



**ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCE,
SCHOOL OF MEDICINE, TIKUR ANBESSA SPECIALIZED HOSPITAL**

Incidence and associated factors for failed spinal anesthesia undergoing elective surgery at Tikur Anbesa specialized hospital. Prospective observational study.

INVESTIGATOR:

Dr. Abraham Eshete MD, Anesthesiology, Critical Care and Pain Medicine Resident

ADVISORS:

Dr. Birhane Tesfaye MD, Consultant Anesthesiologist .

Dr. Blen Ayele MD, pediatrics consultant Anesthesiologist .

A research project submitted to Addis Ababa university school of medicine department of anesthesiology, critical care and pain medicine in partial fulfillment of the requirement for specialization in anesthesiology, critical care and pain medicine .

**ADDIS ABABA, ETHIOPIA
May, 2023**

1. Summary

Research questions

What are the associated factors of failed spinal anesthesia in surgical patients?

How is the magnitude of failed spinal anesthesia in surgical patients?

Objectives:

- 1 To identify the incidence of failed spinal anesthesia in surgical patients.
2. To explore the possible factors of failed spinal anesthesia.
3. To suggest strategies for preventing and managing failed spinal anesthesia.

Methods:

Study will be a prospective observational study conducted on patients undergoing spinal anesthesia. Data will be collected from patients who have experienced a failed spinal block and will be compared with the data collected from patients who have had successful spinal blocks. Data collection will include patient demographics, surgical procedure, type of anesthetic medication used, level of block achieved, and any complications associated with spinal anesthesia. Statistical analysis will be performed to identify any factors that are associated with failed spinal anaesthesia. then it will be analyzed using SPSS Version 27.

Time frame:

July 1st to November 30th, 2023. at Tikur Anbesa specialized hospital.

Estimated budget

Its 25.000 birr

Name of investigator	Dr.Abraham Eshete
Full title of the research project	Incidence and associated factors for failed spinal anesthesia undergoing elective surgery
Study Area	Black lion comprehensive specialized hospital
Total Cost of the project	25000 ETB
Source(s) of Funding	Black lion comprehensive specialized hospital
Address of investigator	Cell phone: +251920802798
	Email: abrahameshete@gmail.com
Name of Advisor(s)	Dr. Birhane Tesfaye MD, consultant anesthesiologist Dr. Blen MD, pediatrics anesthesiologist

Table of contents

Summary	2
Abbreviations	6
List of Tables	7
Acknowledgement	8
Abstract	9
CHAPTER1-INTRODUCTION	10
STATEMENT OF THE PROBLEM	11
CHAPTER 2-RATIONALE OF THE STUDY	12
CHAPTER 3-LITERATURE REVIEW	14
CHAPTER 4- Objective	18
CHAPTER 5-METHODOLOGY	19
CHAPTER 6-ELIGIBILITY CRITERIA	20
CHAPTER 7-1.SAMPLE SIZE DETERMINATION AND SAMPLING PROCEDURE	21
1.1..Sample size determination.	21
1.2..Sampling Procedure	22
1.3..Study variables	23
CHAPTER 8-1.Data collection methods	24
1.1.Data Processing and Analysis	25
1.2.Ethical Consideration	26
1.3.WORK PLAN	27
Budget of the study	28
CHAPTER 9 1.RESULTS	29
1.1.Sensory and motor block assessment after spinal anesthesia	36
1.2.Incidence of failed spinal anaesthesia	37
CHAPTER 10-1.FACTORS ASSOCIATED WITH FAILED SPINAL ANESTHESIA	38
1.1.Multivariate analysis showing factors associated with failed spinal anesthesia	40
CHAPTER 11-DISCUSSION	41
CHAPTER 12-CONCLUSION AND RECOMMENDATIONS	46
1.3.REFERENCE.....	-47
Conceptual Frame Work	50
1.4. Informed Consent Form	51
1.5. Survey Questionnaire	52

LIST OF FIGURES

Figure 1. Characteristics of cerebrospinal fluid	35
Figure 2-Failed spinal anesthesia among different types of surgery.....	37
Figure 3 The incidence of failed spinal anaesthesia.....	38
Figure 4. Conceptual Frame Work.....	47

Abbreviations

AOR.....Adjusted odds ratio

ASA American Society of Anesthesiologists

BMI body mass index

BSc.....Bachelor degree in anesthesia

CI confidence interval

COR Crude odds ratio

CSF Cerebrospinal fluid

SA spinal anesthesia

GA..... General Anesthesia

LA Local anesthetic

MSc..... Master degree in anesthesia

SA Spinal Anesthesia

SPSS..... Statistical Package for Social Science

TASH Tikur Anbessa Specialized Hospital

List of Tables

Table 1 .WORK PLAN-----	29
Table 2-Budget of the study-----	30
Table 3. Socio-demographic characteristics of the study participants-----	31
Table 4. Patient characteristics-----	32
Table 5. Technical related factors.-----	33
Table 6 . Drug related factors.-----	34
Table 7. Characteristics of cerebrospinal fluid -----	35
Table 8. Type of surgery-----	36
Table 9. Bi variate Logistic Regression analysis -----	40
Table 10 .Multivariate analysis-----	41

Acknowledgement

I am grateful to Dr. Blen Ayele (MD, Consultant Pediatric Anesthesiologist) and Dr. Birhane Tesfaye (MD, Consultant Anesthesiologist) for their valuable contributions to the development of the proposal and the selection of the research topic. I would also like to thank the Department of Anesthesiology, Critical Care, and Pain Medicine research committee for their input in selecting the research topic.

