL ANESTHESIA.

NOVEMBER, 2023

HAWASSA, ETHIOPIA

Approval Sheet-I

This study, titled "Incidence and predictors of postoperative pain among pediatric surgical patients at Hawassa University Comprehensive Specialized Hospital, 2023," was conducted and submitted by Endeshaw Wale, MSc student in partial fulfillment of the requirements for MSc in advanced clinical anesthesia. Advisors have reviewed it and made recommendations for its approval and acceptance

Name of advisors	Signature	Date
1. Getu Ataro (MSc, MHPE, Asst. prof)	----------	----------
2. Yesuf Ahmed (BSc, MSc lecturer in anesthesia)	----------	----------

EXAMINERS APPROVAL SHEET

SCHOOL OF GRADUATE STUDIES

HAWASSA UNIVERSITY EXAMINERS APPROVAL SHEET

(Submission sheet-2)

We, the undersigned, members of the board of Examiners of the final open defense by Endeshaw Wale have read and evaluated his/her thesis entitled **Incidence and predictors of postoperative pain among pediatric surgical patients at** Hawassa University Comprehensive Specialized Hospital and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirements for the degree.

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Name of major advisor Signature

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Name of internal examiner-I Signature

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Name of internal examiner-II Signature

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Name of External examiner Signature

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SGS Approval Signature

Final approval and acceptance of the thesis is contingent upon the submission of the final copy of the thesis to the school of graduate studies (SGS) through the department /school graduate committee (DGS/SGC) of the candidates department.

Stamp of SGS Date: ----------

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Abbreviations and Acronyms

ASA	American Society of Anesthesiology
BMI	Body mass index
CM	Centimeter
ENT	Ear, Nose, Throat
FLACC	Face, Leg, Activity, Crying, Consolability
HUCSH	Hawassa University Comprehensive Specialized Hospital
ICU	Intensive care unit
MM	Millimeter
MYPAS-SH	Modified Yale Preoperative Anxiety Scale- short form
NSAID	Non-steroidal anti-inflammatory drugs
PCM	Paracetamol
SPSS	Statistical package for social science
VAS	Visual analog scale

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Abstract

Background: Post-operative pain is a type of acute pain that may develop following surgical exposure and is triggered by an inflammatory reaction and the activation of afferent neural cells. In Ethiopia, there is insufficient data about postoperative pain incidence, predictors, and management in the pediatric population despite the existence of evidence-based worldwide reports.

Objective: To determine the incidence and predictors of postoperative pain among pediatric surgical patients at Hawassa University Comprehensive Specialized Hospital from February 10 – May 10, 2023.

Methods: A prospective cohort study was conducted on pediatric surgical patients from February 10-May 10, 2023. Pretested semi-structured questionnaires were used to collect data until 24 hours after surgery. The data collectors assessed pain with time interval of 2, 4, 6, 8, 10, 12, and 24 hour postoperatively. Statistical Package for Social Sciences version 26 was used to code, input, and analyzes the data. By using binary logistic regression variables with a p-value < 0.2 were enter to multivariable logistic regression and adjusted odd ratio was calculated with 95% confidence interval. A p-value of < 0.05 was considered statistically significant.

Result: A total of 142 children aged 2 months- 14 years were included in the study. The overall incidence of postoperative pain was 66.2% (95%CI: 58.2-75.4). History of preoperative pain (AOR, 4.599, 95% CI: 1.110-19.057), preoperative anxiety (AOR: 5.421, 95% CI: 1.379-21.313), duration of surgery <1 hour (AOR: 0.078, 95% CI: 0.010-0.629), 1-3 hours (AOR: 0.164, 95% CI: 0.031-0.877), and surgical incision length <5 cm (AOR: 0.024, 95% CI: 0.003-0.169) were all significantly associated with postoperative pain.

Conclusion and recommendation: The incidence of postoperative pain in pediatric surgical patients is high. Duration of surgery, surgical incision length, preoperative anxiety, and pain predict postoperative pain. Therefore, care providers should target these factors to minimize the magnitude of the problem and appropriate pain management strategy should be implemented.

Key words: Predictors, pain management, pediatric surgical patient, children, postoperative pain, incidence

Chapter One: Introduction

1.1 Background

According to the most recent definition provided by the revised International Association for the Study of Pain (IASP), pain is an “unpleasant sensory and emotional experience related to actual or potential tissue damage" (1). Post-operative pain is a form of acute pain that can occur after surgical exposure due to an inflammatory reaction and initiation of afferent neuronal cells (2).

Surgery is a frequent medical treatment that causes pain in children. Approximately 85% of children have pain after surgery(3, 4) and 63% experience clinically significant pain when they return home(3, 5, 6). Even though healthcare providers develop advanced professional knowledge about pain management and the emergence of new analgesics, postoperative pain remains a challenge and a significant number of children are suffering now (7, 8)**.**

The highest burden of inadequate pain management is mostly carried by geriatrics, pregnant, breastfeeding women, children, and mentally ill patients (9). Inadequate management of pain in children has undesirable physical and psychological consequences which lead to long hospital stays, more readmission and sensitivity to pain, and increased anxiety during medical events that take place later in life (10-12).

Although newborns and infants experience pain like older children and adolescents, professionals’ ability and approach to assessing and managing neonatal pain are inadequate and controversial since they are non-verbal and have no standardized or universal approach to assessing their pain. But, nowadays there are a lot of age-appropriate validated pain scoring systems for the pediatric population (13).

Evidence demonstrates that controlling pain in the pediatric age group is beneficial; improving physiologic, behavioral, and hormonal outcomes (14). Different studies showed that; the increased risk of postoperative pain could be due to the lack of assessment tools (15, 16). Self-report is the gold standard assessment tool for pain severity, but it is difficult to apply in pediatrics(17).

Among children's pain assessment tools, the Face, Leg, Activity, Cry, and consolability (FLACC) pain assessment scale is the best and most valid tool to assess the level of pain in children aged 2 months to 7 years old and The Visual Analog Scale is for those children greater than 7 years old(18-21). The Visual Analog Scale has been used to point out the level of pain on a 100 mm long line with the initial point representing no pain and the final point representing the worst pain (19).

Evidence showed that the incidence of post-operative pain was found to be very high in children. Studies conducted globally and at the national level found the incidence of postoperative pain was 27-77 % and 40.5-90.1%, respectively (22-26). Regarding surgical departments, moderate to severe postoperative pain seemed to be more frequent in general surgery (34%) and orthopedic departments(52%) (27).

1.2 Statement of the Problem

Due to the difficulty of identifying the root causes and the difficulty to assess their level of pain, pediatric surgical patients may be more likely to have a high incidence of postoperative Pain. Nowadays, postoperative pain is a common after surgical procedures in children and it is a worldwide health problem(28).

Millions of individuals suffered from insufficient pain management despite the adoption of pain relief as a fundamental human right by several workshops and summits of the African Union(29). One main factor contributing to patients' unnecessary suffering for pain has been shown to be improper analgesic usage.

Solid research shows that patients take half or less of the prescribed analgesics, do not take extra analgesics when they report being in high level of pain, do not benefit from the therapeutic effects of multimodal analgesia, and suffer from analgesic side effects like sedation, nausea, vomiting, constipation, and bleeding(30-33). Furthermore, strict laws governing access to potent opioids, inadequate treatment, unstandardized practice, lack of well-trained professionals, insufficient access of potent opioids, and poor preoperative preparation of surgical patients might also contribute to the occurrences of postoperative pain (29, 34-37).

Even though there has been improvement in pain management techniques, postoperative pain happens frequently after surgical exposure in pediatrics and they are the most vulnerable and undertreated population. The majority of studies on the incidence, treatment, evaluation, and risk factors for pain have been conducted on adults.

Prevalence studies conducted globally reported that more than 80% of hospitalized patients feel pain(38). According to a study done in Sweden Around 75% of pediatric surgery patients received insufficient analgesia postoperatively and 40% of them experienced moderate to severe pain (39).

