ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE

DEPARTEMENT OF ANESTHESIA

THE EFFECT OF LATERAL VERSUS SITTING POSITION DURING SPINAL ANESTHESIA ON POST DURAL PUNCTURE HEADACHE AND HEMODYNAMIC STATUS AMONG ELECTIVE ORTHOPEDIC PATIENTS IN BLACK LION SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA, 2023/24.

A PROSPECTIVE COHORT STUDY

INVESTIGATOR: MULATU MILKIAS (BSc IN ANESTHESIA)

ADVISOR: GERESU GEBEYEHU (BSc, MSc IN ANESTHESIA)

ADUGNA KASSA (ASSISTANT PROFESSOR OF ANESTHESIA)

RESEARCH THESIS TO BE SUBMITTED TO ADDID ABABA UNIVERSITY DEPARTMENT OF ANESTHESIA AS A PARTIAL FULIFILLMENT OF REQUIREMENTS FOR THE MASTER OF SCIENCE IN ADVANCED CLINICAL ANESTHESIA.

June 2024

Addis Ababa, Ethiopia

RESEARCH PROJECT

Name of investigator	Mulatu Milkias Borana (BSc in Anesthesia)
Name of advisors	Geresu Gebeyehu (BSc, MSc Anesthetist and Lecturer) Adugna Kassa (Assistant Professor of Anesthesia)
The full title of the research project	The effect of lateral versus sitting position during spinal anesthesia on postdural puncture headache and hemodynamic status among orthopedic patients in Black lion specialized, Addis Ababa, Ethiopia, 2023/24. A prospective cohort study
Duration of project	January 1, 2024 –April 30, 2024G.C.
Study area	Black Lion Specialized Hospital, Addis Ababa, Ethiopia
Total cost of the project	27,895 E. B
Address of the investigator	Tel: 0945841148 email: mulatumilkias11@gmail.com

CERTIFICATION

This is to certify that the thesis prepared by Mulatu Milkias, entitled: The effect of lateral versus sitting position during spinal anesthesia on postdural puncture headache and hemodynamic status among orthopedic patients in Black lion specialized hospital and submitted in partial fulfillment of requirements for the degree of Degree of Masters of sciences in advanced clinical anesthesia complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Author

Name _____ Signature _____ Date _____

Approval of the board of examiners

1. Advisor

Name _____ Signature _____ Date _____

2. Internal Examiner

Name _____ Signature _____ Date _____

3. External Examiner

Name _____ Signature _____ Date _____

ABSTRACT

Background: Although spinal anesthesia is simple and creates a safe environment for surgeries below umbilicus, it has many associated side effects that affect the quality of health system on patients' satisfaction. A postdural puncture headache is a common complication of spinal anesthesia. Although orthopedic patients are among patients that take spinal anesthesia repeatedly, studies that explain the association of postdural puncture headache with position during administration of spinal anesthesia are limited.

Objectives: The objective of this study was to assess the effect of lateral vs. sitting position during administration of spinal anesthesia on postdural puncture headache and hemodynamic status among elective orthopedic patients.

Method: A prospective cohort study was conducted at Tikur Anbessa Specialized hospital, on department of orthopedics and traumatology from January 1 to April 30, 2024. A total of 84 patients aged 20 to 66 with ASA class of I and II were selected by systematic random sampling technique. The demographic data, intraoperative hemodynamics and other results were collected and described in tables and figures. An independent samples t-test was used to analyze hemodynamic status and a chi-square test was used to compare postdural puncture headache. A statistical significance was determined when p value <0.05.

Result: The result of this study shows that incidence of postdural puncture headache among elective orthopedic patients was 15.5% with 23% postdural puncture headache is from sitting position and 7.3% from lateral position which is statistically significant with p value of .035. Hypotension was significantly high in patients who have taken spinal anesthesia in lateral position.

Conclusion and Recommendation: Our study demonstrated that the incidence of PDPH is low when spinal anesthesia is administered in lateral position and also administration of spinal anesthesia in lateral position decreased MAP which was a statistically significant. We recommend anesthesia providers to make administering spinal anesthesia in lateral position to patients with stable baseline blood pressure, part of routine activity in order to decrease an incidence of a debilitating complication of SA called PDPH on this group of surgical patients.

Key words: Spinal anesthesia, postdural puncture headache, orthopedic patients, position

Acknowledgement:

I would like to extend my heartfelt gratitude to my advisors, Mr. Geresu Gebeyehu and Mr. Adugna Kassa, for their unwavering guidance and invaluable support throughout the entire research proposal writing process. I would also like to express my appreciation to the instructors in the anesthesia department who provided me with insightful comments and feedback during the proposal defense. Their expertise and encouragement have been instrumental in shaping this research proposal.

Contents

LIST OF TABLES

LIST OF FIGURES

LISTS OF ABBERVIATIONS

AAU- Addis Ababa University

ADP- Accidental dural puncture

ASA- American Society of Anesthesiologists

BMI: Body Mass Index

CN- Cranial Nerve

CSF: Cerebro-Spinal Fluid

DBP- Diastolic blood pressure

G- Guage

GA- General Anesthesia

LP- Lumbar Puncture

MAP- Mean arterial pressure

NA- Nuraxial Anesthesia

NRS- Numerical Rating Scale

OR- Operation room

PDPH- Postdural puncture headache

SA- Spinal Anesthesia

SAB- Subarachnoid Block

SBP- Systolic blood pressure

TASH- Tikur Anbessa Specialized Hospital

UDP- Unintentional Dural Puncture

CHAPTER 1: INTRODUCTION

1.1. Background information

Spinal anesthesia was the first regional anesthetic treatment used, and August Bier performed the first operation while under spinal anaesthetic in 1898 in Germany. Although he felt a severe headache after spinal anesthesia, he injected cocaine into his subarachnoid space, which resulted in a loss of sensation below the level of the injection. Prior to this, the only available local anesthetic methods were infiltration anesthesia and topical anaesthetic for the eyes[1].

In order to quickly and completely block spinal cord nerves during surgery, modest dosages of local anesthetic solutions are injected into the lumbar spine's subarachnoid space; this procedure is known as spinal anesthesia[2]. Although it is simple and creates a safe environment for surgeries below umbilicus, it has many associated side effects that affect the patients' satisfaction and quality of life. Intraopertive hypotension, bradycardia, nausea, vomiting, arrhythmia, cardiac arrest, spinal hematoma, neurological injury, transient neurological syndrome, arachinoiditis and Post dural puncture headache are the side effects of spinal anesthesia. Many of the for mentioned side effects can be avoided by taking a caution when preparing a patient for spinal and administering spinal anesthesia intraoperatively[3].

Over 22.3 million orthopedic surgery procedures were carried out globally in 2017[3]. The total number of Orthopedic Procedures performed in the US was 18,577,953 in 2022. The 2021 American Joint Replacement Registry(AJRR) annual report reported on 2,244,587 primary and revision hip and knee arthroplasties between 2012 and 2020[4].