ABSTRACT-The objective of this study is to review the incidence and associated factors contributing to failed spinal anesthesia, a well-known complication associated with various factors that can lead to poor surgical outcomes. Several factors contribute to this complication, including obesity, difficult spinal needle insertion, spinal cord anomalies, improper medication administration, technical errors, and co-morbidity. In summary, failed spinal anesthesia is a critical concern that may lead to considerable morbidity and mortality. Therefore, appropriate measures should be taken to mitigate this complication by analyzing potential risks, adhering to proper techniques, and increasing awareness among anesthesia providers.

Objectives-To study the incidence and associated factors of failed spinal anesthesia in adults who underwent elective surgery in Tikur Anbessa hospitals at Addis Ababa, Ethiopia.

Methods-A prospective observational survey was conducted on 280 eligible adult elective surgical patients **July 1st to November 30th, 2023 at TASH, Addis Ababa, Ethiopia.** Simple random sampling method was employed for selecting samples. Data was entered and analyzed with SPSS version 27. Bi-variate and multivariate logistic regression analysis was done to assess significance of factors associated with failed spinal anesthesia. At 95% confidence interval a p-value of less than 0.05 was considered as statistically significant.

Outcomes -The incidence of failed SA among the adult who underwent elective surgery under SA was 18.5% (51/276). Multivariate logistic regression analysis showed that anaesthesia providers who had < 2 year of work experience (AOR =8.195, 95%CI = 3.324-20.205), bloody CSF appearance during lumbar puncture (AOR = 21.268, 95% CI = 8.564-52.81) and count of spinal attempted is more than two times (AOR=3.262, 95%, CI=1.417-7.509) were found to be a significant factor for SA.

CHAPTER ONE.

1. INTRODUCTION

1.1 BACKGROUND- Failed spinal anesthesia can result in incomplete or inconsistent block, resulting in inadequate analgesia or incomplete immobilization. . Failed spinal anesthesia is a significant complication that can cause anxiety and distress among patients undergoing procedures that require spinal anesthesia. This complication can lead to increased morbidity and potentially life-threatening implications. Currently, there is limited knowledge on the causes and associated factors of failed spinal anesthesia.

This research is significant because it will provide insights into the factors that contribute to failed spinal anesthesia. The findings of this study will form a basis for the development of interventions for this complication. Understanding the associated risk factors for failed spinal anesthesia will aid in the identification of patients who are at high risk and allow for appropriate risk stratification. Furthermore, the study will evaluate the impact of failed spinal anesthesia on patient outcomes, which is essential in improving patient care.

Despite the already listed benefits ,spinal anesthesia failure does occur. Failed spinal anesthesia remains a challenge in clinical practice, and several factors have been identified as associated with its occurrence. Recent studies have highlighted the impact of obesity, anatomic variations,CSF character and technical difficulties such as increased number of attempts and experience of the anesthesia provider on the failure rate of spinal anesthesia. These findings could aid in the development of strategies to minimize the incidence of failed spinal anesthesia.

Overall,the incidence rate of failed spinal anesthesia is between 1-17 % .The occurrence vary among studies/countries . The findings of this research will contribute to improving the quality of care for patients undergoing procedures that require spinal anesthesia and aid in reducing the occurrence of complications.

1.2. STATEMENT OF THE PROBLEM .

Failed spinal anesthesia is a common problem encountered during various surgery, which results in an inability to complete the intended surgical procedure. The incidence of failed spinal anesthesia is higher in obese patients, patients with spinal deformities, and those who have undergone prior spinal surgery. (Kuczkowski, K. M. (2007)(pp. 303-308).

There are various causes of failed spinal anesthesia, including inadequate local anesthesia administration, improper needle placement, and difficulty in identifying the epidural space. Failed spinal anesthesia can result in adverse outcomes such as complications related to general anesthesia and increased hospital stays, which can lead to additional costs and potential harm to the patient's health.

There is a need for interventions that can reduce the incidence of failed spinal anesthesia during orthopedic surgery and improve patient outcomes. Different solution such as the use of ultrasound guidance for needle placement techniques , use of additives , adequate concentration or volume of local anesthesia, and correct injection technique . Therefore ,it will decrease the incidence of failed spinal anesthesia, and improved patient recovery.