With an overall incidence of 76.2%, which is high, the pain was found to be highly common in children referred to pediatric emergency departments in Ethiopia. It can be identified more frequently in children > 4 years old (87%) than in those younger than 4 years old (22). Another cross-sectional study done in northern Ethiopia, found pediatric patients experienced

postoperative pain at a rate of 40.5%(23). However, this is cross-sectional study and didn't include infants and toddlers.

Another study done in Ethiopia found that moderate to severe pain is quite common in children and infants accounting for prevalence rates of 88.9% and 90.1% before and at admission, respectively (24). Similarly, a prospective cross-sectional study was done in central Ethiopia on under-five children from February 2020- January 2021. This study showed that 74.2% of study participants had records of postoperative pain in the first 48 hours after surgical procedure(40).

Poorly treated pain after a surgical procedure leads to a lot of consequences like psychological, physiological, and emotional adverse effects, long time hospital stays, and Persistent postsurgical pain or chronic postsurgical pain with an estimated incidence of 35% and 38% at 6 and 12 months, respectively(23, 41). Even in spite of the fact that postoperative pain has long been recognized as a serious public health concern and that there is improved understanding and resources for managing pain, poorly managed pain continues to be a major barrier to the care of patients in postoperative period(30, 42).

Numerous studies conducted in the past to determine the best postoperative pain management techniques for children have demonstrated the efficacy of opioid therapy, even though considerable side effects are a major concern in addition to their analgesic benefits. Additionally, non-steroidal anti-inflammatory drugs (NSAID) have been shown to help the management of postoperative pain in both adult and pediatric groups. NSAIDs may help children and neonates use fewer opioids, but this benefit is still up for debate. Furthermore, it is still unknown if combining NSAIDs and opioids can benefit children's postoperative pain treatment(43).

1.3. Significance of the study

The proper and effective management of pain has remained one of the major issues since it is challenging to diagnose and identify predictors of postoperative pain in pediatrics. The majority of those admitted to hospitals suffer from uncontrolled postoperative pain.

Even though children are the most vulnerable group, there are limited studies in Ethiopia investigating the postoperative pain status of children admitted to hospitals which initiates us to conduct research on this topic. This research is used to describe the incidence and predictors of postoperative pain among surgical pediatric patients at Hawassa University comprehensive

specialized Hospital (HUCSH) and aims to improve the quality of care. In addition, this study will be able to improve the existing pain management practices at Hawassa University Comprehensive Specialized Hospital.

Chapter Two: Literature Review

Post-operative pain is a type of acute pain that occurs as a result of surgical exposure and it has a lot of complications if not identified and treated early. Children are the most susceptible group in this stressful situation, which is regarded as a worldwide health issue. They are still suffering, even though many things have been done to improve perioperative pain management. It is believed that a large proportion of the world's pediatric population suffers from inadequate pain treatment(44, 45).

2.1 Incidence of Postoperative Pain

Postoperative pain incidence is common in pediatrics which accounts 40.5-90.1% at national level. A prospective observational study was done in the United States of America (USA) on the incidence of moderate-severe pain in Hospitalized children in 2012. A total of 321 children from 1 month up to 18 years of age were included in the study. According to this study, the prevalence of moderate-severe pain was 27% and underutilization of regional anesthesia techniques may have contributed to this increased pain scores.

Another prospective cross-sectional survey conducted in a Canadian pediatric teaching Hospital in 2008 with a sample size of 241 patients found that 27% of patients usually had pain before admission, and 77% experienced pain during admission. Of these, 23% had moderate or severe pain at the interview and 64% had moderate or severe pain sometime in the previous 24 hours (25).

A similar study was conducted in 2020 on prevalence and contributing factors associated with postoperative pain in pediatric patients: in northern Ethiopia with a cross-sectional study design on a total sample size of 153 pediatric patients aged 2 -12 years. Based on this study, the prevalence of moderate to severe pain after pediatric surgery was 40.5%(23).

An institutional-based cross-sectional study was conducted in 2018 at St Paul’s Hospital Millennium Medical College pediatric emergency. A total of 290 patients 1 month to 18 years of

age were included in the study. The overall prevalence of pain was 76.2%, from this 70% have mild to moderate pain and the remaining 6.2% have severe pain (22).

Another prospective study was done in 2012 at Jimma University Specialized Hospital on investigations of pain status in children. A total of 162 infants and children were included. The sample contains 38 infants, 68 toddlers, and 56 school-age and above. All 162 infants and children were assessed for pain by the FACIAL PAIN rating scale for children >3 years old, the Verbal rating scale for children > 6 years old, and the FLACC PAIN rating scale for children 2 months to 3 years old. The final results obtained from this research show that moderate to severe pain prevalence was 88.9% before admission and 90.1 % at admission. This was decreased to 64.2% 24 hours after admission(24).

2.2 Sociodemographic Factors

A cross-sectional study was conducted in the US hospitalized children in 2012. The research found that teenagers and infants experienced higher prevalence rates of moderate-severe pain (38% and 32% respectively) than children (17%)(26). Another cross-sectional study on the determinants of postoperative pain in school-age patients undergoing elective surgery was done in Singapore in 2011. Children between the ages of 6-14 years were study participants. This study found that postoperative pain was significantly influenced by gender. Compared to girls, boys experienced less postoperative pain(46).

Multicenter longitudinal a study was done at Harvard University among 190 study subjects in 2013. According to the research, there was no significant association between postoperative pain and age, sex, and race/ethnicity(18).

Based on the cross-sectional study done in Ethiopia in 2018 on pediatrics pain management with total subjects of 290, Pain was detected more in those children aged >47 months (87%) as compared to those children aged 47 months. Additionally, this research also concludes that children with severe acute malnutrition (SAM) were 13.5 times more likely to develop pain(22).

2.3 Preoperative Factors

Risk factors contributing to postoperative pain in children are poorly understood since previous research largely focused on adults. Multicenter longitudinal a study was done at Harvard University Hospital among 190 study participants in 2013. According to the research, pediatric

patients who had preoperative pain were more likely to have moderate to severe post-operative pain than those who were not (47).

A Prospective cohort study was done on the association between children's emotional/behavioral problems before adeno-tonsillectomy and postoperative pain scores at home in Paola Children's Hospital in Antwerp (Belgium) between April 2013 and January 2016. A total of 160 children aged 1.5-5 years were included in this study. The study found that Pre-existing problems like emotional reactiveness, anxiety, and depression were independently associated with higher pain scores during the first three postoperative days after adeno-tonsillectomy(48).

In India, research on the prediction of postoperative pain was conducted in 2011. This research comprised individuals over the age of 65 who had major non-cardiac surgery. The findings show that higher ASA physical status was the best predictor of postoperative pain on the first postoperative day(49).

According to a cross-sectional follow-up study done in 2020 on the prevalence and contributing factors associated with postoperative pain in pediatric patients aged 2- 12 years old in Ethiopia, pediatric patients who had preoperative pain and anxiety were more likely to have moderate to severe post-operative pain than those who were not (23).

In 2018, an institution-based cross-sectional study on pediatric pain management was conducted at St. Paul's Hospital Millennium Medical College. Children aged 1 month to 18 years were included in the study. According to the study, there was no statistically significant relationship between the level of pain and age, surgical procedures, and admission diagnosis(22).

2.4 Intraoperative Factors

A Prospective cohort study was conducted in 2017 in the USA pediatric ambulatory surgery patients. A total of 204 participants who were ASA physical status I or II were included in the study. The study found that anesthesia duration and surgical procedure influenced postoperative pain (50).

Another Prospective cohort study was done on severe acute postoperative pain self-reported by children after ambulatory surgeries with 279 children from both sexes (5-12 years old), in two Brazilian hospitals. The pain intensity was assessed preoperatively, immediately after the

surgery, and first postoperative day. The research found that children who had undergone two surgical procedures were associated with severe postoperative pain(51).