A postdural puncture headache is a possible complication of a lumbar puncture, with symptoms brought on by traction on pain-sensitive regions from low cerebrospinal fluid pressure (intracranial hypotension) as a result of a cerebrospinal fluid leak at the puncture site accompanied by frontal or occipital headache that is exacerbated when standing up, nausea, neck discomfort, dizziness, visual alterations, tinnitus, hearing loss, or radicular symptoms in the arms[5]. In order to decrease this complication many measurements are taken like different positions during administration of SA, decreasing needle size, prophylactic intrathecal saline and others[6].

A prospective cohort study undertaken in Debre Tabor shown the incidence of PDPH among orthopedic patients were 20%[7]. In our set up the incidences of PDPH was 33% according to a research undertaken in 2016[8]. Among orthopedic patients, PDPH was 10% of the time [9]. In a recent study the prevalence of PDPH among orthopedic patients was 20% [7].The incidence of PDPH in patients that have taken SA in sitting position was 20% and 4% in the lateral group which was statistically significant[10].

The prevalence of PDPH varies greatly depending on both procedural (e.g., needle size and type, bevel orientation for cutting needles, position during SA, median versus paramedian approach, number of lumbar puncture (LP) attempts,) and patient risk factors (e.g., age, sex, pregnancy, prior history of PDPH, body mass index[11, 12].

Spinal anesthesia can be associated with a considerable risk of hypotension, which can result in serious consequences like cardiac arrest and stroke, despite its use in providing pain relief during surgical and obstetric procedures. A number of variables, such as the kind of anesthesia, the patient's features, and the technique employed, affect the frequency of hypotension after spinal anesthesia. Elder patients, patients with preexisting medical conditions, women patients and administration of higher dose of local anesthetics can be mentioned [13].

In 2021, a comparative cohort study undertaken in Turkey among orthopedic patients shown a significantly lower SBP, DBP and MAP in lateral position as compared to sitting position after SA administration[14].

A 2023 study conducted in Iran found that administering spinal anesthetic in sitting position as opposed to the lateral position resulted in a statistically significant difference in the vasovagal response [15].

While crystalloid preloading is not recommended, fluid preloading using colloids such hydroxyethyl starch substantially lowers the incidence and severity of arterial hypotension. As long as the rate of administration is sufficient, co-loading with crystalloid or colloid is just as efficient as preloading with hydroxyethyl starch (i.e., bolus over 5 to 10 minutes). Historically, ephedrine has been regarded as the preferred vasoconstrictor, particularly when used to treat

bradycardia-related hypotension brought on by spinal anesthesia. As an α1 adrenergic receptor agonist, phenylephrine is being utilized more and more to treat spinal anesthesia induced hypotension. It has been demonstrated that administering phenylephrine prophylactically that is, right after intrathecal injection of local anesthetics reduces the risk of arterial hypotension[16, 17].

1.2 Pathophysiology

The term "postdural puncture headache" is most frequently used to describe postural headaches t hat occur after procedures that compromise meningeal integrity[18].

The sterile cerebrospinal fluid (CSF), a transparent fluid that surrounds the brain and spinal cord, is kept in the subarachnoid space. The cerebrospinal fluid produced by the brain is about 500 mL per day and is produced at a rate of 20 mL per hour[19]. Because this transcellular fluid is continuously being reabsorbed, only 125–150 mL of it is present at any given time. This transcellular fluid produces normal lumbar opening pressures of 5–15 cm H2O in the horizontal position (40–50 cm H2O in the upright position) [19, 20].

Despite a great deal of research and observational data, the pathogenesis of post-stroke hemolysis remains unclear. It's generally agreed upon that a persistent meningeal leak is the cause of post-traumatic brain hemorrhage (PDPH). The actual mechanism by which CSF hypotension induces headache is currently thought to be a bimodal one that involves both cerebral vasodilation (mostly venous) and lack of intracranial support. It is believed that diminished buoyant support causes the brain to droop when it is upright, putting pressure and traction on the dura, cranial nerves, bridge veins, and venous sinuses, which are pain-sensitive structures in the cranium [5, 18, 21, 22].

PDPH symptoms are caused by multiple brain circuits. These include the cranial nerves IX and X in situations of occipital pain, the cervical nerves C1–C3 in cases of neck and shoulder pain, and the ophthalmic branch of the trigeminal nerve (CN (cranial nerve) V1) in cases of frontal head pain. There's evidence linking vagal stimulation (CN X) and nausea. The direct contact between the cochlear aqueduct and the perilymph results in an imbalance between the endolymph and perilymph and decreased perilymphatic pressures in the inner ear, which is the primary cause of the secondary symptoms of vestibular and auditory. The transient paralysis of

the CN III, IV, and VI nerves, which supply the extraocular muscles of the eye, is thought to be the source of significant visual impairments. Because of the CN VI of the abducens nerve[18].

The Pathophysiology of hypotension

1. Vasodilation and sympathetic blockage

Reduced peripheral resistance and blood pressure result from the quick blocking of sympathetic nerve fibers brought on by spinal anesthesia. The spinal cord's secretion of vasodilators like prostacyclin and nitric oxide is the cause of this. Reduced vasoconstrictor activity as a result of sympathetic nerve fiber blockage also contributes to vasodilation.

2. Venous pooling and decreased blood volume

Venous pooling, or the buildup of blood in the venous system, is another effect of blocking sympathetic nerve fibers. This may result in a drop in cardiac output and blood volume, which exacerbates hypotension.

3. Cardiac depression

Cardiac depression, a condition marked by a decrease in heart rate, stroke volume, and cardiac output, can also be brought on by spinal anesthesia. This results from the spinal cord releasing negative inotropic chemicals including bradykinin and adenosine.

4. A reduction in cardiac preload

The amount of blood returning to the heart, or cardiac preload, might also drop as a result of SA. Both blood pressure and cardiac output may drop as a result of this.

5. An uptick in parasympathetic function

Increased parasympathetic activity brought on by spinal anesthesia may also result in a drop in cardiac output and heart rate. This may exacerbate hypotension even further.

6. Vasoactive chemicals are released

Bradykinin and calcitonin gene-related peptide are two examples of vasoactive chemicals that can be released from the spinal cord during spinal anesthesia. These drugs have the potential to dilate blood vessels, which exacerbates hypotension[23, 24].

1.3. Problem statement

Spinal anesthesia is a common procedure in orthopedic surgery, but it can come with a painful complication: postdural puncture headache (PDPH). This headache can be severe and debilitating, affecting patients who undergo spinal anesthesia. Despite its widespread use, the risk of PDPH remains a concern in orthopedic patients.

The exact causes of PDPH are complex and varied, but several factors have been identified as potential risk factors, including the way patients are positioned during spinal anesthesia.

Some research has suggested that how patients are positioned during spinal anesthesia might contribute to the development of postdural puncture headache (PDPH). The sitting position has been linked to increased risk of PDPH due to the added pressure on the dura mater and the potential for cerebrospinal fluid (CSF) leakage. However, there isn't enough evidence to confirm this theory, and the best position for spinal anesthesia remains uncertain.

In orthopedic patients undergoing spinal anesthesia, the sitting position is commonly used to facilitate the administration of spinal anesthesia. However, this position has also been associated with an increased risk of PDPH, possibly due to the increased pressure on the epidural space and the potential for increased CSF leak. The lateral position is less commonly used in orthopedic surgery, but it may be a more optimal position for minimizing the risk of PDPH.