In Ethiopia, at TASH, despite the day-to-day use of spinal anesthesia procedures, spinal anesthesia failure is observed in everyday practice. The problem seems not to be well addressed. Data about the incidence of failed spinal anesthesia in different surgical procedures are based on reports of some studies done in other countries. Hence, the purpose of this study is to determine the incidence of failed spinal anesthesia in adults who undergo spinal anesthesia for different surgeries and to explore factors associated with it, in order to provide valuable insights to effectively find solutions to the problems.

CHAPTER TWO

1. RATIONALE OF THE STUDY

Spinal anesthesia, also known as regional anesthesia, is a widely used technique in surgery. The technique involves injecting an anesthetic agent into the Cerebrospinal fluid in the spinal cord, which results in rapid onset of anesthesia to the lower part of the body. However, despite its widespread use, spinal anesthesia failures still occur, which can have significant negative effects on patient outcomes. Therefore, it is necessary to research and understand the reasons behind the failures to improve the quality of care offered to patients .

Failure of spinal anesthesia can be due to a range of factors, including patient-related factors, technical factors, and drug-related factors. Understanding these factors can help to identify ways to minimize their occurrence and improve patient outcomes. For instance, one patient-related factor is obesity, which can affect the distribution of spinal anesthesia in the Cerebrospinal fluid, potentially leading to incomplete anesthesia. Identifying obesity as a high-risk factor in spinal anesthesia failure can help the anesthesiologist to take necessary precautions to prevent or minimize the effects of inadequate anesthesia. Necessary measures such as using higher doses of local anesthetics or altering needle insertion technique to ensure successful spinal anesthesia administration.(Banerjee, A., & Stovall, R. (2020))

Failed spinal anesthesia can have adverse outcomes on patient health and well being. In some cases, patients may experience nerve damage, leading to chronic pain and disability. Postoperative pain and discomfort can also occur in cases of inadequate anesthesia, potentially causing psychological distress, and prolonging recovery time. Therefore, understanding the underlying reasons for spinal anesthesia failures can help to avoid such complications and improve patient outcomes. Reference in APA style:

Failed spinal anesthesia can have adverse outcomes on patient health and well-being. In some cases, patients may experience nerve damage, leading to chronic pain and disability. Postoperative pain and discomfort can also occur in cases of inadequate

anesthesia, potentially causing psychological distress and prolonging recovery time. Therefore, understanding the underlying reasons for spinal anesthesia failures can help to avoid such complications and improve patient outcomes. (Agrawal, Kaur, & Goswami, 2017)

By exploring factors that contribute to spinal anesthesia failure and developing interventions to prevent or mitigate such occurrences, surgical patients can receive better care and successfully recover post-surgery. Furthermore, sharing research on failed spinal anesthesia can facilitate the spread of knowledge to other medical practitioners and improve patient care collectively. (Schreiber & Aunspach, 2021)

Finally, exploring failed spinal anesthesia has benefit for future generations. The knowledge gained can be passed on to medical students and residents who can continue to refine best practices and improve patient outcomes. In addition, generate further research on spinal anesthesia can lead to the development of new, safer, and more efficient anesthetic techniques. Understanding the factors associated with failed spinal anesthesia during orthopedic surgery can, therefore, expand the knowledge base of medical professionals on pain management and anesthesia, leading to advances in patient care and outcomes.

In conclusion, researching failed spinal anesthesia is crucial to improving patient outcomes, preventing complications, and advancing the field of pain management. It is necessary to identify the underlying factors contributing to spinal anesthesia failure, finding ways to mitigate such factors, and developing interventions to prevent recurrence. Finally, such research can contribute to the improved skills and knowledge of medical practitioners and ultimately benefit current and future generations of elective surgical patients. (Mariano et al., 2015).

CHAPTER THREE

1. LITERATURE REVIEW

Definition failed spinal anesthesia different across studies. British journal of anesthesia 2009 describe failed spinal anesthesia as inadequate level, quality or duration of local anesthetic. Different authors define failed spinal anesthesia in various ways but most literature consider it when there is inadequate anesthesia or analgesia after injecting local anesthetic in to CSF with further requirement of systemic analgesia or conversion to general anesthesia .Some authors explain failed spinal anesthesia as inability to insert spinal needle in to subarachnoid space or simply failure to perform spinal anesthesia.

According to Parikh KS (2008), defined failed spinal anesthesia as pain or discomfort necessitating the need to undertake additional measures to continue surgery or failure to provide comfortable surgical conditions and/or patient satisfaction during the surgical procedure with or without conversion to general anesthesia.

In this study, failed spinal anesthesia refers to either inadequacy of the administered spinal anesthesia to begin the intended surgery or repeating the block after the failure or requirement of systemic analgesia.

A number of studies have investigated the incidence, associated factors , and the possible management options of failed spinal anesthesia in surgical patients.

A multi center prospective analysis in 1214 patients by Régis Fuzier et al showed that the incidence of spinal anesthesia failure was 3.2% . Actually many studies concluded the incidence is beyond this figure .For instance, one of American teaching hospital mentioned the incidence of failed spinal anesthesia was 17%, mostly due to preventable factors.