A nationwide survey was conducted in 2002 in Sweden on acute postoperative pain in children aged 0-7 years. Based on this study moderate to severe pain seemed to be more frequent in general (34%) and in orthopedic (52%) surgery(27).

A retrospective analysis was done in the Medical University of Graz, Austria teaching hospital in 2016 on postoperative pediatric pain prevalence. A total of 815 postoperative children and adolescents (age <_18 years) were included in the study. Based on the study result, type of surgery is an important predictor for the incidence of post-surgical pain in children. Duration of surgery, body mass index, sex, and type of anesthesia, had no significant impact(52).

A cross-sectional follow-up study was done with a total of 153 patients aged 2- 12 years old in 2020. Based on this study, pediatric patients with an incision length greater than 10cm were 3.41 times more likely to have moderate to severe post-operative pain than those with an incision length less than 5cm(23). However, this research didn't included infants and toddlers as well as it is a cross-sectional study design.

2.5 postoperative Factors

A prospective cohort study was conducted on 90 patients aged 1–10 years at a Comprehensive Specialized teaching hospital in Ethiopia in 2020 on a comparison of a caudal block with rectal diclofenac, caudal block with paracetamol, and a caudal block alone for postoperative presence of pain in pediatric Patients. There was minimal postoperative pain in the caudal block combined with rectal diclofenac compared to the caudal block combined with rectal paracetamol and caudal block alone group (53).

From March to June 2009, prospective research on the treatment of postoperative pain was carried out at the Niamey National Hospital's Department of Anesthesia and Intensive Care. This study comprised a total of 553 patients with ages greater than or equal to 7 years. The survey found that tramadol (76.5%), paracetamol (64.5%), nonsteroidal anti-inflammatory medications (12.1%), and nalbuphine were the most often utilized analgesics. The study also discovered that postoperative analgesia is underutilized because of poverty, illiteracy, and poor training of healthcare professionals(54).

The effectiveness of balanced analgesia, which mixes non-steroidal anti-inflammatory drugs (NSAID) and opioids, for the treatment of postoperative pain in young patients, was examined in a meta-analysis in 2012. There were 27 publications in this meta-analysis. From the total study subjects included in the analysis, 567 of the participants got NSAIDs, compared to 418 who did not. The demand for postoperative opioids and the degree of pain intensity after surgery in children and infants reduced when non-steroidal anti-inflammatory medications and opioids were administered together. However, it was unable to identify any reduction in pain intensity brought on by NSAID medication within the first 24 hours after surgery (43).

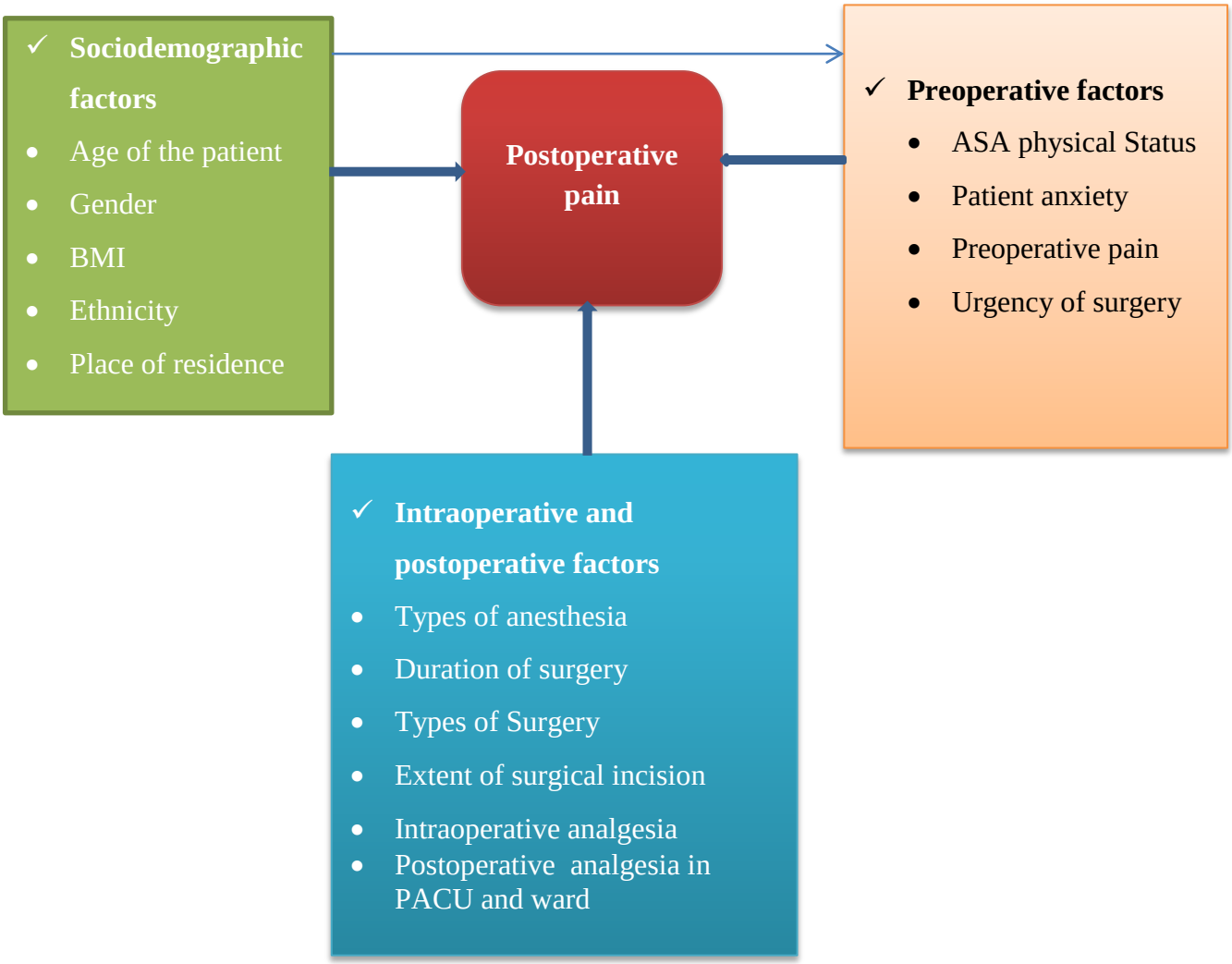

Figure 1: Conceptual framework for possible predictors of postoperative pain, extracted from literature reviews(55, 56), 2023.

Chapter Three: Objective

3.1 General Objective

To determine the incidence and predictors of postoperative pain among pediatric surgical patients at Hawassa University Comprehensive Specialized Hospital, from February 10 to May 10, 2023.

3.2 Specific Objectives

- To assess the incidence of postoperative pain among pediatric surgical patients at Hawassa University Comprehensive Specialized Hospital, from February 10 to May 10, 2023.
- To identify predictors of postoperative pain among pediatric surgical patients at Hawassa University Comprehensive Specialized Hospital from February 10 to May 10, 2023.

Chapter Four: Methods and Materials

4.1 Study Area

The study was conducted at Hawassa University Comprehensive Specialized Hospital in Sidama region which is located 275 km away from Addis Ababa in the southern part of Ethiopia. Hawassa is a capital city of Sidama region and it has nine Hospitals, seven of which are private and two of which are public. Hawassa University Comprehensive Specialized Hospital (HUCSH) is one of the federal ministries of health's teaching Hospitals for Hawassa University's College of Medicine and Health Sciences.

The population who get service in this Hospital is from Sidama, Oromia, and SNN and is estimated to be 18 million. It has a total of 400 beds and 10 operation rooms. It receives approximately 5,000 outpatient and emergency visits per month. Furthermore, HUCSH provides services for pediatric, gynecology, obstetrics, orthopedics, neurology, urology, ENT, and plastic surgery. Additionally, it gives services for internal medicine, child health, OPD, and major diagnosis facilities(57).

