

ADDIS ABABA UNIVERSITY



COLLEGE OF HEALTH SCIENCE SCHOOL OF MEDICINE DEPARTMENT OF ANESTHESIA

ASSOCIATION BETWEEN ABO BLOOD GROUP AND POST-OPERATIVE PAIN IN CHILDREN
AFTER ADENOTONSILLECTOMY: A PROSPECTIVE COHORT STUDY IN PUBLIC HOSPITALS
OF ADDIS ABABA, ETHIOPIA.

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A RESEARCH PROPOSAL SUBMITTED TO ADDIS ABABA UNIVERSITY COLLEGE OF
HEALTH SCIENCE SCHOOL OF MEDICINE DEPARTMENT OF ANESTHESIA IN
PARTIAL FULFILLMENT FOR THE REQUIREMENTS OF MASTER OF SCIENCE
DEGREE IN ADVANCED CLINICAL ANESTHESIA

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Declaration

I, the undersigned, hereby certify that this thesis is my original work and that it partially fulfills the requirements for the Master of Anesthesia.

I am aware that plagiarism won't be tolerated and that any directly quoted content has been properly cited.

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As advisors, we have approved this thesis result, which has been submitted for examination for the Master of Science in Anesthesia.

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ABSTRACT

Introduction: The main cause of morbidity after an adenotonsillectomy is generally recognized to be pain. Clinically, there can be significant differences in pain perception and intensity amongst people in the same surgical context, with similar pain states, similar pathologies, or with similar disease severity. The Inter- individual difference for pain is influenced by genetic and environmental factors. The diversity in individual differences in pain is partially explained by minor alterations in DNA. Among all DNA polymorphisms, the ABO blood type is one of the most significant genetic phenotypes. Hence, Knowing about the relationship between ABO blood system and post-operative pain can improve post-operative pain management and reduce pain related sequela.

Objective: To investigate the association between ABO blood group and post-operative pain in children after adenotonsillectomy in public hospitals of Addis Ababa, Ethiopia from February 2024 to April 2024.

Method: A multi-center prospective cohort study was conducted in public hospitals of Addis Ababa among pediatrics patients who underwent adenotonsillectomy procedures under general anesthesia with a total of 88 patients having four group based on blood type and each containing 22 patients. FLACC pain scale and post-operative analgesic consumption was recorded postoperatively along with collection of demographic data. The measured outcomes were postoperative pain indicated by the pain score and the total analgesic consumption among the four major ABO blood groups. The participants in the study were selected by systematic random sampling technique from each group. Data was collected by preoperative chart review, intraoperative and postoperative observation. The data was entered into SPSS version 26 and analysis of variable was undertaken by using one-way ANOVA, Kruskal Wallis H- rank test, and chi-square test.

Result: FLACC pain scores were significantly higher in the AB and B blood groups' than those of the A and O blood groups ($P < 0.05$). Additionally FLACC pain scores of AB blood were the highest among all ($P < 0.01$). regarding to analgesia consumption children in the blood groups A and O received much lower total dosages of analgesics during a 24-hour period than did children in the AB and B blood groups ($P < 0.05$).

Conclusion: In conclusion, the present study found that there is an association between blood group and post-operative pain scores and post-operative analgesia consumption in children undergoing adenotonsillectomy. We recommend clinicians to consider patients' blood group during pain management.

Key words: ABO blood group, FLACC pain score, Postoperative pain

Abbreviations and Acronyms

ASA	American society of Anesthesiologist
ABO	A, B, AB, O blood group
ACL	Anterior cruciate ligament
BMI	Body mass index
BIS	Bispectral index
FLACC	Face, Leg, Activity, Cry and Consolability pain scale
DNA	Deoxyribonucleic acid
ENT	Ear, Nose, Throat
ETT	Endotracheal Tube
ECG	Electrocardiogram
HR	Heart rate
IV	Intravenous
MAP	Mean Arterial Pressure
KG	Kilogram
MCG	Microgram
MG	Milligram
ML	Milliliter
NGO	Non-governmental organization
NIBP	Non-invasive Blood Pressure
PACU	Post Anesthesia Care Unit
VNRS	Verbal Numeric Rating Scale

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CHAPTER ONE

INTRODUCTION

1.1 Background

One of the procedures that children undergo the most frequently is an adenotonsillectomy[1]. To stop recurrent infections and inflammation, the palatine tonsils are completely or partially removed by the procedure [2, 3]. The prevalence of tonsillectomy has considerably grown over the past 35 years, with obstructive sleep apnea and recurring throat infections being the two most common causes [4-6]. An estimated 530,000 tonsillectomies are done on children under the age of 15 every year. Tonsillectomy is also the second-most frequent pediatric ambulatory surgical operation in the US after myringotomy with tube insertion [7]. In children under the age of 15, 289,000 ambulatory tonsillectomy procedures were carried out in 2010 [8].

Tonsillectomy consequences include bleeding, nausea, vomiting, and postoperative pain, with the latter being the most frequent problem [9-12]. In general, postoperative treatment is challenging due to the potential consequences of tonsillectomy [13]. The main cause of morbidity after an adenotonsillectomy is generally recognized to be pain [14]. Tonsillectomy is linked to significant blood loss during the procedure [15] as well as subsequent inflammatory reactions brought on by tissue trauma, which result in intense pain and post-operative morbidities owing to the buildup of local tissue exudates surrounding the surgical site [16, 17]. Additionally, tonsillectomy exposes nerve endings (tonsillar, glossopharyngeal, maxillary trigeminal and lesser palatine nerve branches) and damages the pharyngeal muscles[18], which can result in some adverse post-operative outcomes like excruciating pain, difficulty breathing or swallowing, vomiting, and otalgia ([19, 20]). The majority of children will experience moderate to severe postoperative pain, and opioids are the mainstay of painkiller therapy [21].

Clinically, there can be significant differences in pain perception and intensity amongst people in the same surgical context, with similar pain states, similar pathologies, or with similar disease severity [22-24]. A variety of factors, including genetic, developmental, family, psychological, social, cultural, ethnic group, and demographic variables, may have an impact on how people express and respond to pain differently [23].

Growing evidence points to genetic factors as a major contributor to individual variations in pain tolerance, both clinically and experimentally [22]. The diversity in individual differences in pain may be partially explained by minor alterations in DNA, according to recent advancements in genetics [25]. According to mounting evidence, heterozygous DNA elements are closely associated to the significant inter-individual variation in pain sensitivity and susceptibility, as well as to the emergence of certain pain syndromes and analgesic sensitivity [21].

Among all DNA polymorphisms, the ABO blood type is one of the most significant genetic phenotypes [21] and contains antigenic polysaccharides that are polymorphic, hereditary, and present on erythrocytes and other tissues. [26]. It is the most important system for human blood transfusion because the antigens in it are the most immunogenic of all blood group antigens [27, 28]. On chromosome 9, at 9q34.1–q34.2, are the genes encoding the ABO blood system. This locus contains the allelic types A, B, and O. The A and B alleles of the locus each encode a distinct glycosyltransferase, which is responsible for producing the N-acetylgalactosamine and α-D-galactose carbohydrate structures that recognize the A and B antigens on RBCs. the O allele encodes an unidentified enzyme and No A or B antigens are generated [27-29]. The dispersal of the ABO blood types is unequal locally and globally [30].

ABO blood groups have been associated to an increased risk of developing a number of diseases, including cancer, cardiovascular disease, infections and hematologic disorders, cognitive disorders, circulatory diseases, metabolic diseases (diabetes), and malaria [31-34].

Our study will look at the consumption of analgesics and postoperative pain scores in children age of 3-10 undergoing adenotonsillectomy to see if specific blood type in the ABO blood system perceive pain in different way.

1.2 Statement of Problem

One of the most crucial aspects of tonsillectomy is pain management [35]. Pain following an adenotonsillectomy has been reported in 20–50% of surgically treated kids [36], Despite reports from parents that over 80% of kids were in substantial pain on postoperative day 2, one small prospective research found that almost 50% of patients were still in significant pain on day 7 [37]. Tonsil surgery recovery entails a lot of discomfort and seems to be more difficult than other kinds of pediatric surgical procedures [38, 39]. With the exception of strabismus surgery, tonsillectomy was linked with significantly greater moderate-to-severe/worst pain at home and a significantly longer pain duration at home (7.25 vs. 2.16 days mean) compared with all other groups [38].

Poor surgical pain management can cause extended recovery times, postponed discharge, and dietary deficiencies that can lead to dehydration, especially in young patients. These elements will lengthen hospital stays and necessitate intravenous (IV) fluids [36]. The discomfort may cause a reduction in oral intake and dehydration that necessitates a hospital readmission [35]. The risk of hemorrhage is greatly increased in patients who experience acute or growing pain in the first few days following a tonsillectomy [40]. The most dangerous side effect is post-tonsillectomy bleeding, which in rare circumstances can be fatal[41]. Further, significant pain after surgery causes children to heal more slowly and have higher rates of postoperative morbidity, such as disturbed sleep, and behavioral changes[42].