The study conducted by Alabi et al., (2017) reported that the incidence of failed spinal anesthesia was 11.7%,

According to Yüksek, Ahmet, et al. (2020), of all anesthesia procedures, failure rate of spinal anesthesia is 16.6%. In this study, obstetric anesthesia was the most common surgery with failed SA (28.7%) .

A retrospective survey by Rukewe et al (2015) in Nigeria teaching hospital, the failure rate in obstetric anesthesia was 9.1%. It indicates that the rate of failed spinal anesthesia of the study was high. The researchers suggest developing clear guidelines to standardize obstetric spinal anesthetic practice as well as the management of failures.

A Cross Sectional Study on spinal anesthesia failure rate in 2021 by Ribka et al in Ethiopia was 21.01%. A result of this study when compared with the findings of previous similar and related studies is on the high side. A thorough look at the results of previous studies showed that, for most of the studies, the incidence of failed spinal anesthesia was between 1% and 17%.

According to Colish, Jane, et al (2020) on an 8-year retrospective analysis of patients undergoing elective hip and knee joint arthroplasty reported the incidence of failed spinal to be about 3.8%. Another study by Kiran et al. (2017) identified obesity, age, and female gender as risk factors for failed spinal anesthesia. The authors also noted that certain surgical procedures, such as those requiring a higher level of sensory block or longer duration of anesthesia, were associated with increased rates of failed spinal anesthesia.

Studies conducted in our country on the overall incidence according to Ashagrie et al., (2020) on the incidence and associated factors of failed spinal anesthesia among parturient underwent cesarean section, at Gondar University teaching hospital, Ethiopia, (2019), the overall incidence of failed spinal was 19.5% .

With respect to associated factors, results of different studies come up with different predicting factors. Colish, Jane, et al (2020) reported that spinal anesthetic failure was associated with younger age, lower body mass index (BMI), needle insertion site, needle size and baricity .

A prospective observational study conducted by Ashagrie HE et al (2019) reported that the predictors for failed spinal anesthesia are co-morbidity, needle size, anesthetist's experience, surgeon's experience, bloody CSF flow, and volume of local anesthetics. On the other hand, Rukewe et al (2015), reported that the predictors for failed spinal anesthesia were more due to multiple attempts, use of the L4/L5 inter space, and the level of experience of the anesthesia provider.

Research done by Fuzier et al in 2011 . the number of puncture attempts at 3 or more and the absence of adjuvant medication associated with local anesthetic were sole independent factors associated with the increased risk of failure. The failure of spinal anesthesia was rare in patients older than 70 years.

Research done in 2017 by Adeyinka et al., the experience of anesthesia provider , multiple puncture, dose of bupivacaine, and level of drug administered were significantly associated with failed spinal anesthesia in cesarean section. Similar research study done by Ružman T, et al. confirmed that multiple skin punctures were associated with higher spinal failure rate.

In reference to the research done in 2015 by Debasish et al in India , predictor factor for failed spinal anesthesia could be inadequate dose of local anesthetic or loss of the drug from the junction of the needle and syringe may be other causes of failed block. Loss of potency of the drug due to prolonged exposure to light or high CSF alkalinity may result in failure of spinal anesthesia .

Overall, there is a need for further research to better understand the causes and risk factors of failed spinal anesthesia. Such research could help improve patient outcomes by identifying modifiable factors that can be addressed to reduce the incidence of failed spinal anesthesia.

Management for failed spinal anesthesia involves timely recognition of the issue and prompt intervention. In regard to prospective research done by AA Abraham et al 2010 in India on the incidence and intervention options in patients underwent failed spinal anesthesia. And out of 42 patients with failed spinal , 23 of them had been managed by second spinal anesthesia. Few of the patient developed complications after the second injection which could not be explained to the second spinal alone. The author suggests giving second spinal anesthesia is safe and genuine method for failed spinal. In this literature, cooperation from the surgeon and only two attempts are recommended.

Other techniques, such as increasing the trendelenberg tilt, asking the surgeon to apply local anesthetic in the area, supplementing with Fentanyl , converting to GA and epidural anesthesia can also be considered.

Precise and timely management of failed spinal anesthesia can prevent further complications, provide pain control, and allow for the continuation of surgery.

In summary, previous research indicates that failed spinal anesthesia is a relatively rare but potentially serious complication of surgical procedures. Most failed spinal anesthesia were higher in obstetric cases particularly in cesarean section. The main causes are technical error, inadequate dosage, and patient factors, and these factors should be carefully monitored and managed during spinal anesthesia procedures. Proper training, early identification, and intervention are crucial in preventing this complication and improving patient outcomes.

CHAPTER FOUR.

1. Objective

General objective

To assess the incidence and associated factors of failed spinal anesthesia in elective surgical patients at TASH , Addis Ababa, Ethiopia .