Different approaches were used to in the past to prevent this complication of SA. According to a 2022 meta-analysis, there was no evidence to support the efficacy of preventive neuraxial morphine against PDPH [25]. The superiority of SPG block over conservative treatment and lidocaine puff for short-term pain relief from PDPH was suggested by very low to middling quality evidence, according to a meta-analysis of RCT trans-nasal sphenopalatine ganglion block for PDPH management[26].

In orthopedic surgery, spinal anesthesia is given frequently to relieve pain and lower the possibility of problems. However, a patient's hemodynamic status during spinal anesthesia can be greatly impacted by how they are positioned, which can be extremely concerning for orthopedic patients who might have underlying cardiovascular issues. In particular, the lateral and sitting positions are frequently employed in orthopedic surgery, although little research has

been done on how they affect hemodynamic state. Additionally, it is unknown whether posture option is best for orthopedic patients to preserve hemodynamic stability during spinal anesthesia.

Therefore, this study aims to investigate the incidence of PDPH in orthopedic patients undergoing SA in lateral vs sitting positions. The primary objective is to compare the incidence of PDPH between patients who receive spinal anesthesia in the lateral versus sitting position. The secondary objective is to compare hemodynamic status among group.

1.3 Significance of the study

This study aims to investigate the incidence of PDPH in orthopedic patients undergoing SA in both lateral and sitting position. The primary objective is to compare the incidence of PDPH between patients who receive spinal anesthesia in the lateral versus sitting position. The secondary objectives are to compare hemodynamic status among groups and also compare severity of PDPH pain among two groups.

The significance of this study lies in its potential to provide insight into the optimal position for spinal anesthesia in orthopedic patients. By comparing the incidence of PDPH between patients who receive SA in the lateral vs sitting position, this study may help identify the most effective position for minimizing the risk of PDPH. This knowledge may be used to inform clinical practice and improve patient outcomes.

In orthopedic surgery, it is essential to comprehend how sitting versus lateral posture affects hemodynamic status during spinal anesthetic in order to maximize patient results. Patient results can be greatly impacted by the position used for administration of SA, especially in those with low baseline vital signs. In order to provide best practices in patient care, this study is to examine the impact of sitting versus lateral position on hemodynamic state during spinal anesthesia in orthopedic patients.

Orthopedic patients undergoing spinal anesthesia are at risk of developing hemodynamic instability, which can be exacerbated by the position in which they are placed during the procedure. Although sitting position is commonly used in orthopedic surgery, while lateral position is used less commonly, their effect on hemodynamic status is not well studied.

Overall, this study has significant implications for clinical practice and patient outcomes, and its findings may be used to inform decisions about the best approach for managing PDPH in orthopedic patients and select best approach to hemodynamically instable patients.

CHAPTER TWO: LITERATURE REVIEW

2.2 Magnitude of PDPH

The magnitude of PDPH varies in different regions of the world in different patient groups. For instance an RCT conducted by Mossafa, F., et al in Iran orthopedic patients between 2007 and 2008 were shown the incidence of PDPH 10%[9].

Moreover a prospective observational cohort study (DelPizzo, K., et al.,) that included a total of 656 patients to analyze the risk of PDPH among adults and adolescents, showed the overall incidence of PDPH 3.4% in 2020[27].

Furthermore in a comparative study for the incidence of PDPH in 2011 among 127 patients, by Majd, S.A., et al., shown the overall incidence of PDPH 30.4%[28].

Additionally, according to an RCT in 152 mothers done in Dilla University by Abate, S.M., et al., in 2021/2022, the overall incidence of post-dural puncture headache was 25.7% among parturient [29].

Apart from this, in 2019, a cross sectional study was undertaken on 112 obstetric patients by Kassa, A.A. et al, in University of Gondar teaching and referral hospital, Ethiopia revealed the prevalence of PDPH 38.8%[30].

Also a prospective cohort study done in northern Ethiopia by Oumer, K.E., et al., found 20% of the incidence of PDPH among orthopedic patients[31].

The prevalence of PDPH was found to be 33% in a cross-sectional study conducted in TASH, Ethiopia, on the assessment of PDPH and associated factors among patients undergoing SA for orthopedic and urologic procedures[8].

2.3 PDPH and position during SA administration

Rekha, V. et al 2023 shown that 20% of the orthopedic patients had PDPH in the sitting group and only 4% in the lateral group with the overall incidence of 12% in his prospective RCT[10].

Furthermore the Incidence of PDPH after spinal anesthesia on sitting position was 28% and 12% on lateral position according to an RCT taken on Indian parturient in 2023 [32].

When SA was performed in the sitting position for elective CS, the PDPH was higher than when the procedure was performed in the right lateral position, according to an RCT conducted in Turkey by Dogukan M, et al. on 104 pregnant women set to have elective CS[33].

When seated, the CSF pressure is 40 cm of H2O, and when lying down, it is between 5 and 20 cm of H2O. This increased CSF pressure in the seated position has the potential to enlarge the dura's hole and lengthen the CSF leak [28].

2.4 Position and hemodynamic status of patients

According to Kongur, E., et al. (2021), following SA induction in orthopedic patients, SBP, DBP, and MAP were considerably lower in lateral position as compared to sitting position.[14].

Hypotension was less common in the lateral than in the sitting position, with a frequency of hypotension in the L and S groups of 24.5% and 57.7%, respectively, according to an RCT (2021) on the Effect of SA in Sitting and Lateral Positions on the Hemodynamic Condition in CS($P = 0.001$)[34].

In order to examine the impact of sitting versus lateral posture on hemodynamics, Nuru Yimam conducted a prospective cohort research at Ghandi Memorial Hospital on 170 pregnant patients. The results indicated a significant incidence of hypotension in the sitting group (25% vs. 75%, $P = 0.036$).

2.4 Hypothesis

HO1; There is no statistical difference in PDPH during SA in sitting position and lateral position
HA1; There is statistical difference in PDPH during SA in sitting position and lateral position

HO2; There is no statistical difference in PDPH pain severity during SA in sitting position and lateral position
HA2; There is statistical difference in PDPH pain severity during SA in sitting position and lateral position
HO3; There is no statistical difference in hemodynamic status during SA in sitting position and lateral position
HA3; There is statistical difference in hemodynamic status during SA in sitting position and lateral position

CHAPTER THREE: OBJECTIVES

3.1 General objective

To compare the effect of lateral vs sitting position during SA on the development of PDPH and hemodynamic status among orthopedic patients in Black Lion Specialized hospital, Addis Ababa, Ethiopia, 2023/24.

3.2 Specific objectives

To compare the incidence of PDPH in sitting vs. lateral position during SA among orthopedic patients in Black Lion Specialized Hospital, 2023/24.

To compare the effect of lateral vs sitting position during SA on the intraoperative MAP and HR among orthopedic patients in Black Lion Specialized Hospital, 2023/24.

CHAPTER FOUR: METHOD OF THE STUDY

4.1 Study area

The study will take place in Addis Ababa, a chartered city with three levels of authority: the city government at the top, the 11 sub-cities at the second level, and the woreda at the third. In Addis Ababa, there are 46 private hospitals and 13 public ones. Many hospitals offers orthopedic surgeries in Addis Ababa, Ethiopia but this study was conducted only in TASH, Department of orthopedics and traumatology. TASH offers diagnosis and treatments for approximately 370,000 - 400,000 patients per year. The various departments, faculties and residents under specialty training in the School of Medicine provide patient care in the hospital.