While various complementary and alternative treatments have been researched, some of them (such as honey, acupuncture, ice etc.) have shown some promise, pain control in this situation is today predominantly handled by pharmaceutical methods [43].

Studies have shown that tonsillectomies are surgical operations that cause substantial degrees of discomfort, and post-tonsillectomy pain management is frequently insufficient [44, 45]. While too much pain medication may cause major adverse events, too little pain medication may cause significant patient anguish and suffering [46]. The inadequate pain control experienced after an adenotonsillectomy persists despite the availability of a variety of analgesic options, frustrating both patients and specialists [21].

As a subjective and very personal experience, pain creates difficulties for both researchers and clinicians. The fact that it is impossible to quantify pain directly and must instead rely on people reports and, to some extent, their behavior to give us a look into their experiences is a well-recognized challenge caused by the subjective nature of pain [23].

The vastly different analgesic drug dose requirements to produce adequate pain relief with tolerable side effects in individuals add to the difficulty of clinical pain management. These considerable inter-subject differences are supported by interplaying genetic and environmental variables [47]. Additionally, inter-individual variations in genetics have an impact on the pharmacokinetics and pharmacodynamics of painkillers as well as pain sensitivity [24].

Understanding the molecular basis of pain sensitivity, varying reactions to analgesic medicines, and tailored treatment depend on examining the genetic foundation of human variability in pain. Researchers studying pain have gained insight into the genetic systems underlying pain and have applied this information thanks to recent discoveries and advanced technologies. According to a number of recent articles, certain genetic polymorphisms cause inter-individual variability in pain sensitivity and analgesic medication responses [48].

To far, it has been determined that over 300 putative pain genes may be involved in heritable variations in analgesic responsiveness and pain sensitivity in both humans and animals [24, 49]. Numerous genetic association studies have looked at the effects of single-nucleotide polymorphisms in different target genes on pain sensitivity and/or analgesic dosing requirements. These studies have been conducted in patients with a range of clinical pain types or in humans exposed to experimentally induced pain stimuli in a laboratory setting [49].

However, independent researchers have either failed to reproduce the findings of the majority of genetic association studies in the field of pain or have only partially duplicated them [48, 50]. It is still unknown which specific DNA variants are responsible for the sense of physiological pain [51].

Among all DNA polymorphisms, the ABO blood type is one of the most significant genetic phenotypes [21]. Numerous researches have demonstrated the connection between different diseases and the ABO blood group. However, there are few studies demonstrating a connection between ABO blood type and pain[52].

1.3 Justification/ Significance of the Study

Post-operative pain after adenotonsillectomy is still a major concern for medical practitioners and it is still a source of morbidity for many patients. Even though there are different methods to treat pain after adenotonsillectomy, pain management is not efficient as intended yet. Evidences from different literature also support this. One reason for this could be the Inter- individual difference for pain which is influenced by genetic and environmental factors. As we know the ABO system is one of the polymorphic genes found on chromosome 9 and it may have some association with pain. Some previously done researches show relation between blood groups and pain. In addition to this the ABO blood group was associated with different disease in many studies.

Knowing about the relationship between ABO blood system and post-operative pain can improve post-operative pain management and reduce pain related sequela. Some studies had been done in different countries which comparing pains among different blood groups but their result are conflicting and don't have a consistent result.

To the best of my knowledge and inquiry, this study has no published data from Africa, including Ethiopia. This highlights the need for study in Ethiopia and across Africa. The findings of this study will be valuable information for administrators, policy makers, perioperative care providers (especially anesthetists), and can serve as a baseline for other research projects.

CHAPTER TWO

2.1 Literature Review

Yiri D., Haixia S., Jianshe Y. et al. conducted a prospective observational study in China (2014) with a total of 72 participants from patients scheduled for surgeries such as tonsillectomy, cholecystectomy, and spinal operations. Each blood group (A, B, AB, O) contained 18 participants. The study compared the anesthetic effects of propofol among patients with different ABO blood groups by measuring mean arterial pressure (MAP), heart rate (HR), and bispectral index (BIS) at four different times during propofol infusion under general anesthesia (when the concentration of propofol was 1 mcg/mL (T1), 2 mcg/mL (T2), 3 mcg/mL (T3), and 4 mcg/mL (T4)). The study found a significant difference in MAP, HR, and BIS between the groups. At every time point, the patients in the B group had the highest MAP and HR ($p < 0.05$ for both). Patients in the A blood group showed the highest BIS values at T3 and T4 ($p < 0.05$) [53].

A five year retrospective cohort study in Denmark on association between the ABO blood types and post-operative pain done by Mia B.L, Sten R, and parisa G between January 2012 and august 2017 on a total of 66 patients (18-64 age) with different blood groups (blood group A= 34.85%, B= 9.09%, O= 56.06%, AB= 0%) who had an anterior cruciate ligament (ACL) reconstruction found that no significant difference between a certain blood type and post- operative pain measured by the amount of post-operative analgesics consumed ($p=0.517$) [54].

According to the randomized open experimental pilot study (2017) conducted in Denmark by Amallie H.S, Anne J, Amalie R and Parisa G et al. with a total of 37 healthy volunteers within the age range of 22-25, distributed in the four blood type groups (A= 10, B= 10, AB= 7, O= 10) showed that participants with blood type B scored the highest pressure pain threshold (lowest mechanical pain sensitivity) at the examined craniofacial facial muscles with two rounds of pressure pain threshold assessments measured by a hand held algometer separated by a cold pressor test and participants with blood type AB tended to score the lowest pressure pain threshold and exhibited the strongest conditioned pain ($p < 0.05$). cold pressor test was conducted by immersion of participants non-dominant hand into iced water of 1-4 degree Celsius for 2

minute and no significant difference was found between different blood types measured by VAS score ($p=0.56$) [55].

A prospective cohort study in turkey (2020) done by Mehmet K and Gökçe G et al. in total of 200 patients who were divide into 4 groups according to A, B, AB, O blood groups, each group consisting of 50 patients who undergo saphenous vein ablaton using N-Butyl Cyanoacrylate for primary venous insufficiency found that B and AB blood groups were significantly higher in VAS scores and days of analgesic need after procedure than in the A and O blood groups ($p < 0.001$) [52].

Tanvi A, Deepak R, and Amit D et al. (2021) conducted correlational study in India; a total of 160 healthy male and female volunteers (blood group A=33, blood group B=68, blood group AB=18, blood group O=33), within the age range of 18-25 enrolled in this study which have one experimental session in which two rounds of pressure pain thresholds over the core muscles (i.e. rectus abdominis) done separated by a cold presser test and the result showed that pain tolerance had significant difference and association among different blood groups and blood group O had the least mechanical sensitivity as it had the highest pain tolerance [56].

In a retrospective cohort study (2021) carried out in Thailand, Nimmaanrat S and his colleague et al. found that the following variables were predictive of postoperative opioid consumption in the first 24 hours following cesarean section: operation time, opioid consumption in the PACU, maximum VNRS within the first 24 hours, and consumption of both paracetamol and ibuprofen. The study involved a total of 1530 pregnant women who underwent a cesarean section under spinal anesthesia, with blood group distribution of type O (40.6%), type A (23.4%), type B (28%), and type AB (8%). In the first 24 hours following a cesarean section, there was no link between the ABO blood type and the need for opioids postoperatively ($p=0.683$) [57].

A prospective cohort research involving 3316 patients who underwent various anesthetic procedures and got immediate postoperative care in the PACU was carried out in Thailand (2022) by Nimmaanrat S. and his colleague et al. Female sex, body mass index, preoperative gabapentin use, preoperative anxiety score, anesthetic techniques, type of operation, amount of

intraoperative opiates consumed, intraoperative use of paracetamol, parecoxib, and ondansetron, length of anesthesia and surgery, amount of blood loss, pain upon arrival in the PACU, and use of paracetamol and parecoxib in the PACU were found to be factors influencing the amount of opioid consumption in the PACU. ABO blood type did not linked with early postoperative opioid use ($p=0.252$) [58].

A prospective cohort study in china (2022) conducted by Longyuan S and Jianwen W et al. in total of 124 pediatrics surgical patients, aged 3-7 years, who undergo elective adenotonsillectomy (blood type A= 33, type B= 30, type O= 35, type AB= 26). The initial CHEOPS assessment revealed a considerably higher pain score for patients from AB and B than those in A and O groups and higher consumption of rescue fentanyl during PACU stay ($P<0.01$) [21].

2.2. Conceptual framework

The creation of this conceptual framework involved consulting numerous literatures about the Association between ABO blood group and post-operative pain in order to identify relationships between variables. It represents a collection of interconnected concepts that represent an image of the relationship between postoperative pain and the factors influencing postoperative pain.