Specific objectives

- To assess the incidence of failed spinal anesthesia.
- To identify significant predictors of failed spinal anesthesia.
- Based on the research findings, to suggest means to minimize risks associated with failed spinal anesthesia

CHAPTER FIVE

1.METHODOLOGY

1.1 Study area

Tikur Anbessa specialized hospital is the largest multi- specialist specialized comprehensive and teaching hospital in Ethiopia, opened in 1972. . It is also an institution where specialized clinical services that are not available in other public or private institutions are available to the whole nation.

1.2. Study design and study period

An institutional based prospective observational study design will be employed from July 1st to November 30th, 2023.

1.3. Target Population

All patients who were scheduled for elective surgery and planned for spinal anesthesia at TASH.

1.4. Study population

patients who had been planned for spinal anesthesia and underwent elective surgery during the study period at TASH.

CHAPTER SIX

1. Eligibility criteria

1.1 Inclusion Criteria .

- Patients that underwent elective surgery had been planned for spinal anesthesia.
- All patients of ASA classification I, II and III
- Patients of aged 18 years and older.

1.2 Exclusion Criteria .

- Obstetric surgery.
- Emergency surgery.

CHAPTER SEVEN

1. Sample size determination and sampling procedure .

1.1 Sample size determination.

The sample size was determined using the standard sample size formula (Cochran's formula)

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

Where

n is the sample size,

Z is the statistic corresponding to level of confidence,

P is expected percentage of occurrence, and

d is precision (corresponding to effect size).

The level of confidence aimed for this study is 95%. The assumed percentage of occurrence (p) estimated from previous studies at Public Hospitals at Addis Ababa, Ethiopia by Ribika was 21.01%. As it is large enough (between 10% and 90%), a precision (d) of 5% was considered to be appropriate.

By using single proportion formula our total sample size would be

$$n = (1.96)^2 \times 0.2101 (1 - 0.2101) / 0.05 \times 0.05$$

The sample size required for the study was 255. With the consideration of 10% for incomplete data the study sample size was 280.

1.2 Sampling Procedure

The study populations will be selected using systematic random sampling. . The sampling interval; K was determined for each table using the formula: $K=N/n$. where, N = population (all spinal procedures over last 3 months , n = total sample size (280). Therefore, the first study participant will be selected using lottery method from the elective cases.

1.3 .Study variables

1.3.1 .Dependent Variables

Failed spinal anesthesia

1.3.2 .Independent variable

- Patient demography Sex, Age Weight, height and BMI
- ASA status
- Surgery Type and duration
- Level of the Surgeon
- Number of attempt
- Position during procedure
- Palpability of Spinous process
- Deformity of the spine
- Drug factor: LA Type, Dose, Baricity , adjuvant,Brand.
- Experience of anesthesia providers
- Level of seniority
- CSF characteristics
- Needle size and type

CHAPTER EIGHT .

1.Data collection methods

Data collection will be done using structured and pretested questionnaire before actual data collection. The structured questionnaire will be filled, by the data collector, using relevant information from the patient chart and direct observation of the procedure in the operation room.

Data included in the questionnaire were demographic data (age, height, weight), BMI , ASA Status, Spinal landmark (easily palpable Spinous processes, poorly palpable Spinous processes and unable to positively identify Spinous processes), spinal anatomy (normal or deformed), needle gauge, status of the anesthesia (educational level and experience), number of attempts, drug dose, volume,brand ,Baricity, patient position during the procedure and duration ,type of surgery (orthopedic surgery, urologic surgery, gynecologic surgery, general surgery, ,vascular surgery) .

1.1. Data Processing and Analysis.

1.1.1. Data quality assurance .

Before actual data collection,, accuracy and clarity of questions will be assessed by the investigator. Briefing about the objectives and relevance of the study, clarification on each items included in the study will be given to data collectors. And completeness and consistency of data collected will be checked on regular basis.

1.1.2. Data entry and analysis .

After the data has been collected.The questionnaire paper will be checked manually for completeness and then it will be analyzed using SPSS Version 27. At 95% confidence interval a p-value of less than 0.05 will be considered as statistically significant.

1.1.3. Operational Definitions.

Failed spinal anaesthesia can be defined as partial or incomplete block with in 20 min after injection and requiring supplemental analgesia or changing to general anesthesia or repeat spinal anesthesia.

Adult. –refers to age equal or greater than 18 years old

Poorly palpable Spinous process – where the Spinous process can felt but with difficulty.

Easily palpable Spinous process –easily palpable Spinous process

Position. refers to patient position during performing the spinal anesthesia.

Non palpable Spinous process – where the Spinous process can not be appreciated .

Bromage scale . a tool to assess the strength of motor block of lower extremity.

Modified Holman grading; a tool to assess the level of sensory block.

Successful spinal anesthesia/adequate block. the surgery can be conducted after sensory and motor block checked with out pain and discomfort or the surgeon able to perform the operation .