4.2 study Period

The study was conducted from February 10 to May 10, 2023

4.3 Study Design

Single center prospective cohort study

4.4 Population

4.4.1 Source population

All pediatric patients who would have surgery at HUCSH

4.4.2 Study population

All paediatric surgical patients who can fulfil inclusion criteria undergo both elective and emergency surgery at HUCSH from February 10 to May 10, 2023.

4.5 Inclusion and exclusion criteria

4.5.1 Inclusion criteria

- ASA class I or II paediatric surgical patients
- 2 Months-14 years old
- Both elective and emergency paediatric surgical patients

4.5.2 Exclusion Criteria

- Clinical instability or illness necessitating admission to the ICU
- Neurologic impairment or other medical disorders impairing completion of the VAS and questionnaire.
- Patients coming with life-threatening emergency condition
- Patients with chronic pain, like cancer pain
- Ambulatory surgery

4.6Variables of the study

4.6.1 Dependent Variable

- Postoperative pain

4.6.2 Independent Variable

- Personal and Socio-demographic characteristics**:** Age, BMI, ethnicity, sex, and residence place of the patient
- ASA physical status
- Types of Surgery
- Duration of surgery
- The extensiveness of surgical incision
- Types of anesthesia
- Preoperative experience of pain and anxiety
- Intraoperative and postoperative administrations of analgesia

4.7 Sample size and sampling technique

The sample size was calculated by using a single population proportion formula $n = Z_{\alpha/2}^2 * p*(1-p) / d^2$, and by adding a 10% non-response rate.

A previous study done in 2021 in northern Ethiopia on pediatric surgical patients conclude that the prevalence of postoperative pain was 40.5%(23). By taking population proportion (p) 40.5%, q=1-p, a confidence interval of 95% (Z=1.96), and a margin of error (d) of 5%. This resulted in total sample size= $(1.96)2x\ (0.405)\ (0.595)/\ (0.05)^2 = 370.291 \approx 370$

The total number of operation done in pediatrics annually is < 10,000. Therefore, the final sample size was calculated by using reduction formula as; nf =n / (1+ n /N).

nf = The final sample size

n = The minimum sample size

N= The total number of pediatrics with the age range of two months -14 years undergone surgery in HUCSH in the past retrospective three months which is 199 (from situational analysis).

The final sample size= nf= n / (1+n/N), nf = 370 /1+370/199 = 129.416 with a 10 % non-response rate, nf=142.358 ≈ 142. The selection of study participants was carried out at HUCSH by using consecutive sampling techniques.

4.8 Data collection method, quality control, and analysis

4.8.1 Data Collection Procedure

A pretested and semi-structured questionnaire was used to gather data. The questionnaire was originally written in English before being translated into Amharic and items were adapted from existing literature(55, 56).

Three trained first-year MSc anesthesia students gathered the data. Two of the three trained students were responsible for data collection, while one was act as a supervisor to check completeness and quality of data in addition to data collection. For elective procedures, following verbal and written informed permission being obtained from the family or caregiver, children who were to participate in the research were evaluated a day before surgery. Some information was taken from the file, including the patient's age, sex, ASA physical status, types of procedures, diagnosis, types of analgesics used, length of the surgical incision, and duration of the procedure. Additional information was obtained through direct attendant interviews and patients themselves if they were verbal**.**

An age-appropriate pain scale was used to evaluate the presence and intensity of pain in the preoperative period and for 24 hours following surgery. This scale included the VAS for children between the ages of >7 -14 years and the FLACC scale for children between 2 months and 7 years old. Postoperatively patients were followed and pain was assessed with time interval of 2, 4, 6, 8, 10, 12 and 24 hour after the surgical procedure.

Ages of two months to seven years old children were evaluated using the FLACC scale with exposed body parts and limbs; the observation lasted between 2 and 5 minutes. Each parameter is scored between 0 and 2, with a total score of 10. The overall score should be interpreted as follows: 0 indicates no pain, 1-3 indicates mild, 4-6 moderate, and 7–10 indicates severe pain, respectively.

Before surgery, children between the ages of >7 and 14 were taught how to use a visual analog scale to assess their degree of pain. How bad is your pain, the data collectors questioned the child. Make a vertical mark on the line below to indicate the degree of pain you are presently feeling. Using a ruler, determine the distance in millimeters or centimeters between the "no pain

marker" (zero) and the present pain mark and record the measurement. The measurement and their respective classification were as follows:

- 0 -5 mm – No Pain
- 6 to 40 mm – Mild Pain
- 41 to 74 mm – Moderate Pain
- 75 to 100 mm – Severe Pain

Preoperative anxiety was measured in waiting area and at the operation room by using MYPAS-SF (modified Yale Preoperative Anxiety Scale score, short form), which has 4 domains and 18 items. If the score is between 22.92-30 indicates no anxiety and ≥ 30 indicates anxiety.

4.8.2 Data Quality Management

To assess the reliability of the tool and clarity of the variables, a Pre-test was done on 5% (7) of patients who weren't included in the main study. Cronbach alpha which shows internal consistency was 0.83(83.0%).

The data quality was assessed before, during, and after data collection. Before collecting data, data collectors had a half-day of training. The data collectors were given explanations of the objectives and relevance of the study, as well as the components of each study instrument and the whole data-gathering process. During the data collection procedure, regular supervision and follow-up were carried out. Each questionnaire was examined by the supervisor for consistency and correctness of data, and the investigator was also confirming the process.

4.8.3 Data Processing and Analysis

The data were coded and checked for errors and missing data before analysis. The data was eventually entered and analysed using SPSS version 26. The multicollinearity of independent variables was checked with VIF. The value of VIF was <10. Cross-tabulation was used to describe the relationship between categorical variables. In the logistic regression analysis, odds ratios (OR) with 95% confidence intervals were calculated.

The outcome was described using descriptive statistics, such as frequency tables, and graphs. The dependent variable was dichotomous (present or absence of pain) which obeys the assumptions of binomial (binary) logistic regression. As a result, we used it to ascertain the association between the dependent and independent variables. The Hosmer-Lemeshow test was

used to verify the model goodness of fit test. A p-value of 0.05 was used as the criterion for statistical significance, and variables with a P-value of < 0.2 in the bivariable binary logistic regression analysis were transferred to the multivariable binary logistic regression analysis.

4.9 Operational Definitions

Postoperative pain: Is defined as pain that results in undesirable feelings and discomfort, due to surgical trauma with an inflammatory reaction experienced immediately after surgery up to 24 hours.

Anxiety: Refers to an overwhelming experience of fear, worry, and nervousness 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 22.92-30 indicates no anxiety and ≥ 30 indicates anxiety

FLACC scale: This is a behavioral pain assessment scale used for nonverbal children starting from 2 months up to 7 years old to assess their level of pain with a total score of 0-10.

Comfortable: The FLACC tool contains a score of zero which indicates no pain

Mild pain: Only elicited by close questioning or FLACC score (1–3)

Moderate pain: Bothering the patient, but often controllable by lying still. The patient may ask for analgesia, and the FLACC score is (4–6)

Severe pain: Dominating the consciousness and calling out for urgent relief or the FLACC score (7-10)

VAS: This is a self-report measure of pain intensity developed for > 7 years up to 14 years old children to score the sensation of pain on the widely accepted 0-100mm horizontal line. It is validated as no pain (0-5 mm), mild pain (6-40 mm), moderate pain (41-74 mm), and severe pain (75-100 mm) (58-60).

Pediatrics population: The group of population aged 2 months -14 years old.

4.10 Ethical Considerations

Ethical approval was obtained from Hawassa University's institutional review board. Informed consent was taken from a parent of the study participants after telling them the aim of the study, the benefits, and the harm of participating in the study. Patients have the full right to withdraw from the study at any step if they are not volunteers. Confidentiality was maintained at every step of the study.