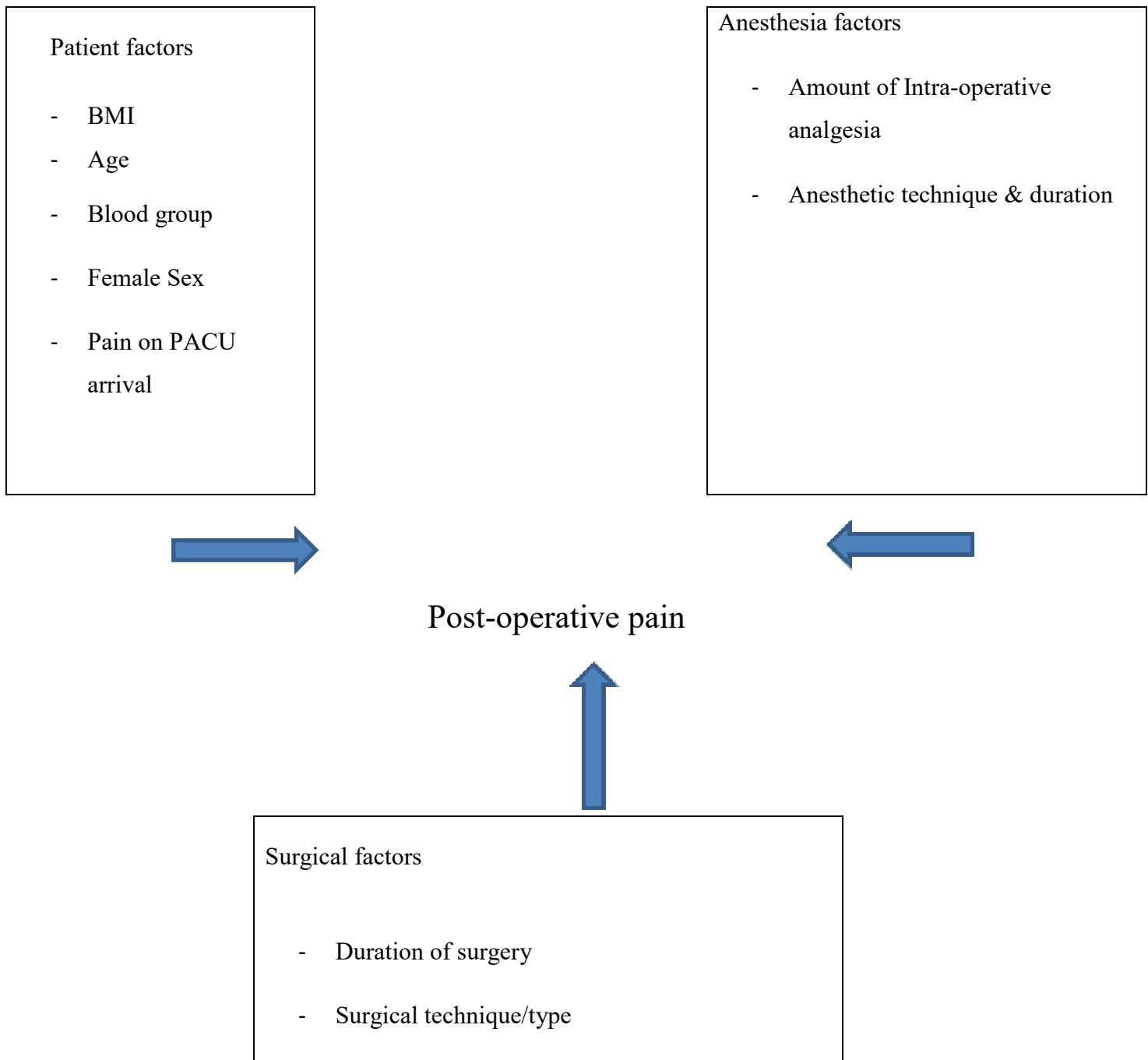


Figure 1 conceptual frame work

CHAPTER THREE

OBJECTIVES

3.1 General Objective

To investigate the association between ABO blood group and post-operative pain in children after adenotonsillectomy in public hospitals of Addis Ababa, Ethiopia from December 2023 to march 2024.

3.2 Specific Objective

- ✓ To compare FLACC pain score between ABO blood types among pediatrics adenotonsillectomy patients
- ✓ To compare post-operative analgesic consumption between ABO blood types among pediatrics adenotonsillectomy patients

CHAPTER FOUR

METHODS AND MATERIALS

4.1 Study Area

This study was carried out in hospitals located in Addis Ababa, the capital city of Ethiopia.. In this capital, there are 13 public hospitals, 40 private hospitals, 98 health centers. From these, three of them were selected purposefully considering their patient load and their level (some of them predominantly referral center for ENT). So, this study was conducted at Yekatit 12 medical college hospital, Menilik II compressive specialized hospital and Tikur Anbessa specialized hospital in Addis Ababa, Ethiopia.

At present, Yekatit 12 medical college hospital gives healthcare services such as dialysis, nerve related and above neck treatments and other surgeries are being provided. ENT care and surgery is one of the services being provided with 700-800 admission per year which the majority is adenotonsillectomy. Currently, the ENT ward has 12 beds from the total beds of the hospital.

Menilik II compressive specialized hospital is a public health care hospital in Addis Ababa, and is one of the oldest hospitals in Ethiopia. The hospital is administered by Addis Ababa City Administration and hosts 15,000 patients each day with over 2,300 staffs. The ENT ward has 10 beds out of 800 with 4-6 adenotonsillectomy admission per week.

Tikur Anbesa Specialized Tertiary Hospital is found in Addis Ababa, Ethiopia. The hospital has 800 beds, with more than 130 specialists and 50 nonteaching doctors. It offers diagnostic testing and treatment for approximately 370,000–400,000 patients per year. The ENT ward has 20 beds out of 800 with 3-5 adenotonsillectomy admission per week.

4.2 Study Design and Period

A multi-center prospective cohort study was conducted in public hospitals of Addis Ababa, Ethiopia, from February 2024 to April 2024.

4.3 Population

4.3.1 Source Population

All pediatrics patients who underwent adenotonsillectomy procedures under general anesthesia at selected public hospitals of Addis Ababa.

4.3.2 Study Population

All pediatrics patients who underwent adenotonsillectomy procedures under general anesthesia, those who fulfill inclusion criteria during the data collection period.

4.4 Eligibility Criteria

4.4.1 Inclusion Criteria

All patients age between 3-10 years, both sex and those belongs to ASA class I or II scheduled for elective adenotonsillectomy

4.4.2 Exclusion Criteria

- ✓ History of previous surgery
- ✓ Craniofacial deformities
- ✓ Mental retardation
- ✓ BMI of > 22kg/m²
- ✓ History of bronchial asthma
- ✓ Recent opioid use
- ✓ Peri-operative ketamine use

4.5 Study Variable

4.5.1 dependent Variables

- ✓ Postoperative pain measured by FLACC pain score and analgesia consumption

4.5.2 Independent Variables

- ✓ ABO Blood group
- ✓ Age
- ✓ Sex
- ✓ Weight
- ✓ Height
- ✓ BMI
- ✓ Surgery duration
- ✓ Anesthesia duration
- ✓ type of current surgical technique
- ✓ Intra-operative analgesia dosage
- ✓ Time to rescue analgesia

4.6 Sampling Technique and Sample Size Determination

4.6.1. Sample Size Determination

Since there is no previous study done (as far as my search and knowledge is concerned) in the study area in Ethiopia and Africa, result adopted from literature was used to calculate sample size based on the primary outcome variable. After a review of study, one previously done study (china, 2022) was taken as its primary outcome is comparing association between ABO blood group and post-operative in children by comparing mean Total PACU Analgesic (fentanyl) requirement, the mean and a standard deviations were $(0.56 \pm 0.62 \text{ mcg/person})$, (1.12 ± 0.59) , (1.07 ± 0.65) , (0.54 ± 0.55) for blood group A, AB, B, O respectively.

Then by using comparison of mean, sample size is calculated for A and AB then for B and O blood groups

$$n_1 = \frac{(\sigma_1^2 + \sigma_2^2)(Z_{\alpha/2} + Z_{\beta})^2}{(\mu_1 - \mu_2)^2}$$

Where

n_1 = sample for patients with A and AB blood group.

n_2 = sample for patients with B and O blood group.

μ_1 = sample mean in patients with blood group A.

μ_2 = sample mean in patients with blood group AB.

$\mu_1 - \mu_2$ = the difference the investigator wishes to detect.

$(\sigma_1)^2$ = sample variance in patients with blood group A.

$(\sigma_2)^2$ = sample variance in patients with blood group AB.

A conventional multiplier for alpha = 0.05, which is 1.96.

Conventional multiplier for power = 0.80 which is 0.84.

Substituting for these variables yields:

$$N_1 = \frac{(0.62)^2 + (0.59)^2 \times (1.96 + 0.84)^2}{(1.12 - 0.56)^2} \dots\dots\dots N = 18.31 \sim 19 \text{ for each group (A\&AB)}$$

The same procedure was carried out to get the sample size of N_2 (sample for patients with B and O blood group) by using comparison of mean from the previous study and $N_2 = 20.23 \sim 21$ for each group (B&O).