1.2.Ethical Consideration

Following the research approval, Ethical clearance was obtained from the university . The purposes and the importance of the study was explained and verbal as well as written informed consent will be obtained from each participant. Confidentiality was maintained at all levels of the study by avoiding identifiers and using codes to identify patients. The participant's involvement in the study was on a voluntary basis.

1.2.1 .Dissemination of results

The final report of the study will be submitted to Addis Ababa University, School of Medicine Department of anesthesiology, AAU. The aim is to publish the findings of the study on journals .

Table 1 .WORK PLAN

	May.	June	July	Aug.	Sept	Oct.	Nov.	JAN.	Feb	Mar	Apr	May
Task												
Prepare proposal	×											
Submission of proposal for advisor review	×											
Finalize proposal for IRB submission	×											
IRB review		×										
Commence research work												
Data collection			×	×	×	×						
Data analysis							×	×				
Write up draft thesis								×				
Review by advisor									×			
Finalize thesis write up									×			
Submission for defense										×		
Revise thesis after defense											×	
Final submission											×	

Table 2-Budget of the study

category	Items	Quantity	Cost in ETB	Total / ETB
Materials and supplies	paper	1,120	2000	3120
	stabler		700	700
	Pen		100	100
printing		40	860	900
Photo copying		1,120	7,840	8,960
Transport			1,000	1000
Accommodation			3,000	3000
contingency			2,500	2500
Research assistants			4,5000	4500
Refreshments			2500	2500
				25,000 ETB

CHAPTER NINE

1. RESULTS

1.1.Socio-demographic Characteristics of Patients.

The study population included 280 adult scheduled for elective surgery who underwent spinal anesthesia. Because of incomplete data , 4 patients were not included. As a result, the sample size was 276 and the response rate of 98.5 %. The youngest age is 19 and the oldest age is 86 with a range 67. From the participants,170 (61.6%) were males and 106 (38.4%) were females.The average age of patients was 45.87 +/- 18.48, with the majority (>>61%) were below 45 years old.. The percent r of obese patients with BMI of > or = 30 were 7.1 %.(table 1).

Table-3- Socio-demographic characteristics of the study participants who underwent spinal anesthesia. (n=276) July 1st to November 30th, 2023 at TASH

Variable	Category	Frequency (n)	Percent(%)
Gender	Male	171	61.1 %
	Female	109	38.9 %
	Total	280	100%
Age in years	19-29	70	25%
	30-44	100	35.7%
	45-59	45	16.1%
	> or= 60	65	23.2%
	Total	280	100%
Height in meter	1.45-1.59	56	20%
	1.6-1.75	201	71.8%
	1.76-1.84	20	7.1%
	> or= 1.85	3	1.1%
	Total	280	100%
B.M.I in kg per m ²	< or =18.5	27	9.6%
	18.5-24.9	153	54.6%
	25-29.9	76	27.1%

	30 or more	20	7.1%
	Missing	4	1.42%
	Total	276	98.5%

BMI- body mass index Kg per m²-kilogram per meter square

1.2. Patient related factors

From 276 patients , about 149 (54%) were ASA I , 112 (40.6%) were ASA II and 15 (5.4%) were ASA III. (Table 2).The spinous process was easily palpable in 67% of patients but it was poorly palpable in 29.7% of patients and the rest (>>3%) of patients spine was not palpable.Majority of patients (n=256, 92.8%) had normal spine process anatomy and the other 20 (7.2%) of patients had spinal anatomy deformity.(table2)

Table 4. Patient characteristics July 1st to November 30th, 2023 at TASH

variable	category	frequency	percent
ASA class	ASA I	149	54%
	ASA II	112	40.6%
	ASA III	15	5.4%
Spinal anatomy	Normal	256	92.8%
	Deformed	20	7.2%
Palpability of spinous process	Easily palpable	185	67%
	Non palpable	82	29.7%
	Poorly palpable	9	3.3%
	Total	276	100%

1.3 .Technical related factors

Most of the spinal anesthesia was provided by anesthesiology resident (n=230,83.3%) and (n=22, 8%) was administered by by MSc anesthetist. The majority (n=175,63.4%) of spinal anesthesia administered were done by anesthesia providers with experience of two to five years and 28.3% of patients were anesthetized with anesthesia provider of less than 2years of experience. With respect to position during the procedure, 97.1% were done in a sitting position. Lumbar puncture was done at L3-L4 space for 217(78.6%) of patients. Quincke Spinal needle 23 G and 24 G was used in 182/ 65% and 90/ 32.1 % of patients respectively. N=156, (56.5%) of spinal anesthesia was provided with 2 or less attempts. (table 3).