4.2 Study design

A prospective cohort study was conducted from January 1 to April 30, 2024 in TASH, department of orthopedics and traumatology.

4.3 Source population

All elective patients scheduled for orthopedic surgery under SA in TASH was used as a source population.

4.4 Study population

All elective orthopedic surgical patients who undergo orthopedic procedures under spinal anesthesia from January 1 to April 30 in TASH that fulfills inclusion criteria were used as a study population.

4.5 Sample size calculation

Since no prior research has been conducted in the field of study, the biggest sample size was determined by taking the results from the literature and calculating the sample size based on the major outcome variable. Based on previous studies**[28]**, the incidence of PDPH in surgical patients in sitting position was 45% in comparison with 16.6% in lateral position. By assuming equal sample size for two groups, the sample size is determined by using double population proportion formula:

$$N_1=N_2=\frac{P_1(1-P_1)+P_2(1-P_2)}{(P_1-P_2)^2}\times C$$

Where, N1= number of patients that develop PDPH in sitting position

N2=number of patients that develop PDPH in lateral position

P1=proportion of patients that develop PDPH in sitting position=45%=0.45

P2= proportion of patients that develop PDPH in lateral position=16.6%=0.166

C= standard value at 95% CI and 80% study power= 7.85

$$=\frac{0.45(1-0.45)+0.166(1-0.166)}{(0.45-0.166)^2}\times 7.85$$

$$=\frac{0.385944}{(0.284)^2}\times 7.85$$

=37.6

Ten percent of additional sample is included by assuming loss to follow up from the study and the total sample become 42 for each group.

4.6 Description of variables

4.6.1 Dependent variable

Post dural puncture headache

Severity of PDPH

Hemodynamic status of the patient

4.6.2 Independent variables

Position of the patient during SA administration

BMI

Spinal Needle gauge

Spinal needle type

Number of LP

Age

Sex

Previous SA

4.7 Eligibility criteria

4.7.1 Inclusion criteria

Elective orthopedic patients which are operated under spinal anesthesia

4.7.2 Exclusion criteria

Patients with anxiety disorder

Patients with uncontrolled hypertension, arrhythmia and hypotension

Patient diagnosed with migraine headache by a medically

4.8 Sampling technique

A systematic random sampling procedure was employed to choose study participants from the daily operation schedule list. Based on the average data from the log book for the prior surgery performed in a three-month period, 240 patients underwent elective orthopedic surgery under SA. Since N is the population per three months and n is the overall sample size, the sampling interval K was computed as K=N/n. The first study participant (random start) was chosen by lottery, and as a result, the sampling interval was 240/84 = 3. Those patients who fulfilled inclusion criteria and took spinal in lateral position grouped under lateral group and those who took spinal in sitting position grouped under sitting group. The responsible anesthetist/logist administering anesthesia independently has chosen the positioning for spinal anesthesia without any intervention from the researcher and data collectors. The data collectors grouped participants solely based on their observations of the positioning selected by the administering anesthetist/logist.

4.9 Data collection method

From January 1 to April 30 a trained Anesthetist collected patients' demographics (name, age, gender, phone number, weight, height, BMI) and other questions which were adapted from other researches[14]. In the day of surgery a data collecting anesthetist filled and collected intraoperative data which were required for the analysis (position during administration of SA, needle type, needle size, experience of the anesthetist/anesthesiologist administering SA, bevel direction, number of attempts of SA) before, during and after SA. Finally the patient was followed for five consecutive days starting from 12 hours after SA administration and then each day (24 hours interval)[35]. Patients discharged before finishing the data collection were communicated via telephone by a data collecting anesthetist for the development of the headache. Those patients that didn't finished the follow-up due to different reasons (death, loss of follow-up after discharge) were excluded from the research. According to the mentioned follow up schedule a trained Anesthetist followed the presence or absence of headache. A follow up for development of headache was for five consecutive days. If present, in order to assess the frequency of occurrence, patient was asked for photophobia, tinnitus, vomiting, neck stiffness, its position dependency and the time it developed after SA. Any headache that starts or gets worse while standing up and goes away or gets better in 30 minutes or less after lying down again is referred to as PDPH. Conservative management like hydration, bed rest and analgesics according to the severity of headache was given to the patients that develop headache and was followed for improvement. On advanced and severe headaches other management given to the patient (epidural blood patch) was recorded and followed for improvement. Based on the patients' response, a trained data collecting Anesthetist has filled the characteristics of headache according to the questionnaire which is suitably made for PDPH characterization. Training on how to collect a data was given to a data collecting Anesthetist and the data collection was under supervision of consultant anesthetist. Patients that were not developed PDPH in the 5 days follow up considered as not developed PDPH.

Intraoperative hemodynamic parameters like systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate and oxygen saturation were collected before administration of SA and 1, 5, 10, 15, 30, and 60 minutes after administration of SA[14].

4.9 Operational definition

A headache will be classified as PDPH in our study if it emerges 12 hours to 5 days after SA, gets worse within 15 minutes of being upright, and goes away or gets better within 30 minutes of going back to the recumbent posture.[35]. It can be either associated with nausea, vomiting, photophobia, neck stiffness or not.

Tinnitus: A perception of sound in the absence of an external acoustic stimulus[36].

Photophobia is the feeling of pain in the eyes brought on by bright light exposure[37].

A drop in MAP of more than 25% is referred to be hypotension[38].

Bradycardia: a decrease on heart rate greater than 25% or a hear rate of less than 60 beat per minute[39].

4.10 Data analysis procedure

Following the completion of data collection, an investigating anesthetist manually reviewed the questionnaire paper to ensure it was complete before entering it into the SPSS version 26 computer program for analysis. Normality of the continuous data was checked by Shapiro–Wilk test. . Student's t-test was used to analyze hemodynamic status of the patients (blood pressure, MAP, heart rate and oxygen saturation) which was normally distributed. Chi square test was used to analyze a categorical variable the incidence of PDPH in lateral and sitting positions.

4.11 Data Quality Management

The data collectors, who worked as anesthetists in the orthopedic OR, had a one-day training to ensure the quality of the collected data. Regarding the goal, the study's applicability, the confidentiality of the data, respondent rights, informed permission, and data collection methods, the proper information and instruction were provided. Questions that caused difficulty or ambiguity were rephrased and adjusted. A pre-test including 10% of the total sample size was administered at Yekatit Hospital. The questions were reviewed for clarity, completeness, and consistency. We removed a few pointless inquiries and added the ones that were missing. There was an investigator overseeing the data collection process.

4.12 Ethical considerations

This proposal was submitted to Addis Ababa University institutional review board for ethical clearance. Before beginning the data collection process, the Tikur Anbessa Specialty Hospital was consulted after ethical approval for permission. The goal of the study and any possible risks were explained to each participant, and only those who were willing to take part were included. The confidentiality and privacy of study participants was ensured during the interview and all information accessed were kept and restricted from any access.