The total sample size became 80 when adding a sample size for each blood group. When 10% additional sample is included by assuming loss to follow the final total sample size became 88. Using 1:1 ratio between groups 22 patients per group was taken.

4.6.2. Sampling technique

The sample was selected by using systematic random sampling. First, the population of size N (180) is obtained from non-overlapping sub-population of Yekatit 12 hospital ($N_y= 96$), Minillik Hospital ($N_m= 48$) and TASH Hospital ($N_t= 36$) after institutional analysis was done on elective adenotonsillectomy cases done in 3 months in each hospital and a random sample of size n is drawn from each Hospital. The sample size in each hospital was established proportionately to the hospital's size (i.e., the total number of patients there); this was known as the proportional allocation provided by the formula, $n_i = \frac{n}{N} * N_i$ shown in figure 1.

Where

n_i = proportional allocation

n= total sample size (88)

N= total number of cases found by institutional analysis in 3 hospitals (180)

N_i = total number of cases found by institutional analysis in single hospital ($N_y= 96$, $N_m= 48$, $N_t= 36$)

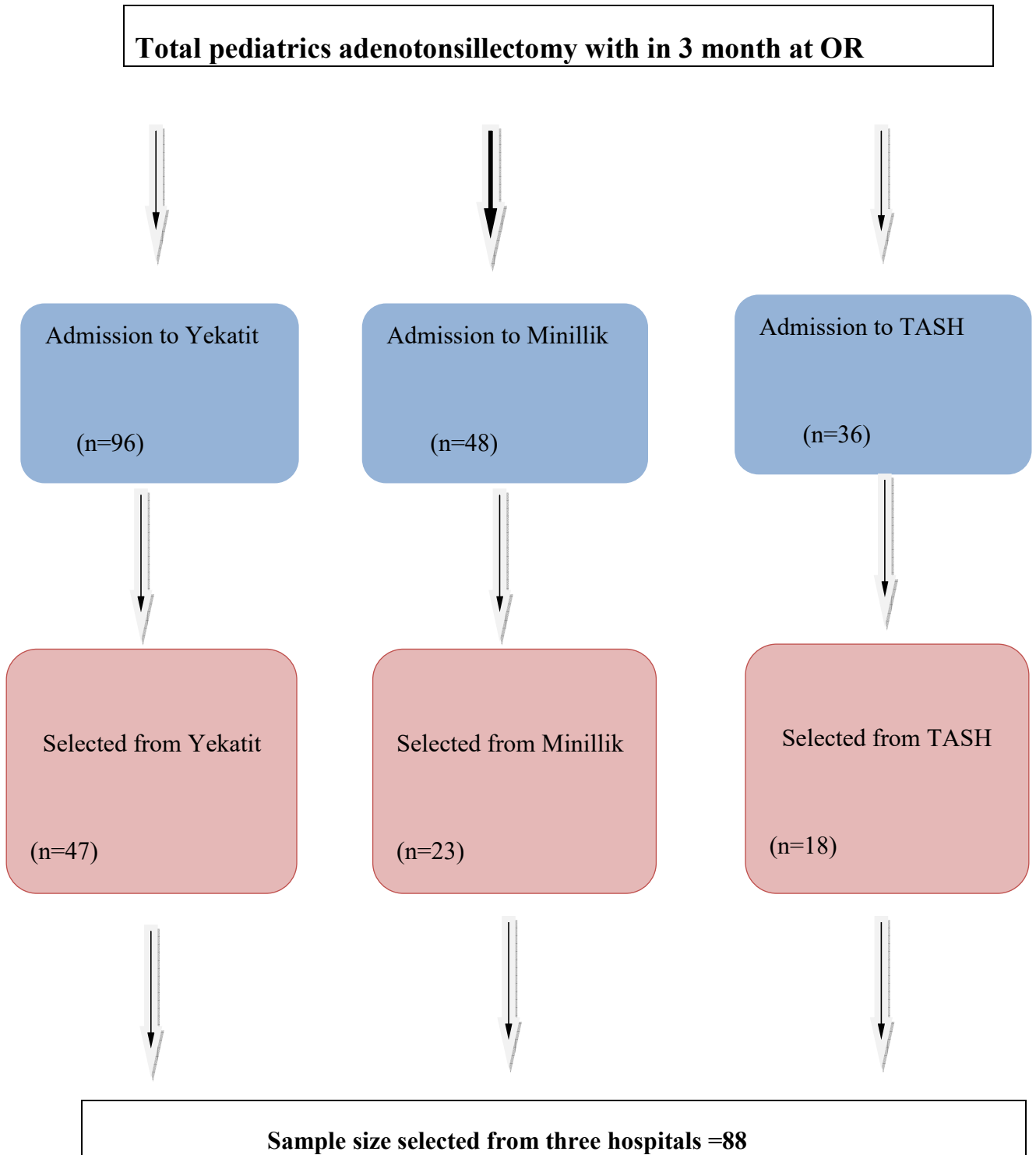


Figure 2: Proportional allocation for sample size

Second, the sampling process was designed to ensure equal representation across the four blood types, despite their varying prevalence in the population. Research indicates that blood type O is

the most abundant, followed by A, B, and AB, in descending order [59-62]. To address this, we employed a stratification on random samples drawn from each hospital and stratified them by blood type.

At Yekatit 12 hospital, 48 samples were drawn, with 12 individuals selected from each blood group. Similarly, at Minilik II hospital, 24 samples were drawn, with 6 individuals selected from each blood group. At Tikur Anbesa hospital, 16 samples were drawn, with 4 individuals selected from each blood group. Finally, Systematic random sampling techniques were applied within each group to select study participants from these hospitals.

The first case from each group was selected using a lottery method from the daily operating room schedule list of Otorhinolaryngology in the respective hospitals. The value of K, representing the sampling interval, was determined using the formula: $K=N/n$, where n is the total sample size and N is the population per three months. With a total sample size of 88 and a population of 180 over three months, K was calculated to be 2. Therefore, sampling intervals were set at two.

We included every second pediatrics adenotonsillar hypertrophy patient who underwent elective adenotonsillectomy in each of the four specific groups during the study period. We thoroughly explained the aim and benefits of the study, as well as the data collection procedures, to the parents of the study subjects.

A preliminary assessment was conducted to ensure that each patient met the inclusion criteria. This process was repeated daily during the data collection period until the required sample size was attained.

4.7. Data Collection Tool and Procedure

Structured checklists and questionnaires in English are derived from earlier research in the same field and comprise ABO blood type, perioperative data, pain severity scale, initial analgesic request time, analgesic usage, and demographic information.

An intravenous (IV) access was set up and blood was collected for blood typing in the surgical ward the day before surgery. On the day of the procedure, the patients were moved to the surgical waiting area. Following a brief description of the study by the data collector, parents

gave their written informed consent, and only those who gave their assent were included in the study.

In the operation room, ASA standard monitoring's was applied (pulse oximetry, ECG, NIBP) and induction of anesthesia was proceeded. After induction of anesthesia endotracheal intubation was performed with endotracheal tube that is appropriate to the patient. Base line vital signs and induction analgesia dosage along with demographic data was collected by trained anesthetist pre and intraoperatively for each study groups (ABO blood type).

At the end of surgery, the tracheal tube was removed and patients were transferred to the PACU unit. In the PACU total analgesic consumption of patients during stay and the Face, Legs, Activity, Cry and Consolability (*FLACC*) scale was evaluated upon arrival to PACU and then every 20 minutes to assess post-operative pain till the patient discharge to the ward by designated PACU nurse for each study group. Once the patients are discharged to the ward their pain levels was recorded at the 6th, 12th and 24th post-operative hours using the FLACC pain scale and analgesia used by professional nurse for each study group. One of the most often used scales nowadays is the Face, Legs, Activity, Cry and Consolability (FLACC) scale, which was first published in 1997 to evaluate postoperative pain in children. The five behaviors on the FLACC scale are face, legs, activity, consolability, and cry. Each behavior is given a value between 0 and 2, adding up to a final score between 0 and 10. A total score of 1-3 will indicate mild discomfort, 4-6 will indicate moderate pain, and 7-10 will indicate severe discomfort or agony[63]. In this research it was used as a continuous scale to evaluate the pain among the four blood types.

Compared with other scales assessing pain in infants and children, the FLACC scale is more convenient and practical in identifying and recording pain [64-66]. Post-operative analgesic administration was used at the anesthetist or PACU/ward nurse discretion as rescue analgesia and the type of analgesia, time at administration, dose was recorded. Pre and intraoperative information was gathered by trained anesthetists, whereas postoperative data was gathered by trained nurses.

The measured outcome was postoperative pain indicated by the pain score and the total analgesic consumption among the four major ABO blood groups in the PACU and ward.

4.8 Data Control Issue

The study's goals and applicability were covered in training, and data collectors received brief orientations on the assessment instruments to ensure the quality of the data. On 5% of the patients who were not included in the primary study at the time of data collection, a pre-test of the questioner, the instrument used to collect data, was conducted outside the designated region. Every inquiry was reviewed by the researcher to ensure it was relevant and comprehensive during the data gathering process. Data cleansing and cross-checking were done before to SPSS analysis, and incomplete data were not entered.