4.11Dissemination plan

The final result of this research will be presented and submitted after defense to Hawassa University College of Medicine and Health Science and the Department of Anesthesia. Finally, the result will be presented in the regional conferences and it will be sent to local and international journals for publication.

Chapter Five: Result

5.1 Socio-demographic characteristics

In this study, a total of 142 patients, including 56.3 %(80) males and 43.7 %(62) females that underwent elective and emergency surgery at HUCSH between February 10- May 10 were enrolled. The median age of study subjects was 5 years (IQR, 2-9).

The majority of the participants, 55.6 %(79) live in rural areas, and the rest 44.4 %(63) live in urban. Regarding patient ethnicity 55.6%(79) were Sidama, 33.8%(48) Oromo, 2.8%(4) Wolayta, 2.8%(4) Gurage, 2.8%(4) Ken Bata, 1.4%(2) Gedio, and .7%(1) of participants were others. Figure 2 shown below indicates the distribution of age of the study participants.

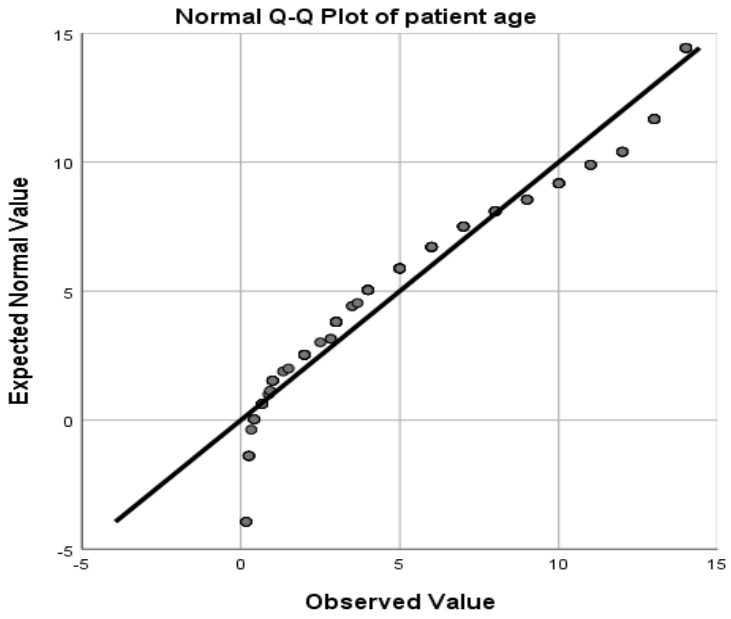

Figure 2: Q-Q plot showing distribution of age of the participants

5.2 Preoperative Factors

Among the study subjects, 54.9 %(78) and 47.9% (68) had anxiety and pain in the preoperative period, respectively. Among those who have preoperative anxiety, 84.6 %(66) have experienced postoperative pain. Fifty-four point nine percent (78) of study subjects were scheduled for elective surgical intervention and 45.1 % (64) patients were admitted for emergency surgery. The majority of patients 83.1% (118) were found to be ASA physical status I and 16.9 %(24) were ASA II.

5.3 Intraoperative Factors

The majority, 83.1% (118), received general anesthesia, while the remaining subjects 15.5% (22), and 1.4% (2) done with spinal anesthesia and sedation, respectively. Regarding duration of surgery 49.3 %(70) were >3 hours, 32.4 %(46) were 1-3 hours followed by 18.3 %(26) <1 hour of duration. The median duration of all the surgical procedures (median ± IQR) was 1.33±1.27 hours. Incision length was estimated by using a measurement and chart review from the surgical note documentation. 40.1 %(57), 28.2% (40), 26.1% (37), and 5.6% (8) have >10 cm, 5-10 cm, <5 cm, and un-estimated surgical incision length, respectively. Figure 3 shown below indicates types of surgery

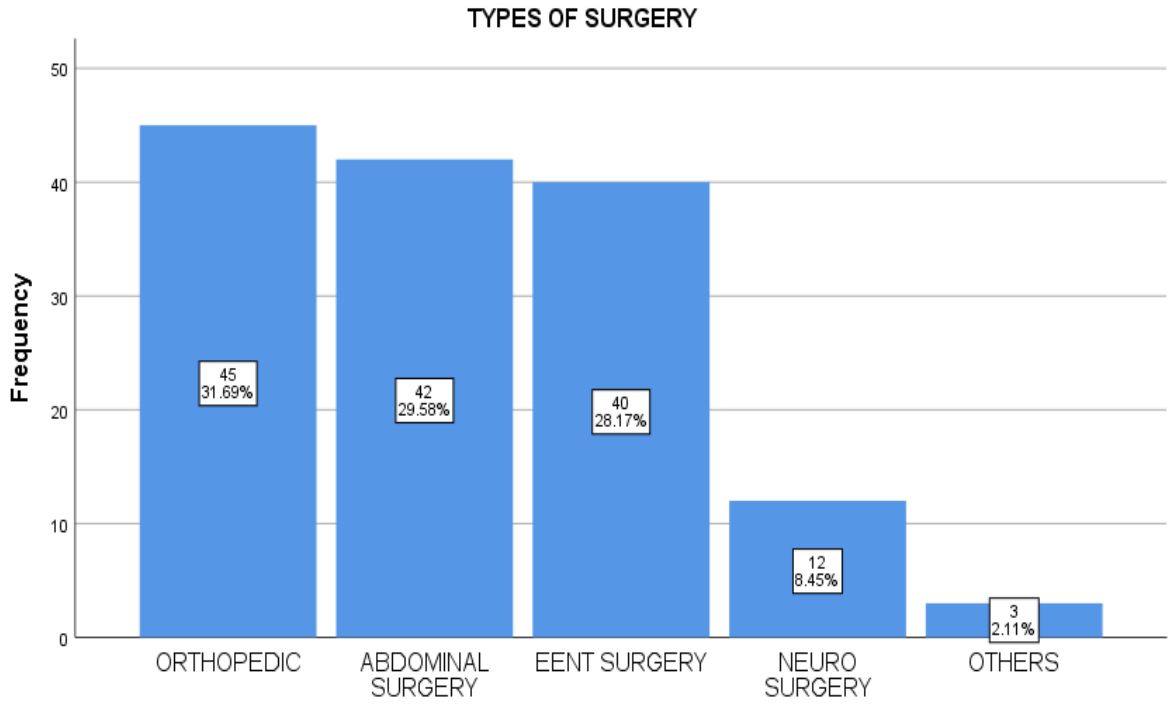

Figure 3. Bar chart showing types of surgery

5.4 postoperative Factors

In PACU after surgery 23.9%(34) were given PCM, 14.1%(20) were given tramadol, 3.5%(5) were given combined tramadol and diclofenac followed by 2.1%(3) other analgesic medications and the rest 56.3%(80) weren't take any pain medicine. The commonest analgesic drugs given during 24 hours postoperatively in the ward were tramadol 43.7 %(62) and PCM 40.8 %(58), followed by combined tramadol and diclofenac 10.6 %(15). The remaining 4.9 %(7) haven't

got any types of analgesics. Overall, the most commonly available and prescribed medication in the ward was tramadol, PCM, and diclofenac. There is a lack of potent analgesics.

5.5 Incidence of postoperative pain

In the current study, the incidence of postoperative pain was 66.2% (95%CI: 58.2-75.4) within 24 after surgery. In terms of severity, 14.8% of participants had mild pain, and 51.4% of participants had moderate to severe pain.