4.13 Dissemination of results

The thesis will be delivered and turned in to the school of anesthesia at Addis Ababa University, college of health sciences. A single copy will be distributed to research participants' institutions and other relevant organizations. The manuscript will thereafter be released in a reputable journal.

CHAPTER FIVE: RESULT

5.1 Socio-demographic characteristics of the participants

All 84 patients were included in the research with a response rate of 100%. Spinal anesthesia was given in sitting position in 42 patients and in lateral position in 42 patients scheduled for elective orthopedic surgery. Cutting type of spinal needle was used in both groups of patients. There was no statistically significant difference among groups based on sex of patients, gauge of spinal number of attempts, volume of fluid infused, duration of surgery, previous history of SA, intraoperative blood loss, level of lumbar puncture, baricity and volume of LA used.

Position	Sitting	Lateral	
Variables	Mean ± SD	Mean ± SD	P value
Age of the patient	44.71 ± 11.366	42.95 ± 11.495	.082
Weight of the patient (kg)	62.62 ± 3.819	63.38 ± 2.963	.094
Height of the patient (cm)	163.05 ± 4.909	162.00 ± 5.146	.097
BMI of the patient	23.56 ± 1.201	23.88 ± 1.384	.848
Intraoperative blood loss	416.19 ± 155.170	414.05 ± 152.300	.479
Volume of fluid infused (ml)	1854.76 ± 463.393	1869.05 ± 456.11	.282
Gauge 23	14 (33.3%)	11 (26.2%)	
24	20 (47.6%)	21 (50%)	.738
25	8 (19%)	10 (23.8%)	
ASA class I	20 (47.6%)	19 (45.2%)	
II	22 (52.4%)	23 (54.8%)	.827
Sex M	22 (52.4%)	21 (50%)	
F	20 (47.6%)	21(50%)	.827

Table 1 Socio-demographics of patients undergoing spinal anesthesia for orthopedic procedures in Black Lion Specialized Referral Hospital from January 1 to April 30, 2024 G.C

5.2 Comparison of PDPH among two groups

The overall incidence of PDPH among elective orthopedic patients was 13/84 (15.5%). From sitting group of patients 10 (23.8%) out of 42 developed PDPH and 3/42 (7.1%) developed PDPH from lateral group which was statistically significant (p= .035). From a total of 13 patients who developed PDPH 5 (38.5%) were males and 8 (61.5) were females. The distribution of PDPH in our study also confined to POD 1 to 3 but only 1 PDPH occurred in POD 4 with no PDPH occurrence in POD 5. PDPH was associated with tinnitus in 4 patients and photophobia in 5 patients in sitting position, whereas 2 patients had tinnitus and 1 photophobia from lateral group.

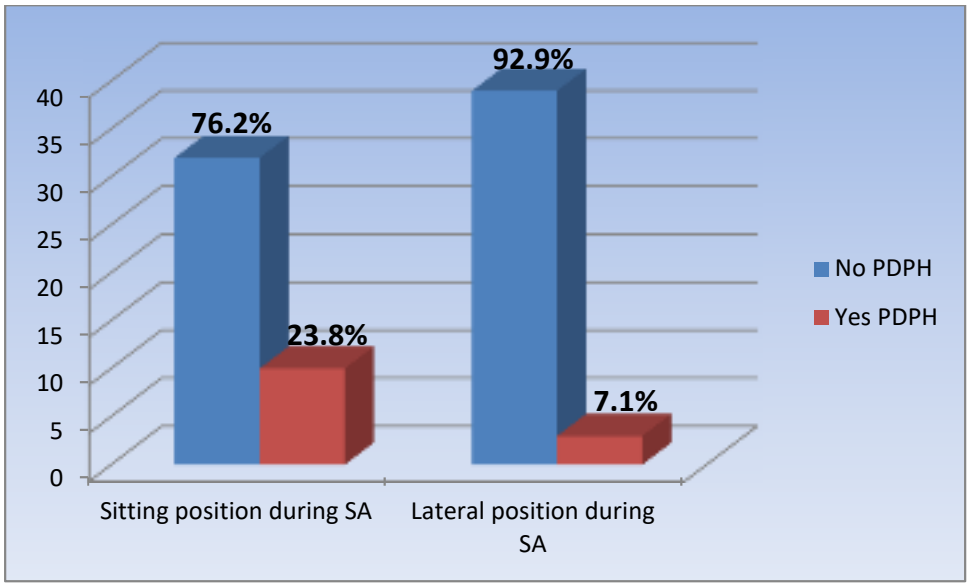

Figure 1 Bar graph illustrating the distribution of PDPH between groups in patients receiving SA for orthopedic surgeries in TASH between January 1 and April 30, 2024 G.C.

5.3 Intraoperative vital signs

There was statistically significant difference (p< .05) among two groups when compared with mean arterial pressure. One patient took noradrenaline for hypotension from sitting group and 4 from lateral group. 9 patients developed nausea, vomiting and shivering from lateral group whereas 1 patient was complicated with nausea from sitting group. No statistically significant difference (p> .05) was observed among groups when compared based on intraoperative heart

rate and oxygen saturation. This and p values of variables are situated in the following tables and figures as follows:

	SBP (mmHg)			DBP (mmHg			MAP (mmHg)		
Time	Sitting	Lateral	P value	Sitting	Lateral	P value	Sitting	Lateral	P value
Bef. SA	117.05	118.29	.452	70.86	69.62	.282	86.10	85.56	.647
1 min	117.05	118.29	.452	70.86	69.62	.282	86.25	85.84	.723
5 min	115.64	114.62	.514	69.83	67.24	.022	85.10	83.03	.064
10 min	113.57	102.86	<.000	66.67	60.10	<.000	82.30	74.24	<.000
15 min	112.14	104.24	<.000	66.36	59.95	<.000	81.64	74.65	<.000
30 min	115.50	116.10	.718	69.29	67.64	.147	84.69	83.79	.441
60 min	116.93	118.78	.222	71.19	69.50	.097	86.44	85.93	.613

Table 2 Comparison of SBP, DBP and MAP of patients undergoing SA for orthopedic procedures in TASH from January 1 to March 30, 2024 G.C among groups based on time

	HR			**SPO2**		
Time	Sitting	Lateral	P value	Sitting	Lateral	P value
Before SA	82.12	81.38	.705	95.45	96.14	.139
1 min after SA	80.60	80.17	.820	95.60	96.14	.255
5 min after SA	81	81.36	.858	95.69	96.14	.348
10 min after SA	83.45	80.88	.195	94.93	94.79	.783
15 min after SA	81.98	81.38	.739	95.17	95.02	.780
30 min after SA	80.21	80.19	.990	95.62	95.21	.348
60 min after SA	80.21	80.17	.980	95.93	96.14	.653

Hint: HR heart rate and SPO2 oxygen saturation

Table 3 Comparison of HR and SPO2 of patients undergoing SA for orthopedic procedures in TASH from January 1 to March 30, 2024 G.C among groups based on time