Table 5. Technical related factors (n=276) July 1st to November 30th, 2023 at TASH

Variable	Category	Frequency(n)	Percent(%)
Educational statues of the anaesthesia professionals (n =276)			
Level of education	Anesthesiologist	2	.7%
	Anesthesiology resident	230	83.3%
	MSC anesthetist	22	8.0%
	MSC anesthesia student	15	5.4%
	BSC anesthetist	5	1.8%
	BSc student	2	.7%
	Total	276	100%
Experience	2yrs to 5yrs	175	63.4%
	Less than 2 yrs	78	28.3%
	More than 5yrs	23	8.3%
Technique related			
Position during spinal anesthesia	Lateral	8	2.9%
	Sitting	268	97.1%
Site of lumbar puncture	L2-L3	33	12%
	L3 -L4	217	78.6%
	L4-L5	26	9.4%
Number of spinal attempt	< or =2	156	56.5%
	>2	120	43.5%
Needle size in gauge	23 gauge	181	65.6%
	24 gauge	87	31.5%
	25 gauge	8	2.9%
Needle type	Quincke	276	100%

1.4 Drug related factors.

All patients took local anesthesia skin infiltration. Heavy 0.5 % hyperbaric bupivacaine was used for all patients and n= 188, 68.1% /Marcaine brand ,n= 73, 26.4% Sakaine brand were administered respectively. Adjuvants were added in n=243, 88% of the cases. From the Adjuvants 83.65% was morphine.

Table 6. Drug related factors (n=276) July 1st to November 30th, 2023 at TASH

Variable	Category	Frequency(=n)	Percent(%)
Type of local anesthetic.	Bupivacaine(.5%)	276	100%
Volume of local anesthetics in ml	2.5ml	4	1.4%
	3.5ml	14	5%
	3ml	255	92.3%
	4ml	3	1%
Baricity	Hyperbaric	276	100%
Brand	Bupicain	15	5.4%
	Marcaine	188	68.1%
	Sakaine	73	26.4%
Adjuvants	yes	243	88.%
	No	33	12.%
	Morphine	204	83.6%
	Morphine + dexa.	33	13.6%
	Fentanyl	6	2.5%
	Total	243	100%

1.5. Characteristics of cerebrospinal fluid

During spinal anesthesia procedure, the appearance of clear CSF accounts 77.2% whereas 22.8% are bloody CSF respectively.

Table 7.Characteristics of cerebrospinal fluid (n=276)

Variable	Category	Frequency (n)	Percent (%)
CSF color	Bloody	63	22.8%
	Clear	213	77.2%

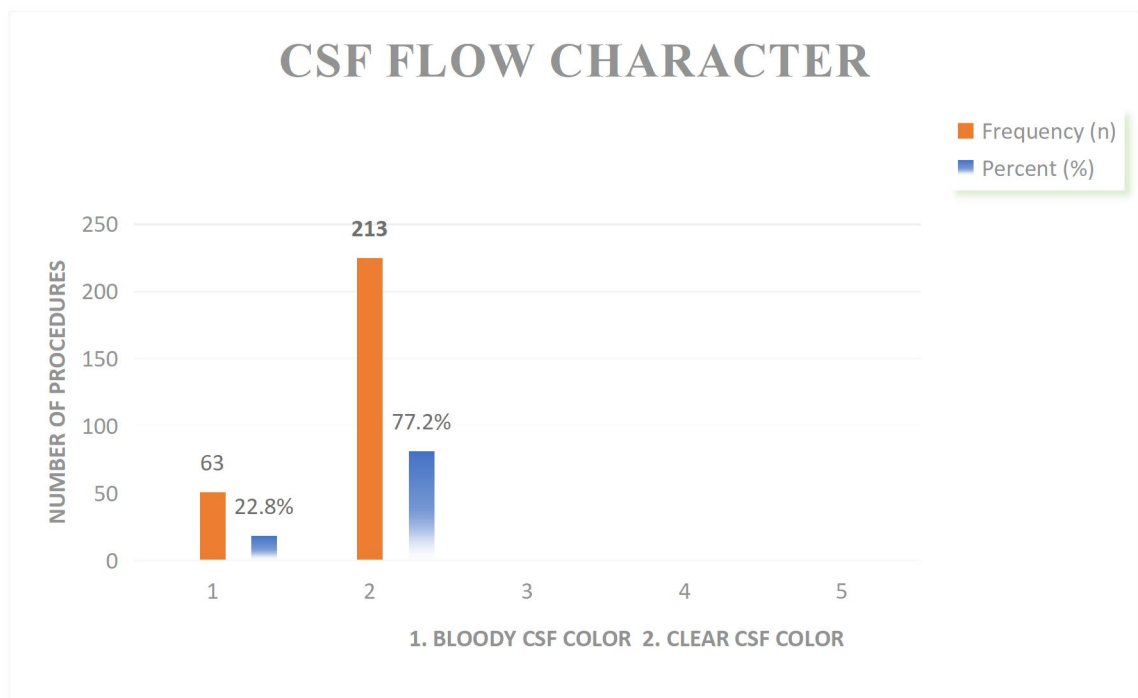


Figure 1. Characteristics of cerebrospinal fluid July 1st to November 30th, 2023 at TASH

1.6. Factors related with surgery.

Urologic surgery was the most common type of operation (n =122 , 44.2 %) followed by orthopedic surgery (n =112 ,40.6 %), gynecologic surgery (n =26 ,9.4%), general surgery (n =26 ,9.4%) and vascular surgery (n =5 , 1.8%) respectively. All of the cases were elective surgery.