4.9 Data Analysis and Interpretation

Data analysis was conducted using SPSS software version 26. Descriptive analysis was performed to identify the number and percentage of demographic characteristics. Data were tested for normal distribution using the Shapiro wilk test. Variance analysis was used to analyze the normally distributed data, which were expressed using the mean \pm standard deviation. Tukey HSD test were used for Post Hoc tests. Conversely, non-normally distributed data were subjected to Kruskal–Wallis testing and shown as median with interquartile range (IQR). A series of Mann-whitney test with Bonferroni adjustment were used to identify group differences. To compare categorical variables between groups, the chi-square test was employed. Statistical significance were set at $P < 0.05$.

4.10 Ethical Consideration

Before the study began, ethical approval was received from the university's ethical clearance committee as well as the department of anesthesia. The data collector received written informed consent from each participant's parents after explaining the significance of the study. By using codes rather than identities to identify patients, confidentiality was maintained throughout the trial. The study participants gave their consent to participate voluntarily.

4.11 Result Dissemination Plan

The results of the study will be sent to journals for publication and presented to the department of anesthesia at the College of Health Science at Addis Ababa University as part of the M.Sc. program in advanced clinical anesthesia. They will also be shared through the annual Ethiopian Anesthetists Association (EAA) National Conference and the annual Students and Staff Research Conference.

4.12. Operational Definition

Face, Legs, Activity, Cry and Consolability (FLACC) scale – is One of the most often used scales to evaluate postoperative pain in children. The five behaviors on the FLACC scale are face, legs, activity, consolability, and cry. Each behavior is given a value between 0 and 2, adding up to a final score between 0 and 10. A total score of 1-3 will indicate mild discomfort, 4-6 will indicate moderate pain, and 7–10 will indicate severe discomfort or agony[63]. In this research it was used as a continuous scale to evaluate the pain among the four blood types.

Pediatrics age group - is age group between 3-10 years of age

ABO blood group system - The presence or lack of the antigens A and B, which are carried on the surface of red blood cells, determines the ABO blood group system, which classifies human blood according to the inherited characteristics of erythrocytes. Thus, blood types A, B, O, and AB can be present in an individual

Post-operative pain - is an acute pain type brought on by surgical trauma that triggers an inflammatory response and the start of an afferent neuronal barrage[67].

CHAPTER FIVE

5.1 RESULT

A total of 88 study patients from either sex ranging in age from 3-10 years old diagnosed with adenotonsillitis and underwent adenotonsillectomy under General Anesthesia with endotracheal tube at selected governmental hospitals were divided into 4 groups according to A, AB, B, and O blood group, each consisting of 22 patients enrolled in the study and complete data collected during the study period with 100% response rate.

5.1.1 Demographic characteristic of patients

The average age of Total participants (N=88) was 6.36 (SD=2.26) and the average BMI of total participants was 19.85 (SD=1.22). Table 1 shows other demographic characteristics of participants

Demographic characteristics of children with various blood groups who underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2023 to April 2024

	Patients characteristics	Frequency	Percentage
Blood group	A	22	25%
	AB	22	25%
	B	22	25%
	O	22	25%
	Total	88	100%
ASA	ASA 1	54	61.4%
	ASA 2	34	38.6%
	Total	88	100%
Gender	Female	46	52.3%
	Male	42	47.7%
	Total	88	100%

5.1.2 Perioperative characteristics of patients

No significant difference were observed among groups regarding the Age, sex ratio (see Table 2), BMI, Surgery & Anesthesia duration, Intraoperative analgesia consumption and time for the first rescue analgesia administration in PACU (see table 3).

Table 1: gender characteristics of children with various blood groups who underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2024 to April 2024

Blood group	A	AB	B	O	Total	χ^2	P	
Gender	Female	9(10.2%)	12(13.3%)	11(12.5%)	14(15.9%)	46(52.3%)	2.37	0.5
	Male	13(14.8%)	10(11.4%)	11(12.5%)	8(9.1%)	42(47.7%)		

Chi-Square test; a: 0.05, χ^2 : Pearson chi-square statistics

Table 2: Perioperative characteristics of children with various blood groups that underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2024 to April 2024

Blood group	A	AB	B	O	F	P
Age	6.27±2.29	6.23 ±2.24	6.68±2.23	6.27±2.39	0.190	0.903
BMI	19.86±1.16	19.86±1.32	19.91±1.3	19.77±1.15	0.047	0.986
Surgery duration (min)	51.82±11.60	55.91±13.50	57.05±12.97	53.18±11.07	0.839	0.476
Intra-operative analgesia (fentanyl in mcg)	48±7	49.32±7.12	50.18±6.1	50.68±5.58	0.717	0.544
Anesthesia duration (min)	72.73±14.93	74.77±15.31	69.77±17.69	66.14±15.65	1.2	0.307
Time for first rescue analgesia in PACU (min)	20.23±8.23	20±6.17	20.23±8	20±7.71	0.007	0.999

One-way ANOVA; a: 0.05 F: F-statistics (measure of the ratio of the variance between groups to the variance within groups)

5.1.2 Intraoperative Vital Signs

No significant difference was observed regarding Intra-operative HR and MAP among groups at each time point ($p>0.05$) (see Table 4). Data of Intra-operative vital signs were collected at Base line (T1) and at the end of surgery before extubation (T2).

Table 3: Intraoperative vital signs of children with various blood groups that underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2024 to April 2024

Blood group	A	AB	B	O	F	P
HR Baseline	101.7±11.95	102.36±10.78	98.86±12.56	100.95±10.47	0.391	0.76
	103.68±9.67	106.86±9.36	103.55±10.25	107.32±6.86	1.0	0.365
MAP Baseline	78.77±4.76	79±4.3	79.05±3.78	77.32±3.62	0.902	0.44
	80.41±5.06	81.36±4.33	80.68±6.79	79.32±4.25	0.586	0.626

One-way ANOVA; a: 0.05, F: F-statistics (measure of the ratio of the variance between groups to the variance within groups), HR=Heart rate, MAP= Mean arterial pressure

5.1.4 Postoperative pain assessment

When FLACC pain scores of the groups were examined, the scores were significantly different among the four blood groups at each time point ($P < 0.05$) during Kruskal Wallis H test. (See table 5).

FLACC scores of AB blood group was the highest from other blood groups followed by scores of blood group B at each time point ($P < 0.01$) during a series of mann-whitney test with Bonferroni adjustment between the groups and FLACC scores were not significantly different between A and O blood groups but were significantly lower than those in AB and B blood groups at each time point ($P < 0.01$) see figure 4-7. The order of FLACC scores was AB greater than B, which was greater than A and O ($AB > B > A = O$).

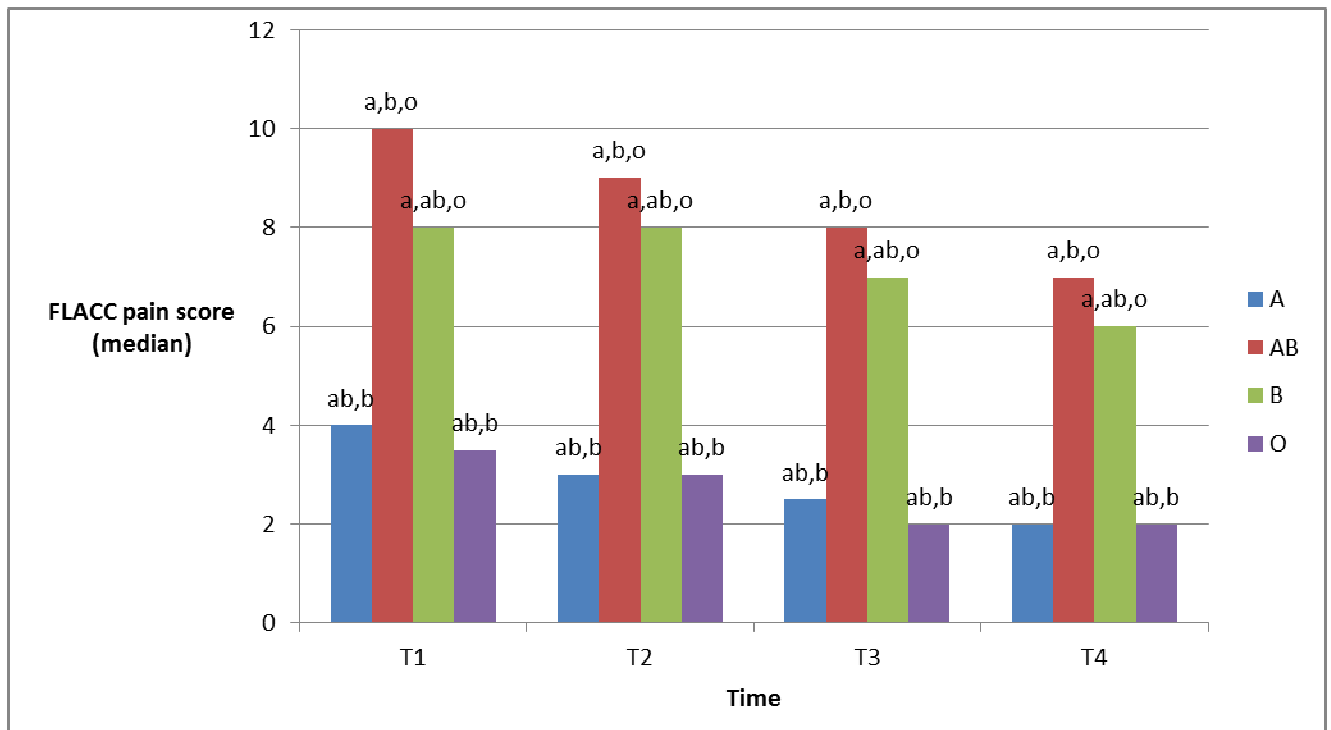
Data of post-operative FLACC pain assessment were collected at following time points: on PACU arrival (T1), 20 minute after PACU arrival (T2), 40 minute after PACU arrival (T3), 60 minute after PACU arrival (T4), 6 hour after the surgery (T5), 12 hour after the surgery (T6) and 24 hour after the surgery (T7).