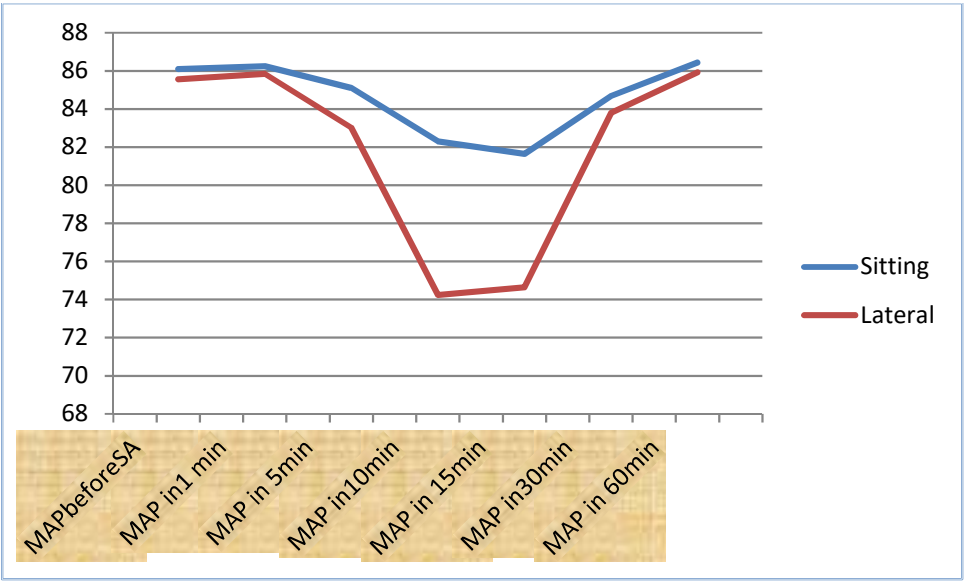

Figure 2 Comparison of MAP of patients undergoing SA for orthopedic procedures in TASH from January 1 to April 30, 2024 G.C among groups based on time

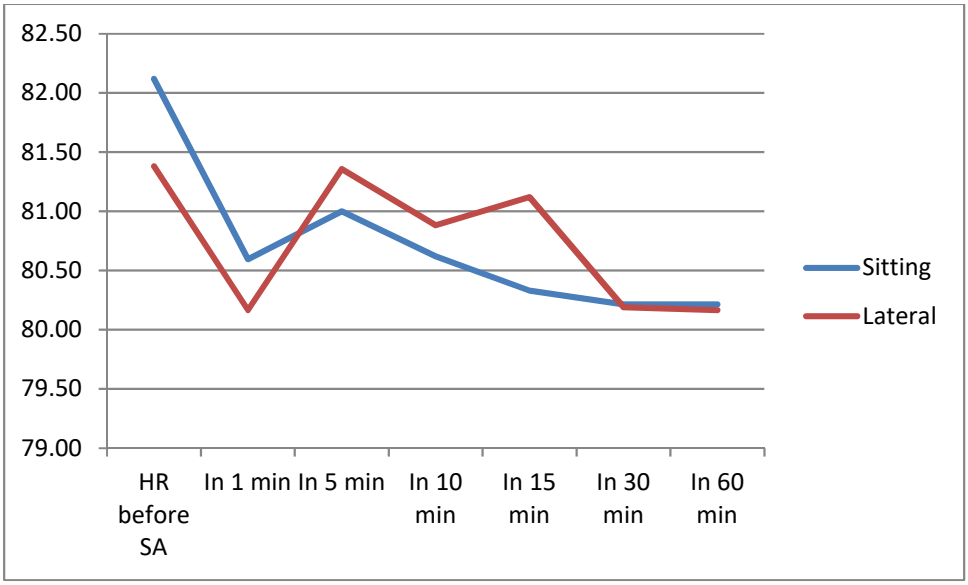

Figure 3 Comparison of HR of patients undergoing SA for orthopedic procedures in TASH from January 1 to April 30, 2024 G.C among groups based on time

CHAPTER FIVE: DISCUSSION

The result of this study shows that PDPH in lateral position is less when compared to patients who have taken spinal anesthesia on sitting position (the incidence of PDPH in sitting position is 23% whereas 7.3% in lateral position). In hemodynamic aspect, the mean arterial pressure of orthopedic patients who has taken spinal anesthesia in lateral position was decreased significantly when compared to sitting position ($p < .001$). There was no statistically significant difference among groups when compared based on heart rate and peripheral oxygen saturation.

A study undertaken among 100 patients aged between 19 and 35 undergoing lower limb surgeries in 2023 shown that the incidence of PDPH was high (20% in sitting vs 4 % lateral which was statistically significant), which is consistent with the findings of our research. Incidence of PDPH after SA on sitting position was 28% and 12% on lateral position according to a research taken on Indian parturient in 2023[32]. This value is higher in parturient compared to our study and a possible cause for this can be an increased cerebral vasodilation in response to cerebrospinal fluid (CSF) hypotension, related to high levels of circulating estrogen.

The overall incidence of post dural puncture headache was 11.66% in a study undertaken in Indian patients who underwent different surgeries in 2016. There was no significant difference in incidence between two groups (P= 0.590). In sitting position the incidence was 12.66% and in Lateral position the incidence was 10.66% [40]. This result is in contrary to our study, the possible reason for this can be inclusion of different groups of patients on the study.

A study in Iran (Majd, S.A., et al.) among general patients undergoing lumbar puncture in sitting vs. lateral position concluded sitting position produce more post lumbar puncture headache in comparison with lateral decubitus position. In this study the incidence of overall PDPH was 30.4% and it was significantly higher in sitting position (45% in sitting vs 16.6% in lateral decubitus). In our study the overall incidence of PDPH among orthopedic patients was 15.5% (23% in sitting vs 7.1% in lateral) which is lower when compared to the above research. The possible cause for this can be the use of small gauge spinal needle(23, 24 and 25 G) and also withdrawal of small amount of CSF, in other hand the above research used a large gauge spinal needle (they used 21 G spinal needle) and withdrawn a large amount of CSF.

In a research undertaken in India in 2023 the distribution of PDPH in the first five days was confined to day 1 to day 3[10], in an approximate way the distribution of PDPH in our study also confined to POD 1 to 3 but only 1 PDPH occurred in POD 4 with no PDPH occurrence in POD 5.

Study undertaken on the effects of patient position on early complications of spinal anesthesia induction in arthroscopic knee surgery in turkey showed a decrease on hemodynamic parameters of the patients (significant decrease in blood pressure and MAP in patients taken SA in lateral position). In this study 18.8% of patients developed hypotension in sitting group and 38.5% of patients from lateral group developed hypotension[14]. In our study 2(5%) patients of patients from sitting group developed hypotension, whereas 10 patients (23.8%) of patients from lateral group developed hypotension. Only 1out of 2 patients required vasopressor from sitting group and 4 out of 10 patients required from lateral group. This shows that the incidence of hypotension is low in this study when compared to the above study.

An RCT (2021) on effect of SA in sitting and lateral positions on the hemodynamic condition in CS shown that hypotension occurred less frequently in the lateral than the sitting position with a frequency of hypotension in L and S groups 24.5% and 57.7%, respectively (P = 0.001)[34]. This study is in contrary to our study because frequency of hypotension is higher in sitting position than lateral position. Gravity, reduced systemic vascular resistance, increased venous capacity, anesthetic induced vasodilation, pregnancy induced changes and other factors contribute to hypotension in sitting position among parturient.