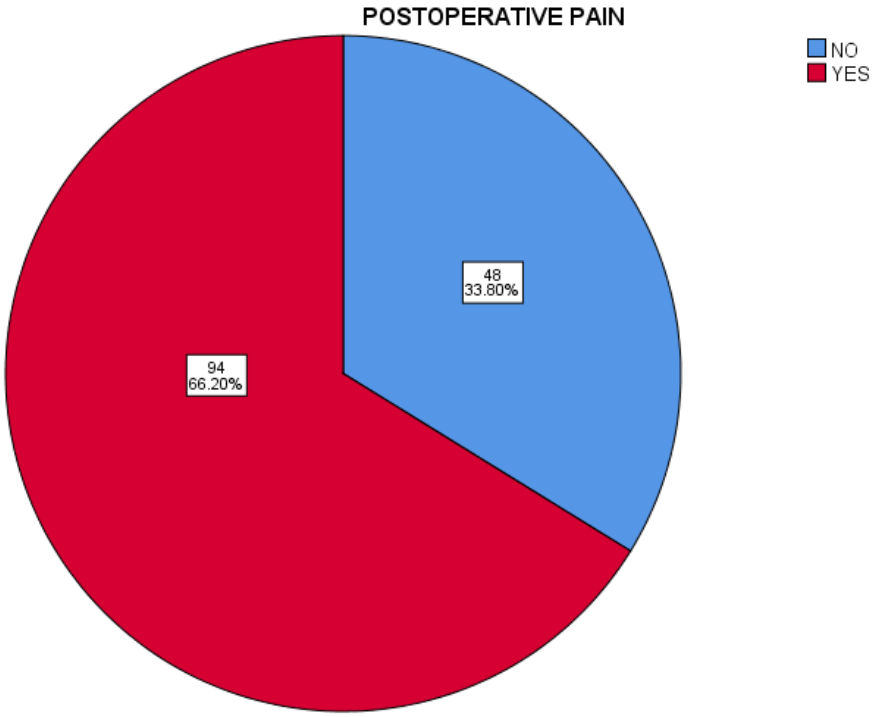

Figure 4: **Pie chart showing the presence/absence of postoperative pain**

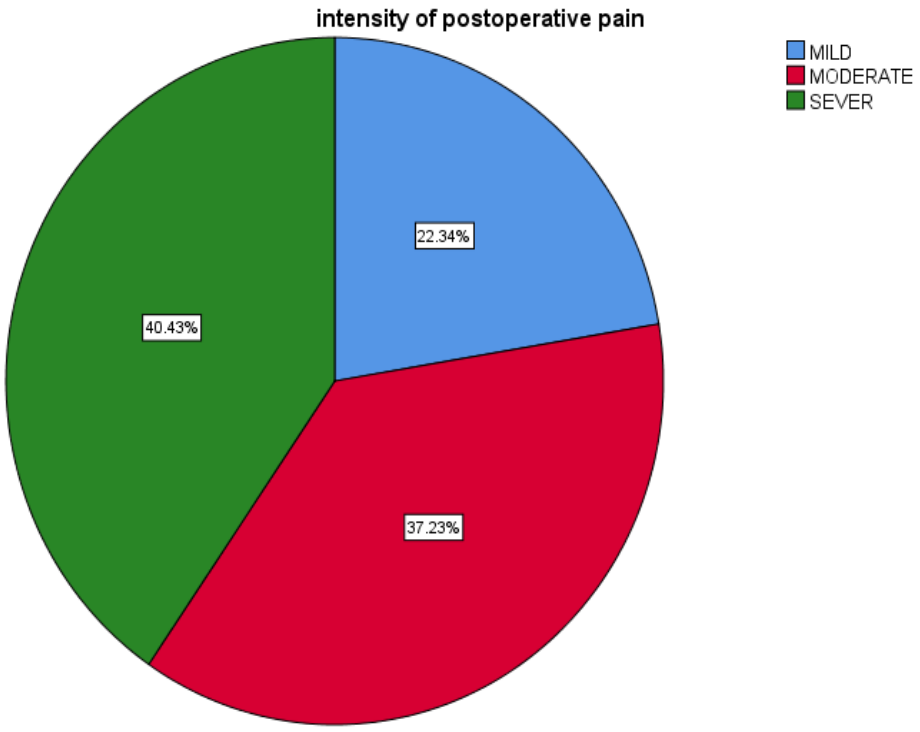

Figure 5: Pie chart showing the intensity of postoperative pain

Table1: Perioperative factors and their association with postoperative pain using cross tabulation, at HUCSH, from February 10 to May 10, 2023 (**n = 142).**

				Postoperative pain	
Variables		N	(%)	Yes	No
Gender	Male	80	56.3	44(71.05%)	18(29.0%)
	Female	62	43.7	50(62.5%)	30(37.5%)
	2month-1 year	29	20.4	25(86.2%)	4(13.8%)
Age	1-3 years	17	12	11(64.7%)	6(35.3%)
	3-6 years	36	25.4	24(66.7%)	12(33.3%)
	> 6 years	60	42.3	26(43.3%)	34(56.7%)
ASA class	ASA I	118	83.1	76(64.4%)	42(35.6%)
	ASA II	24	16.9	18(75.0%)	6(25. 0%)
Preoperative anxiety	Yes	78	54.9	66(84.6%)	12(15.4%)
	No	64	45.1	28(43.8%)	36(56.2%)
Preoperative pain	Yes	68	47.9	59(86.8%)	9(13.2%)
	No	74	53.1	35(47.3%)	39(52.7%)
Types of anesthesia	general anesthesia	118	83.1	87(73.7%)	31(26.5%)
	Spinal anesthesia	22	15.5	7(31.8%)	15(68.2%)
	Others	2	1.4	0(00.0%)	2(100.0%)
Surgical incision length	< 5 cm	37	26.1	8(21.6%)	29(78.4%)
	5-10 cm	40	28.2	32(80.0%)	8(20.0%)
	> 10 cm	57	40.1	50(100.0%)	7(0.0%)
	Unestimated	8	5.6	4(50.0%)	4(50.0%)
Duration of surgery	< 1 hour	26	18.3	10(38.5%)	16(61.5%)
	1-3 hours	46	32.4	22(47.8%)	24(52.2%)
	>3 hours	70	49.3	62(88.6%)	8(11.4%)

Using bivariable logistic regression analysis; history of pre-operative anxiety, history of preoperative pain, patient age, surgical incision length, duration of surgery, type of surgery, and types of analgesia used postoperatively in PACU have P value < 0.2 and entered to multivariable logistic regression. Among those variables, history of having preoperative pain, preoperative anxiety, duration of surgery, and surgical incision length were significantly associated with postoperative pain.

Table 2: **Multivariable logistic regression showing predictors of postoperative pain among pediatric surgical patients at HUCSH, from February 10 to May 10, 2023** (n = 142).

Variables	Category	Outcome		COR(95%CI)	AOR(95%CI)	P-value
		Yes	No			
Preoperative anxiety	Yes	66	12	7.071(3.213-15.563)	5.421(1.379-21.313)	0.016
	No	28	36	1	1	
Preoperative pain	Yes	59	9	7.305(3.164-16.866)	4.599(1.110-19.057)	0.035
	No	35	39	1	1	
Duration of surgery	<1 hour	10	16	0.081(0.027-0.237)	0.078(0.010-0.629)	0.017
	1-3hour	22	24	0.118(0.046-0.302)	0.164(0.031-0.877)	0.035
	>3 hour	62	8	1	1	
Surgical incision length	Unestimated	4	4	0.140(0.028-0.690)	0.211(0.019-2.284)	
	<5 cm	8	29	0.039(0.013-0.118)	0.024(0.003-0.169)	<0.001
	5-10cm	32	8	0.560(0.185-1.694)	0.749(0.131-4.283)	
	>10 cm	50	7	1	1	
Patient age	**2month-1 year**	**25**	**4**	**1**	1	.087
	1-3 years	**11**	**6**	**4.779(1.480-15.438)**	6.150(.644-58.746)	.115
	3-6 years	**24**	**12**	**1.402(0.458-4.289)**	.311(.043- 2.258)	.248
	>6 years	**34**	**26**	**1.529(0.647-3.617)**	3.046(.562-16.492)	.196
postoperative analgesia in PACU	Tramadol	16	4	1	1	.487
	Diclofenac	2	0	4(1.229-13.018)	4.548(.610-33.935)	.140
	PCM	31	3	1.615(0.001-0.043)	6.024(.073-0.953)	.999
	Tramadol and diclofenac	2	1	2(0.174-22.949)	2.164(.063-34.938)	.876
	Other	3	0	10.333(2.921-36.558)	8.634(.770-96.825)	.080
	None	40	40	1.546(0.120-0.531)	9.020(.001-0.098)	.999

COR= Crud odd ratio

AOR= Adjusted odd ratios **1**= Reference

Chapter Six: Discussion

Post-operative pain has become more common in pediatric surgical patients even in well-developed countries despite the emergence of updated evidence as well as the development of advanced professional knowledge about pain management. With our limited resources, it is therefore not too difficult to envision the shadow of the harm. This study determined the incidence and predictors of post-operative pain in pediatric surgical patients at HUCSH, Ethiopia, 2023.