Table 5: FLACC pain scores at different time points in children with various blood groups that underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2024 to April 2024

FLACC score	A M(Q1-Q3)	AB M(Q1-Q3)	B M(Q1-Q3)	O M(Q1-Q3)	H	P
PACU arrival	4(4-5)	10(9-10)	8(8-9)	3.5(3-5)	71.81	<0.001
20 minute	3(3-4)	9(9-10)	8(8-9)	3(2.75-4)	68.96	<0.001
40 minute	2.5(2-3)	8(8-9)	7(6.75-8)	2(2-3)	71.53	<0.001
60 minute	2(2-3)	7(7-8)	6(6-7)	2(1-2.25)	70.30	<0.001
6 hour	2(1.75-3)	6(6-7)	5.5(5-6)	2(1-2)	72.03	<0.001
12 hour	1(1-2)	6(5-6)	4.5(4-5)	1(1-2)	7253	<0.001
24 hour	1(1-2)	5(4-5)	4(3-4)	1(1-2)	70.52	<0.001

aKruskal Wallis H test;a:0.05, H: H statistics (rank difference between groups), M: median, Q: Interquartile range

Figure 4: FLACC scores at PACU (arrival, 20, 40 and 60 minute) in children with various blood groups that underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2024 to April 2024



a: significantly different from group A (P<0.01), ab: significantly different from group AB (P<0.01), b: significantly different from group B (P<0.01), o: significantly different from group O (P<0.01); T1: arrival, T2: 20 minute, T3: 40 minute, T4: 60 minute

Figure 5: FLACC score after 6 hour of surgery in children with various blood groups that underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2023 to April 2024

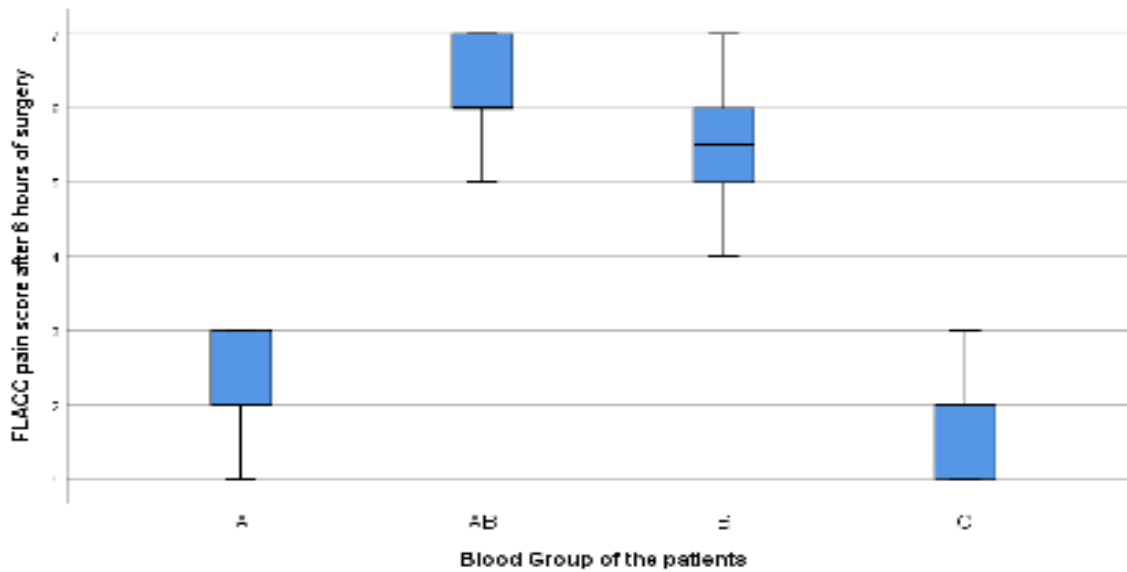


Figure 6: FLACC score after 12 hour of surgery in children with various blood groups that underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2024 to April 2024

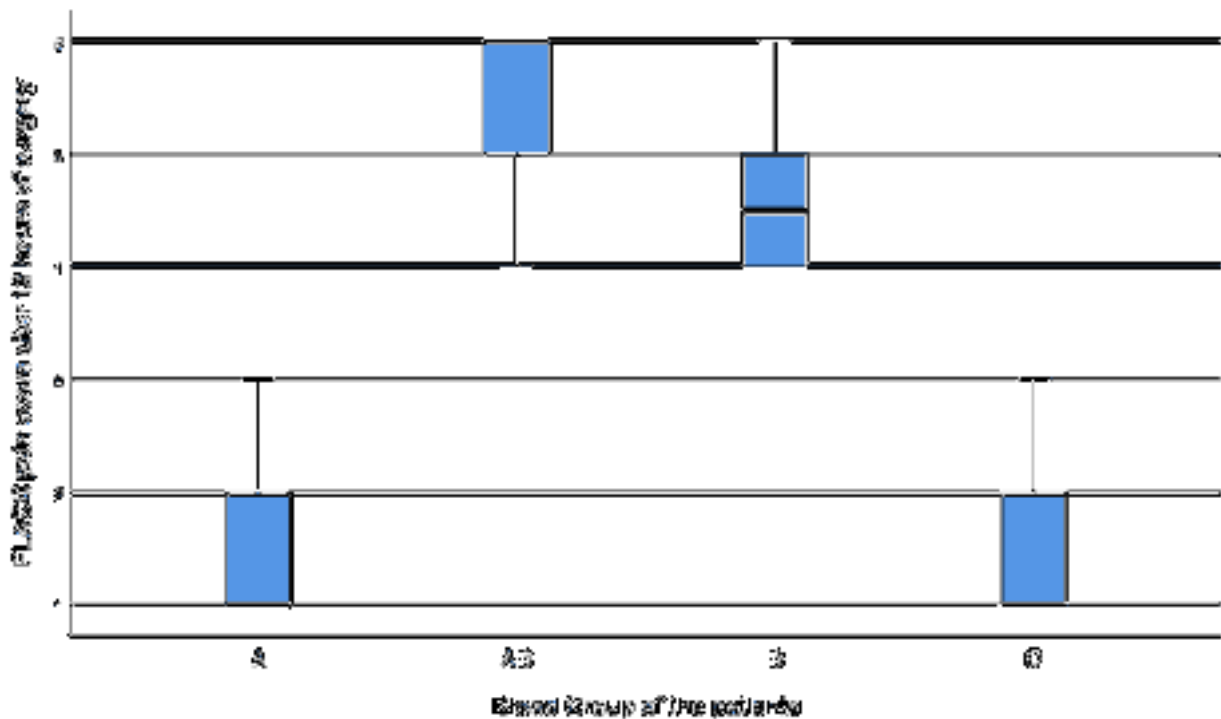
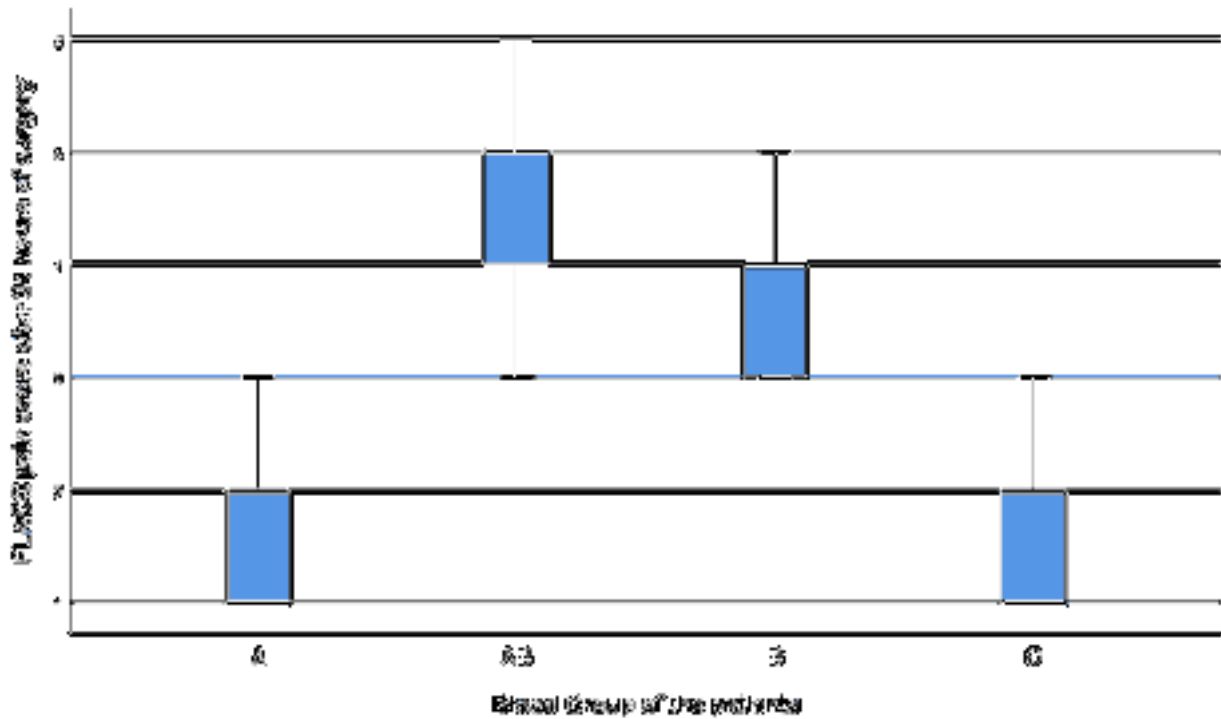