CHAPTER SIX

7.1 Conclusion

Our study demonstrated that there is a statistically significant difference in the incidence of post dural puncture headache among elective orthopedic surgical patients in black lion specialized hospital when SA is given in sitting position and lateral position. The incidence of PDPH is low when spinal anesthesia is administered in lateral position. When compared to sitting position, the administration of spinal anesthesia in lateral position decreased blood pressure and MAP which was a statistically significant. Although this is the case, individuals who are hemodynamically stable prior to SA induction may get SA in the lateral position because they are able to withstand hypotension and respond well to fluids; and in advanced cases to vasopressors.

7.2 Recommendations

We recommend anesthesia providers (Anesthetists and Anesthesiologists) to make administering spinal anesthesia in orthopedic patients with stable baseline vital signs in lateral position part of routine activity in order to decrease a debilitating incidence of complication of SA called PDPH on this group of surgical patients.

We also recommend a further research including emergency orthopedic patients and a well-controlled randomized controlled trial on the incidence of PDPH and effect of lateral vs sitting position during administration of spinal anesthesia on PDPH.

7.3 Limitation of the study

Emergency orthopedic patients were not included in this study.

7.4 Strength of the study

Different factors that can affect the incidence of PDPH were similarly distributed among the groups.

CHAPTER SEVEN: REFERENCE

1. Olawin, A.M. and J.M. Das, *Spinal anesthesia.* StatPearls [Internet], 2022.
2. Devireddy, S.R., *A Study to Evaluate the Effects of Unilateral Spinal Anaesthesia with Intrathecal Hyperbaric Bupivacaine and Adjuvant Fentanyl Using 27 G Spinal Needle in Elective Lower Limb Surgeries*. 2019, Rajiv Gandhi University of Health Sciences (India).
3. AlHussain, A.H., et al., *A Decade's Perspective on the Orthopedic Workforce in Saudi Arabia.* Cureus, 2023. **15**(4).
4. Siddiqi, A., B.R. Levine, and B.D. Springer, *Highlights of the 2021 American joint replacement registry annual report.* Arthroplasty today, 2022. **13**: p. 205-207.
5. Plewa, M.C. and R.K. McAllister, *Postdural puncture headache.* 2017.
6. Patel, R., et al., *A comprehensive update on the treatment and management of postdural puncture headache.* Current pain and headache reports, 2020. **24**: p. 1-9.
7. Oumer, K.E., et al., *Incidence and associated factors of post-dural puncture headache among orthopaedic patients after spinal anesthesia: a prospective cohort study.* Annals of Medicine and Surgery, 2023. **85**(10): p. 4703-4708.
8. Tafesse, D., *Assessments of the Magnitude of Post Dural Puncture Headache (PDPH) and Associated Risk Facrors with PDPH among Patients Undergoing Spinal Anesthesia for Orthopedics and Urologic Procedures in Black Lion Specialized Referral Hospital, Addis Abeba, Ethiopia*. 2016, Addis Ababa University.
9. Mosaffa, F., et al., *Post-dural puncture headache: A comparison between median and paramedian approaches in orthopedic patients.* Anesthesiology and Pain Medicine, 2011. **1**(2): p. 66.
10. Rekha, V. and H. Naaz, *Section: Anaesthesiology.* Int J Acad Med Pharm, 2023. **5**(3): p. 264-268.
11. Weji, B.G., et al., *Incidence and risk factors of postdural puncture headache: prospective cohort study design.* Perioperative Medicine, 2020. **9**(1): p. 1-6.
12. Mekete, G., et al., *Magnitude and associated factors of post Dural puncture headache after spinal anesthesia in surgical patients at comprehensive specialized referral hospital, 2021: A multi-center cross-sectional study.* Interdisciplinary Neurosurgery, 2023. **34**: p. 101817.
13. Shitemaw, T., et al., *Incidence and associated factors for hypotension after spinal anesthesia during cesarean section at Gandhi Memorial Hospital Addis Ababa, Ethiopia.* PloS one, 2020. **15**(8): p. e0236755.
14. Kongur, E., S. Saylan, and A. Eroğlu, *The effects of patient position on early complications of spinal anesthesia induction in arthroscopic knee surgery.* Acta Clinica Croatica, 2021. **60**(1.): p. 68-74.
15. Rahimi, M., et al., *Comparison of vasovagal shock incidence during spinal anesthesia in sitting and lateral position.* HIV Nursing, 2023. **23**(2): p. 1292–1297-1292–1297.
16. Ferré, F., et al., *Control of spinal anesthesia-induced hypotension in adults.* Local and regional anesthesia, 2020: p. 39-46.
17. Abd Elraziq, B.A., et al., *Norepinephrine versus ephedrine in prevention of hypotension after spinal anesthesia.* Al-Azhar International Medical Journal, 2020. **1**(10): p. 37-42.
18. Shahriari, A. and M. Sheikh, *Post-Spinal headache: A new possible pathophysiology.* Anesthesiology and Pain Medicine, 2017. **7**(1).
19. Czarniak, N., et al., *Cerebrospinal Fluid–Basic Concepts Review.* Biomedicines, 2023. **11**(5): p. 1461.
20. Telano, L.N. and S. Baker, *Physiology, cerebral spinal fluid.* 2018.

21. Shin, H.Y., *Recent update on epidural blood patch.* Anesthesia and Pain Medicine, 2022. **17**(1): p. 12-23.
22. Bakshi, S.G. and R.S.P. Gehdoo, *Incidence and management of post-dural puncture headache following spinal anaesthesia and accidental dural puncture from a non-obstetric hospital: A retrospective analysis.* Indian Journal of Anaesthesia, 2018. **62**(11): p. 881-886.
23. Ceruti, S., et al., *Inferior vena cava ultrasound versus passive leg raising test in guiding fluid administration in surgical patients prior to spinal anaesthesia: a post-hoc analysis of the ProCRHYSA randomized trial. PROtocolized Care to Reduce HYpotension after Spinal Anaesthesia.* medRxiv, 2023: p. 2023.05. 22.23290367.
24. Hofhuizen, C., et al., *Spinal anesthesia-induced hypotension is caused by a decrease in stroke volume in elderly patients.* Local and regional anesthesia, 2019: p. 19-26.
25. Hung, K.-C., et al., *Prophylactic Neuraxial Morphine Against Post-Dural Puncture Headache: A Meta-Analysis.* E-Da Medical Journal, 2022. **9**(2): p. 9-20.
26. Dwivedi, P., et al., *Trans-nasal sphenopalatine ganglion block for post-dural puncture headache management: a meta-analysis of randomized trials.* Brazilian Journal of Anesthesiology (English Edition), 2023.
27. DelPizzo, K., et al., *Risk of postdural puncture headache in adolescents and adults.* Anesthesia and analgesia, 2020. **131**(1): p. 273.
28. Majd, S.A., et al., *Evaluation of pre lumbar puncture position on post lumbar puncture headache.* Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences, 2011. **16**(3): p. 282.
29. Abate, S.M., et al., *Efficacy and safety of prophylactic intrathecal normal saline for prevention of post dural puncture headache among women undergoing cesarean section under spinal anesthesia: a randomized controlled trial.* International Journal of Surgery Open, 2021. **35**: p. 100396.
30. Kassa, A.A., T.K. Beyen, and Z.A. Denu, *Post dural puncture headache (PDPH) and associated factors after spinal anesthesia among patients in University of Gondar Referral and Teaching Hospital, Gondar, North West Ethiopia.* 2015.
31. Oumer, K.E., et al., *Incidence and associated factors of post dural puncture headache among orthopedic patients after spinal anesthesia: a prospective cohort study.* Annals of Medicine and Surgery: p. 10.1097.
32. Ansari, A.W., *To compare the effects of sitting and left lateral positions of parturients.* 2023.
33. Doğukan, M., et al., *The effect of spinal anesthesia that is performed in sitting or right lateral position on post-spinal headache and intraocular pressure during elective cesarean section.* Nigerian Journal of Clinical Practice, 2023. **26**(1): p. 90-94.
34. Manouchehrian, N., A. Moradi, and L. Torkashvand, *Comparative study of effect of spinal anesthesia in sitting and lateral positions on the onset time of sensory block and hemodynamic condition in cesarean section: a randomized clinical trial.* Anesthesiology and Pain Medicine, 2021. **11**(1).
35. Singh, S., *Immediate onset of postdural puncture headache after spinal anesthesia.* Journal of Anaesthesiology Clinical Pharmacology, 2017. **33**(1): p. 134-135.
36. Chari, D.A. and C.J. Limb, *Tinnitus.* Medical Clinics, 2018. **102**(6): p. 1081-1093.
37. Katz, B.J. and K.B. Digre, *Diagnosis, pathophysiology, and treatment of photophobia.* Survey of ophthalmology, 2016. **61**(4): p. 466-477.
38. Shamlool, M.M.S., M.M. Ismail, and K.S.A. Elshaer, *Comparative Study between Setting Position Versus Left Lateral Position Effects During Spinal Anesthesia Block in Caesarean Section.* The Egyptian Journal of Hospital Medicine, 2019. **75**(2): p. 2128-2135.