6.1. Incidence of postoperative pain

Based on the findings of this study, the overall incidence of postoperative pain within 24 hours after surgery was 66.2% (95%CI: 58.2-75.4). This finding is comparable with studies conducted in Tikur Anbesa Specialized Teaching Hospital (74.2%), St Paul's Hospital Millennium Medical College (70%), Northwest Ethiopia (70.5%), and Southern Australia (75%) (22, 40, 56, 61).

Our research result was higher than a survey conducted by Cummings et al which indicates that 49% of patients had moderate to severe pain within 24 hours(62), and a study done in US in 2009, where the incidence of moderate-severe pain in those admitted to surgical ward was 44%(25). The discrepancy could be due to differences in socio-economic status, environmental and genetic variations, low applicability of nerve block, lack of good clinical practice and potent analgesics.

Another prospective cross-sectional survey study done at a Canadian tertiary and quaternary pediatric hospital was found 23% incidence of moderate-severe pain(9). This finding is low when compared with our research outcome. This might be due to the development of a continuous quality assurance program for pain at the Hospital for sick children, and the presence of expert health professionals.

The finding of this research result is higher than a study done in Kenya which conclude that 78% of patients were developed pain(63), and study carried out in Ethiopia at Jimma Specialized Hospital which found that moderate-severe pain prevalence was 88.9% before admission and 90.1% at admission(24). This discrepancy may be caused by inadequate analgesic use, most infants and children received paracetamol as their primary analgesics, regardless of their age and

level of pain, and analgesics was given only for half of patients among those who needed treatment.

6.2. Predictors of postoperative pain

In this study, the presence of preoperative pain is one risk factor for the incidence of pain after a surgical procedure. When we compared, those children who had experienced preoperative pain were 4.6 times more likely to develop postoperative pain than those who hadn't preoperative pain (p=0.035, 95%CI; 1.110, 19.057). This conclusion is related to the idea of a central biasing theory which says "the body uses past experiences with pain to judge the intensity/severity of current pain"(64). This result is in line with studies conducted in France, Australia, and Ethiopia (56, 65, 66).

In our study; postoperative pain was detected more in those patients who had preoperative anxiety. Those who have anxiety were 5.4 times more likely to have postsurgical pain compared with children who didn't have preoperative anxiety (P=0.016, 95%CI; 1.379, 21.313). This idea supports the gate control theory published by two researchers, Ronald Melzack and Patrick Wall (67). According to the theory, "people with anxiety or depression experience intense pain and find it difficult to cope with it." This finding was supported by a study conducted in Brazil, Swedish, and northern Ethiopia; those who have preoperative anxiety were more likely to develop moderate to severe postoperative pain than patients who didn't have anxiety (27, 56, 68).

Another independent predictor for postoperative pain was surgical incision length. In comparison to patients with incision lengths >10 cm, patients with an incision length of less than 5 cm were 97.6% times less likely to have postoperative pain (P=0.001). In the same manner, a Hospital-based cross-sectional study was conducted in an Ethiopia operating theatre in 2013 to determine the severity and risk factors of postoperative pain and found that surgical incision length was a major determinant of postoperative pain severity in the first 12 hours after surgery (69).

Similarly, studies done in Ethiopia and the Netherlands in 2022 and 2008 respectively, found the same result. These researches demonstrated that having a wide surgical site incision was a predictor of moderate to severe postoperative pain(55, 70). This is because large surgical site

incisions cause more postoperative pain by increasing inflammation and sensitivity of the peripheral and central neurons.

The duration of surgical procedure was an additional surgical component that consistently correlated with postoperative incidence of pain. In this research, surgical procedures lasting less than one hour were 92.2% times less likely to result in postoperative pain than those lasting more than three hours. Similar to this, compared to surgeries lasting more than three hours, shorter surgeries lasting 1 to 3 hours had an 83.6% times lower risk of developing postoperative pain. Reddi D. and Clarke H. et al.'s studies from 2016 and 2011 respectively came to a similar result. These researchers observed that operations lasting more than three hours were linked to more persistent postsurgical pain (71, 72).

In our study, types of surgery were not a predictive factor for postoperative pediatric pain. This finding is contrary to a study conducted in Austria teaching Hospitals, a survey conducted in Swedish, and a cross-sectional study done in northern Ethiopia. According to those studies, types of surgery were one predictor for the incidence of postoperative pediatric pain (23, 27, 73). This might be due to the difference in medical service, inadequate use of medications necessary for specific departments, absence of specialties in neonatal and child health service, and children being treated along with adults, and fewer children being treated in most departments even though they have high pain scores.

Our study result revealed that; the occurrence of postoperative pain did not have a statistically significant correlation with the sex and age of the children. This outcome is consistent with a survey conducted on the incidence of postoperative pain in children that was done on 170 children recovering from surgery in two major teaching hospitals(61).

However, there was a retrospective cohort association study done in 2018 on a total of 11,510 which contradicts our finding. This retrospective cohort study indicates that postoperative pain decreases with increasing age (74). Furthermore, a cross-sectional study conducted in Ethiopia in 2018 over 3 months on pediatrics found that children aged >47 months were more likely to have pain than children < 47 months (22). This discrepancy could be the difference in admission diagnosis, the majority of children over 47 months old had acute abdominal and other diagnoses

such as soft tissue and bone infections, which are known to cause pain. These diagnoses account for the majority of pain cases in this age range.

Strengths and limitations of the study

6.3 Strength

- This is a prospective cohort study and it includes infants and toddlers who were not included in studies conducted previously.
- This study focuses on pediatric surgical patients and tries to investigate the burden of postoperative pain starting from 2 month of age. This might have positive implications to improve the practice of postoperative pain assessment as well as management for pediatric surgical patients.
- Since there is no sufficient studies done on this topic in Ethiopia particularly in our institution, the study will be used as a baseline information for further research and also it will be one of the sources of hospital-based information for the institution about the incidence and predictors of postoperative pain

6.4 Limitations

- It may not be able to generalize the findings from this study since it was conducted in a single center with a small sample size.
- The age range didn't include all pediatric population
- The study subjects were selected by using a consecutive Sampling technique
- The representation of the heterogeneous surgical specialties (general surgery, EENT, orthopedics, neurology, and others) was unequal and lacked of comparator group.

Chapter Seven: Conclusion and Recommendations

7.1. Conclusion

The overall incidence of postoperative pain in pediatric surgical patients was 66.2%. In terms of severity, 14.8% of participants had mild pain, and 51.4% of participants had moderate-severe pain. This indicates that management of postoperative pain may be suboptimal among surgical patients of HUCSH. Background reasons might include the use of unstandardized treatments, lack of potent analgesics, and poor preoperative preparations of the patient. Factors associated with postoperative pain after pediatric surgeries were duration of surgery, surgical incision length, preoperative anxiety, and preoperative pain.