Figure 7: FLACC score after 24 hour of surgery in children with various blood groups that underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2024 to April 2024



5.1.5 Postoperative analgesia consumption

There was a significant difference regarding postoperative analgesic consumption on the first 24 hour among children with different blood groups ($P < 0.05$) (see table 6). children in the AB and B blood group received significantly higher total dose of analgesics over 24 hour than those in A and O blood groups ($P < 0.05$) but there were no significant difference in total analgesics consumption over 24 hour between AB and B blood groups and between A and O blood groups ($P > 0.05$) during Tukey HSD Post Hoc test (see table 7).

Table 6: Total analgesia consumption over 24 hour in milligram in children with various blood groups that underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2024 to April 2024

Blood group	A	AB	B	O	F	P
Analgesia consumption	360±75.35	737.5±83.86	727.95±94.7	319.64±56.54	183.0	<0.001

Oneway ANOVA; a: 0.05 F: F-statistics (measure of the ratio of the variance between groups to the variance within groups)

Table 7: Multi-group comparison of Total analgesia consumption over 24 hour in milligram in children with various blood groups that underwent adenotonsillectomy under General anesthesia at selected public hospitals of Addis Ababa from February 2024 to April 2024

Blood Group of the patients		Sig.
A	AB	<0.001
	B	<0.001
	O	0.203
AB	A	<0.001
	B	0.922
	O	<0.001
B	A	<0.001
	AB	0.922
	O	<0.001
O	A	0.203
	AB	<0.001
	B	<0.001

Post Hoc; Tukey HSD test a: 0.05

CHAPTER SIX

6.1 discussion

The present study aimed to investigate the association between ABO blood group and post-operative pain in children after adenotonsillectomy in public hospitals of Addis Ababa, Ethiopia. Findings indicate that there was no statistically significant difference between the four blood groups (A, AB, B, and O) in terms of age, sex ratio, BMI, length of surgery, use of intraoperative analgesia, and timing of first rescue analgesia in the post-anesthesia care unit (PACU).

During the Post-operative pain assessment significant difference between groups were noted, FLACC scores of AB blood group was the highest from other blood groups followed by scores of blood group B in turn which was significantly higher than blood group A and O at each time point. There was no significant difference in FLACC score between A and O at each time point.

Additionally, the study discovered that children in the blood groups A and O received much lower total dosages of analgesics during a 24-hour period than did children in the AB and B blood groups.

There was no significant difference in total analgesics consumption between the AB and B blood groups and between the A and O blood groups. The main analgesics used post operatively at selected hospitals was Paracetamol and Tramadol.

According our study's findings, children having adenotonsillectomy experienced post-operative pain differently according on their blood type. In particular, compared to individuals with A and O blood groups, those with AB and B blood groups have more intense pain and need larger dosages of analgesics.

These results are in line with other research that found links between blood type and pain experienced after surgery.

In the prospective cohort study conducted by Longyuanshen, Jianwen, et al. in 2022, the researchers aimed to explore the association between ABO blood type and postoperative pain following elective adenotonsillectomy. Their study involved a total of 124 pediatric surgical patients, aged 3-7 years, with ASA statuses of 1 and 2. The patient distribution by blood type was as follows: A (33), B (30), O (35), and AB (26).

Throughout the intraoperative phase, vital signs were diligently recorded, and perioperative patient characteristics were documented, revealing no significant differences in intraoperative vital signs among the groups. However, postoperatively, pain levels were assessed using the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) at regular intervals, starting from post-anesthesia care unit (PACU) arrival until PACU discharge, with assessments conducted every 5 minutes. Additionally, the need for rescue analgesia (fentanyl) to alleviate pain was noted.

Upon analysis of the follow-up results based on ABO blood type, it was observed that patients with blood types AB and B experienced significantly higher levels of pain and required more analgesic intervention compared to patients with blood types A and O [21]. This is consistent with our finding.

In line with our study, the method they used was prospective cohort in a roughly similar population. In contrast to our study, which found significant difference in post-operative pain score between blood group AB and B, Longyuanshen, Jianwen, et al found no significant difference in pain score between AB and B. this partial difference might be explained by the time of follow up. Patients were followed up for pain and analgesic consumption for up to 24 hours in our study. Longyuanshen, Jianwen, et al.'s study had a shorter follow-up period. Specifically, in their study, patients were monitored only during their time in the post-anesthesia care unit (PACU), with pain reassessments conducted every 5 minutes until discharge from the PACU. Pain assessment tool used in Longyuanshen, Jianwen, et al study was CHEOPS which is different from pain assessment tool used in our study. This could also have an impact on the difference found between our findings and Longyuanshen, Jianwen, et al, in which CHEOPS assessment tool have a score which makes a requirement to administer an analgesic to the child.

Despite this difference, the findings of the study still yielded valuable insights into the association between ABO blood type and postoperative pain intensity, emphasizing the importance of considering blood type variability in pain management strategies following adenotonsillectomy in pediatric patients.

Likewise, another Prospective cohort study by Mehmet et al.'s (2020) aimed to investigate the relationship between ABO blood groups and pain levels during saphenous vein ablation using N-butyl cyanoacrylate (NBCA), in patients with venous insufficiency in a total of 200 patients (50 from each ABO blood group), aged between 21-70 years, undergoing vena block procedure and measuring Pain severity during the procedure using the Visual Analogue Scale (VAS) while NBCA injected into the saphenous vein for Vena block procedure under local anesthesia and following patients for up to 5 days to know how many days they needed pain medication discovered that patients with blood types B and AB experienced noticeably more pain during the procedure and days using analgesics following surgery than patients with blood types A and O (Analgesic use was highest in groups B and AB, lowest in group A). They also found that No significant difference between B and AB blood groups in terms of pain levels or analgesic requirement.[52].

Similar to our study the study by Mehmet et al.'s (prospective cohort study) provide evidence supporting the association between ABO blood group and post-procedural pain perception and analgesic requirements using different population and procedure, and underscore the importance of considering individual patient characteristics, including blood type, in pain management strategies to optimize patient comfort and outcomes for physicians.

Unlike to our study they found No significant difference between B and AB blood groups in terms of pain levels which is different to some extent with our study which found AB blood group having the highest pain level from the other groups followed by blood group B but both having significantly higher score than those group A and O with a rank of $AB > B > A = O$. This difference may be partially explained by the difference in pain follow up which is 24 hour in our research while only one time during Vena block procedure with NBCA injection in Mehmet et al.'s study.

They also found that Analgesic use was highest in groups B and AB and lowest in group A with a rank of $AB=B>O>A$ which is partially in consistent with our finding which shows that blood group AB and B having higher analgesic usage than group A and O with a rank of $AB=B>A=O$ (no difference between group A and O). This difference may be explained by the time for follow up which is 24 hour in our study and 5 days in Mehmet et al.'s study and also the method used to assess analgesia consumption which is total milligram of analgesia after the procedure in our study and days needed for analgesia after prescribing a 500 mg paracetamol four times a day for all patients in Mehmet et al.'s study..