39. Sidhu, S. and J.E. Marine, *Evaluating and managing bradycardia.* Trends in cardiovascular medicine, 2020. **30**(5): p. 265-272.
40. Chakraborty, A. and A. Sinha, *The incidence of post dural puncture headache following spinal anaesthesia:-A comparison of sitting versus lateral decubitus position.* Int J Contemporary Med Res, 2016. **3**: p. 2096-9.

ANNEXX

Annex I: Study Subjects Consent Form

Addis Ababa University, College of Health Sciences Department of Anesthesia

Study Subjects Consent Form

Prospective Cohort Study on effect of lateral vs. sitting position during SA administration on development of PDPH among orthopedic patients in Black Lion Specialized Hospital, Addis Ababa, Ethiopia 2023/2024 G.C. from January, 2024 to April, 2024 G, C.

Greetings! My name _____. As one of the study team members, I'm here to gather some crucial data and ask you some questions. I work as an anesthesiologist, and at Black Lion Specialized Hospital, we are researching how sitting in a lateral versus a sitting position during SA affects the development of post-dural puncture headache in orthopedic patients. If you are interested to engage in this research, we respectfully ask that you supply the necessary information. I was able to locate your name on the surgical operation list. We maintain complete secrecy, and involvement is entirely optional. Five days will pass during this follow-up. For this reason, we sincerely ask that you take part in this study. I recognized the goals of…

A) Agree

B) Disagree If agrees, the observation will be started.

ሰላም! ስሜ _____ እባላለሁ እኔ ከተመራማሪው ቡድን አባላት አንዱ ነኝ እና እዚህ የመጣሁት አንዳንድ ጥያቄዎችን ልጠይቅ እና አንዳንድ ጠቃሚ መረጃዎችን ለመሰብሰብ ነው። ሰመመን ሰጪ ነኝ። በጥቁር አንበሳ ስፔሻላይዝድ ሆስፒታል ውስጥ ባሉ የአጥንት ህክምና ህሙማን ላይ ከ Spinal Anesthesia በኋላ የሚከሰተውን እራስ ምታት ወይም PDPH ጋር የተያያዙ ጉዳዮችን በመጠን እና ተያያዥ ምክንያቶች ላይ ጥናት እያደረግን ነው። በዚህ ጥናት ውስጥ አስፈላጊውን መረጃ እንዲያቀርቡ በአክብሮት ተጠይቀዋል። ለቀዶ ጥገና ከተደረጉት የቀዶ ጥገናዎች ዝርዝር ውስጥ ስምዎን አገኘሁ። ተሳትፎ በፈቃደኝነት ነው: ሚስጥራዊነትን በጥብቅ እንጠብቃለን። ይህ ክትትል ለ 5 ቀናት ይቆያል:: ስለዚህ በዚህ ጥናት ላይ እንድትሳተፉ በትህትና እንጠይቃለን። ስለ ጥናቱ ዓላማዎች እና በጥናቱ ውስጥ ስለሚኖሯቸው ሚናዎች ተረድቻለሁ። እኔ….

ሀ) እስማማለሁ ለ) አልስማማም

ከተስማሙ ምልከታው ይጀምራል።

Annex II Questionnaire

Section I: Socio-Demographic Data

Date:		Phone number:
No.	QUESTIONS	RESPONSE
1	Age	
2	Sex	A. Male B. Female
3	ASA	A. I B. II C. III D. IV
4	Wt., Ht. and BMI	

Section II: Intraoperative events

R.No	QUESTIONS	RESPONSE
5	Previous history of SA exposure	A. yes B. No
6	Position during SA	A. Sitting B. Lateral
7	Bevel direction	A. Cephald B. horizontal
8	Needle type	A. Cutting (Quincke) B. Non-cutting (Sprotte and Whitacre)
9	Guage of needle used	
10	Number of attempts	A. 1 B. 2 C. 3 D. Other(Specify)
11	Dose of drug given(in mg)	
12	Name of drug used as adjuvant and dose(in mg or mcg)	
13	Was the SA failed	A. Yes B. No
14	Was the SA difficult	A. Yes (specify reason)

		B. No
15	Vital signs before SA	A. BP and MAP B. HR C. SPO_2
16	Vital signs 1 minute after SA	A. BP and MAP B. HR C. SPO_2
17	Vital signs 5 minute after SA	A. BP and MAP B. HR C. SPO_2
18	Vital signs 10 minute after SA	A. BP and MAP B. HR C. SPO_2
19	Vital signs 15 minute after SA	A. BP and MAP B. HR C. SPO_2
20	Vital signs 30 minute after SA	A. BP and MAP B. HR C. SPO_2
21	Vital signs 60 minute after SA	A. BP and MAP B. HR C. SPO_2
22	Vasopressor or other agent given for any complication	A. Yes (specify agent and dose) B. No
23	Encircle associated complications	A. Shivering B. Nausea C. Vomiting D. Respiratory failure E. Allergic reaction F. Total spinal block G. Other(Specify)

Section III: Postoperative events

24	On which POD the patient encountered headache	A. POD 1 D. POD4	B. POD2 E. POD5	C. POD3
25	Mark all associated symptoms with the headache	A. Tinittus D. Other(specify)	B. Photophobia	C. Nausea
26	Position Dependency of the headache	A. Present	B. Absent	