7.2. Recommendations

1. for healthcare providers

- Our research found that with increasing preoperative anxiety and pain, there was an increased incidence of postoperative pain in children. Therefore, children should be reassured and psychologically prepared with pharmacological and non-pharmacological therapies preoperatively.
- In addition to this, large surgical incision length and prolonged duration of surgery were major risk factors for the increased incidence of postoperative pain. Therefore, health practitioners must pay close attention to the high postoperative pain incidence rate and should target these factors to minimize the magnitude of the problem

2. For the institution

- The hospital administration should recognize the severity of the issue and make plans for effective measures, such as mobilizing resources or increasing the clinicians' knowledge of the available methods for assessing and treating pain in these patients through regular training and other mechanisms.
- The institution should increase access to potent analgesics

3. For Researchers

- We recommend researchers do a multicenter further more detailed studies on this topic with a large sample size by including a comparator group and extended follow-up time

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Chapter Nine: Annexes

9.1 Consent form

Hawassa University College of medicine and health science department of anesthesia and anesthesiology consent sheet

Date-------/-----/------

Hello dear Participant:

My name is Endeshaw Wale a postgraduate student at Hawassa University College of medicine and health science. I am conducting a research entitled “the Incidence and predictors of postoperative pain among pediatric surgical patients” to complete a Master of Science degree in advanced clinical anesthesia.

Purpose of the study: to determine the incidence and predictors of postoperative pain among pediatric surgical patients and the result of this research may have a positive impact on the quality of patient care and may improve patient management.

Risks and benefits: There is no harm or benefit to participate in this study. You will not be asked for any additional cost than usual. Your participation in this study is voluntary and you are free to withdraw at any time if you are not comfortable. If you decided to participate in the study you will be asked to complete some questions and it will not take more than 15 minutes. Your follow up time is for 24 hours after the surgical procedure.

Confidentiality: all the information of the patient is held confidential. The name of the patient will not appear in any of the documents.

If you have any questions related to this research, you can contact with:

Email address: endeshawwale12@gmail.com

Phone number: 0985946788

9.2 Questionnaire

Table 3: Socio-demographic characteristics of the study participants at HUCSH, Ethiopia 2023.

Serial No	Questions	Response
1.	Patient card number	
2.	Sex	I. Male II. Female
3.	Age	A. 2month -1year B. 1-3 years C. 3-6 years D. >6 years
4.	Ethnicity	A. Sidama B. Wolayta, C. Gurage, D. Hadya, E. Kambata, F. Gedio G. Other-----
5.	Residence place	I. Urban II. Rural
6.	Weight(in kg)	
7.	Height(in cm)	
8.	BMI(in kg/m2)	

Table 4**:** Preoperative risk factors among the participants at HUCSH, Ethiopia in 2023.

Serial o	Questions	Response
1.	ASA physical Status	I. ASA 1 II. ASA 2
2.	Preoperative anxiety	I. Yes II. No
3.	Preoperative pain	I. Yes II. No
4.	Urgency of surgery	I. Elective II. Emergency

Table 5**:** Intraoperative and postoperative risk factors among the participants at HUCSH, Ethiopia, 2023.

S. No	Questions	Response
1.	Anesthetic technique	A. General B. spinal C. Others-----
2.	Type of surgery	A. Orthopedics B. Abdominal C. Neurologic D. ENT E. Others------
3.	Duration of surgery(in hours)	A. <1 hr. B. 1-3 hr. C. >3 hr.
4.	Surgical incision length	A. <5cm B. 5-10cm C. >10 cm D. Unestimated
5.	Intraoperative analgesics(specify the does)	A. Tramadol B. Diclofenac C. Ketamine D. Pethidine E. Morphine F. Local infiltration or nerve block G. PCM G. Other

6.	Postoperative analgesia in PACU (specify the does)	A. Tramadol B. Diclofenac C. PCM D. Pethidine E. Other F. None						
7.	Postoperative analgesia on ward (specify the does)	A. Tramadol B. Diclofenac C. PCM D. Pethidine E. Other F. None						
8.	Pain score							
		2 hr.	4 hr.	6 hr.	8 hr.	10 hr.	12 hr.	24 hr.
9.	Total pain score for children 2 months -7 years old (with FLACC scale)							
10.	Total pain score for children > 7 years -14 years old (with VAS scale)							
11.	Outcome							
	Postoperative pain (presence)	I. Yes II. no						
	Postoperative pain intensity	A. Mild B. Moderate C. Severe						

Pain and anxiety assessment

Ways of pain assessment

1. **In children aged 2 months- 7 years old**

Exposed the patient's body and limbs, then observe for 2-5 minutes and assess the pain status by using the FLACC scale found in the table below.

Table 6: FLACC scale used to assess pain in children aged 2 months- 7 years old

	Score		
Items	**0**	**1**	**2**
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Leg	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly in, a normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Relaxed	Reassured by occasional touching, hugging, or being talked to, distractible	Difficult to console or comfort

.

2. **In children aged >7 years -14 years old**

Ask the patient to rate their current level of pain by placing a mark on the line below in **Figure 6.** Use a ruler to measure the distance in millimeters from the 'no pain marker' (or zero) to the current pain mark and put the number.

Ask the child like this, How severe is your pain? Place a vertical mark on the line below to indicate how badly you feel your pain now.

Figure 6: VAS pain scale to assess pain in children (>7 years up to 14 years old

- 0 to 5 mm – No Pain
- 6 to 40 mm – Mild Pain
- 41 to 74 mm – Moderate Pain
- 75 to 100 mm – Severe Pain

Anxiety assessment: Anxiety assessment is by using mYPAS-SF (modified Yale Preoperative Anxiety Scale score, short form), which has 4 domains and 18 items. Give 1 for each time point. Each score is calculated by dividing each item rating by the highest possible rating (i.e., 6 for the 'vocalizations' item and 4 for all other items), adding all of the produced values, dividing by 4, and multiplying by 100.

This calculation produces a score ranging from 22.92 to 100 with higher values indicating higher anxiety (33, 40)

By adding all scores, if it is between:-

- 22.92-30 no anxiety
- ≥ 30 patients have anxiety

Assessment will be:

1. At the beginning of the preoperative process in the holding area and

2. In the OR when the anesthesia mask is introduced to the child

A. Activity

1 = Looking around, curious, playing with toys, reading (or other age-appropriate behavior); moves around holding area/treatment room to get toys or go to parent; may move toward OR equipment

2 = Not exploring or playing, may look down, may fidget with hands or suck thumb (blanket); may sit close to parent while waiting, or play has a definite manic quality

3 = Moving from toy to parent in an unfocused manner, non-activity derived movements; frenetic/frenzied movement or play; squirming, moving on table, may push mask away or clinging to parent

4 = Actively trying to get away, pushes with feet and arms, may move the whole body; in the waiting room, running around unfocused, not looking at toys or will not separate from parent, desperate clinging

B. Vocalizations

1 = Reading (non-vocalizing appropriate to activity), asking questions, making comments, babbling, laughing, readily answering questions but may be generally quiet; child too young to talk in social situations or too engrossed in play to respond

2 = Responding to adults but whispering, "baby talk", only head nodding

3 = Quiet, no sounds or responses to adults

4 = Whimpering, moaning, groaning, silently crying

5 = Crying or maybe screaming "no"

6 = Crying, screaming, sustained (audible through the mask)

C. Emotional Expressivity

1 = manifestly happy, smiling, or concentrating on play

2 = Neutral, no visible expression on the face

3 = Worried (sad) to frightened, sad, worried, or tearful eyes

4 = Distressed, crying, extremely upset, may have wide eyes

D. State of Apparent Arousal

1 = Alert, looks around occasionally, notices watches what anesthesiologist does with him/her (could be relaxed)

2 = Withdrawn child sitting still and quiet, maybe sucking on thumb or face turned into adult

3 = Vigilant looking quickly all around, may startle to sounds, eyes wide, body tense

4 = Panicked whimpering, may be crying or pushing others away, turns away