On another study with a total of 37 healthy volunteers within the age range of 22-25, distributed in the four blood type groups (A= 10, B= 10, AB= 7, O= 10) Amalie's et al. used an experimental approach to look at the connection between ABO blood type and pain. Participants in this study were instructed to place their non-dominant hands in an ice bucket that was between 1-4 °C in temperature. After submerging their hands in ice water for two minutes, participants were asked to rate the intensity of their pain every ten seconds using the VAS. Furthermore, when pressure was applied to the masseter, temporalis, and deltoid muscles and pain was felt, the algometer probe was used to evaluate the intensity of the pain.

The analysis of the test results based on ABO blood types revealed that individuals with AB blood type had an increase in pain sensitivity from those who underwent a pressure test subsequent to a cold water test and blood type B showed the lowest pain sensitivity (highest pain threshold) [55].

According to our research, people with blood groups AB were more sensitive to pain than those with blood groups B, O and A. The results of our investigation supported the findings of Amalie's et al.'s study, which indicated that patients with blood type AB were the most pain-sensitive group. But in our research, we found that individuals belonging to the B blood type experienced more intense pain than those in the A and O blood groups, and that the degree of pain was ranked according to blood group, with $AB>B>A=O$.

The variations in study designs could be the cause of the partial disparity in outcomes between Amalie's and our investigation. In particular, we saw surgical stimulation of the pharyngeal plexus, maxillary, and glossopharyngeal nerve in children, whereas Amalie et al.'s study observed mechanical stimulation of the facial nerve in adults.

According to Tanvi et al.'s study from 2021, with a total of 160 healthy male and female volunteers (blood group A=33, blood group B=68, blood group AB=18, blood group O=33), within the age range of 18-25 patients found blood type O exhibited the highest pain tolerance and the lowest mechanical sensitivity across all blood types and blood type A having least pain tolerance during pressure pain threshold measurement on abdominal muscles after a cold pressor test [56]. Our study showed that blood group O and A has lower FLACC pain score during the study period which is partially consistent with the above study. The partial discrepancy of results between Tanvi's and our study may be attributed to the differences in study design. Specifically, Tanvi et al.'s observed mechanical stimulation of the abdominal nerves in adults, while our study reported surgical stimulation of the pharyngeal plexus, maxillary, and glossopharyngeal nerve in children.

On the other hand, patients with different blood types did not significantly differ in their post-operative pain assessments but it was shown that patients with O blood type were more likely to use analgesics, according to Mia et al.'s 2017 retrospective cohort study between January 2012 and August 2017 on a total of 66 patients (18-40 age) with different blood groups (blood group A= 34.85%, B= 9.09%, O= 56.06%, AB= 0%) who had an anterior cruciate ligament (ACL) reconstruction [54]. In contrast to the current study, Mia et al.'s study employed a single technique to measure pain (postoperative pain is indicated by the total consumption of postoperative analgesics only). They used a retrospective cohort design in a total of 66 adults underwent knee surgery. This may have lower sensitivity compared to prospective studies. In addition to that they didn't include blood group AB due to its low prevalence in their country and unequal number of patients in each blood type might have influenced the study.

The retrospective cohort study by Nimmaanrat et al. (2021) “Is ABO Blood Group a Predictive Factor for the Amount of Opioid Consumption in the First 24 Hours After Cesarean Section?” with a total of 1530 pregnant women who had a cesarean section under the same regimen of spinal anesthesia (2.2 mL of 0.5% hyperbaric bupivacaine and morphine 0.2 mg) with blood group distribution of blood group O (40.6%), A (23.4%), B (28%) and AB (8%) found no correlation between ABO blood group and opioid requirement postoperatively[57]. The difference between our result and Nimmaanrat et al might be explained by the anesthesia technique. The study by Nimmaanrat et al. was conducted on patients who underwent cesarean section under spinal anesthesia, which has longer duration of analgesia than general anesthesia. The study design is also retrospective cohort, which might be less sensitive than a prospective design.

Nimmaanrat et al.'s 2022 study, "ABO blood group is not a predictive factor for the amount of early opioid consumption in post-anesthesia care unit: a prospective cohort study," examined 3,316 adult ASA 1-3 patients following a variety of surgical procedures and came to the conclusion that ABO blood group is not associated with early postoperative opioid consumption in the PACU. Based on the analysis of the data, the recruited population was divided into three groups based on the amount of opioid requirement measured as morphine milligram equivalent (MME) in the PACU (G1: 0 mg, G2: up to 5 mg, and G3: > 5 mg).

A study by Nimmaanrat et al., in contrast to ours, employed the quantity of opioid required for patient classification and solely assessed whether ABO blood group affects the amount of early opioid consumption in PACU, which may be a brief period of time to follow pain.

Currently, there is no clear research evidence to explain what have exactly contributed to the higher postoperative pain score in AB and B blood group. Further studies are required to explore on this phenomenon of association between pain and ABO blood types.

6.2 Strength of the study

To reduce the possibility of influencing the outcomes, we selected only one type of surgery, limited the age range across groups, and excluded obese patients and it was a multicenter prospective design.

6.3 Limitation of the study

Participants were only children undergoing adenotonsillectomy which may requisite other study in different population and surgical procedure

CHAPTER SEVEN

7.1 Conclusion

In conclusion, the present study found that there is an association between blood group and post-operative pain scores and post-operative analgesia consumption in children undergoing adenotonsillectomy.

AB blood group FLACC pain scores were the highest among blood groups followed by blood group B.

Children in the blood groups A and O received much lower total dosages of analgesics during a 24-hour period than did children in the AB and B blood groups.

7.2 Recommendation

Based on our findings, we recommend clinicians might consider closer monitoring and considering blood type variability in pain management strategies following adenotonsillectomy in pediatric patients

We also recommend further researches to the better understanding of this association on different populations, larger sample sizes and other types of surgeries.

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Annex I: Study Subjects Consent Form

Addis Ababa University, College of Health Sciences Department of Anesthesia Prospective Cohort Study, On Association between ABO blood groups and postoperative pain in children after Adenotonsillectomy, From December 1, 2023 to march 30, 2024 G, C.

Hello! My name is _____ I am of the members of the research team and I am here to ask you some questions and to collect some important information. I am anesthesia provider. We are doing study on Association between ABO blood groups and postoperative pain in children after Adenotonsillectomy. You are kindly requested to your child to participate in this study. If you are willing for your child to participate in this research, I obtained the child name from the list of operation for surgery. Participation is voluntary. We strictly keep confidentiality. This observation will be for 24 hours. So we kindly request your child to participate in the observation? I understood about the objectives of the research and the roles I will have in the research. I have

A) Agree

B) Disagree

If agrees, the observation will be started

ANNEX II: PAIN ASSESSMENT TOOL

Face, Legs, Activity, Cry and Consolability (FLACC) scale

	0	1	2
Face	No particular expression or smile Occasional	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, 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	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort

ANNEX III: Questionnaire

PRE-OPERATIVE AND INTRA-OPERATIVE PARAMETERS

Instruction: For each question, please encircle the possible response/s/

Data code: _____

Section one: Sociodemographic character

1	Age	Years
2	Sex	A/ Male B/ Female
3	Blood group and RH	
4	Weight	Kg
5	Height	Cm
6	BMI	kg/m ²
7	ASA physical status	A/ I B/ II
8	History of previous surgery	A/ yes B/ no
9	History of Bronchial Asthma	A/ yes B/ no
10	Craniofacial deformities and mental retardation	A/ yes B/ no
11	History of recent opioid use	A/ yes B/ no

Section II: Data During Pre and Intraoperative Period

1	Diagnosis	
2	Procedure	
3	Baseline HR	
4	Baseline systolic BP	
5	Baseline diastolic BP	
6	Baseline MAP	
7	Baseline Saturation	
8	Is any premedication given?	A/ yes B/ no
9	If yes for question number 8 (No, go to 10)	Type/dose=
10	Induction drug	A/ Propofol B/ Ketamine

		C/ thiopental	D/ Etomidate
11	Maintenance was with	A/ Inhalational gas	B/ TIVA
12	If maintenance was with TIVA (If No go to Q 13)	A/ with propofol propofol and kitamine	B/ with
13	Does bolus ketamine given intra-operatively in any circumstances?	A/ yes	B/ no
14	Analgesia given at Induction	Type/Dose=	
15	Is any additional analgesia given intra-operatively?	A/ yes	B/ no
16	If yes for question 15 (if no go to Q 17)	Type/Dose=	
17	Surgical technique	A/ Electro cautery	B/ Cobalation
18	Duration of Surgery		
19	Duration of Anesthesia		
20	Vital signs at the end of surgery (before extubation)	HR= BP= SPO2=	MAP=

Section III Post-Operative Observation Vital sign and pain score at recovery room

Vital sign	Arrival time	At 20min	40min	60min
HR				
BP/MAP				
FLACC PAIN SCALE				
ANALGESIA GIVEN, DOSE, TIME				

Section IV Ward follow up for 24

	6th hour	12 th hour	24 th hour
FLACC PAIN SCALE			
ANALGESIA GIVEN, DOES, TIME			