Table 8.Type of surgery July 1st to November 30th, 2023 at TASH

Variable	Category	Frequency(n)	Percent(%)
Type of surgery	Vascular	5	1.8
	Urologic	122	44.2
	Orthopedic	112	40.6
	Gynecology surgery	26	9.4
	General surgery	11	4.0
		276	100
Type of surgery	Elective	276	100
Variable	Category	Frequency(n)	Percent(%)
Type of surgery	Vascular	5	1.8
	Urologic	122	44.2
	Orthopedic	112	40.6
	Gynecology surgery	26	9.4
	General surgery	11	4.0
		276	100
Urgency of the surgery	Elective	276	100

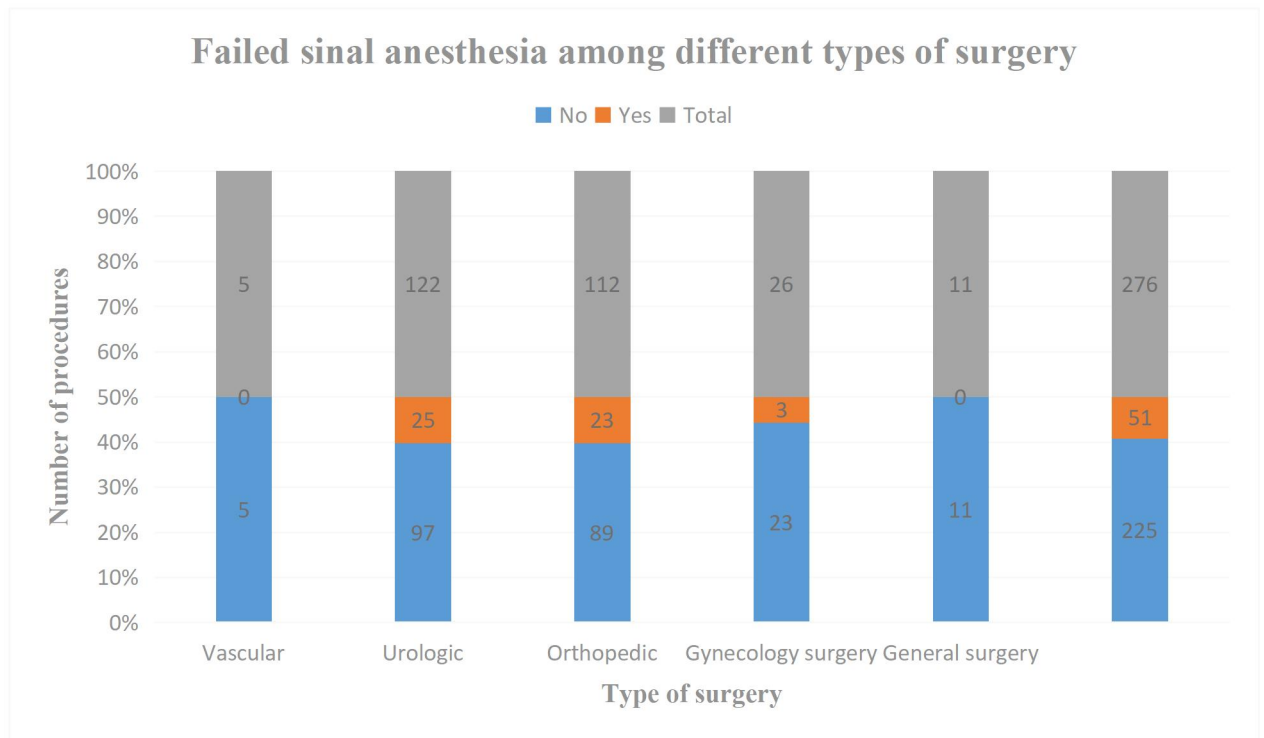


Figure 2-Failed spinal anesthesia among different types of surgery July 1st to November 30th, 2023 at TASH

1.7. Sensory and motor block assessment after spinal anesthesia

The extent of spinal anaesthesia for sensory and motor blockage before surgery was determined using temperature sensation, light touch, pin prick. Most of sensory levels (39.9%) and (38.8%) were assessed using a temperature with alcohol swab and pinprick respectively. The majority of sensory block level assessments showed a loss of sensation (33%) and weak sensation (51.4%) using a modified Holmen scale. . The degree of motor blockade was evaluated using the modified Bromage scale, where the majority of assessments (74.3%) showed an inability to move the feet or knee. (Bromage grade 1).

1.8. Incidence of failed spinal anaesthesia.

Generally, incidence of failed spinal anaesthesia was 18.5 % (n =51/276).

Concerning failure type, majority was complete failure 30 (58.8%) while 21 (41.2%) was partially failed. Complete failure management was by conversion to GA and repeating the block while supplemental analgesia and sedation was applied for partial failure.

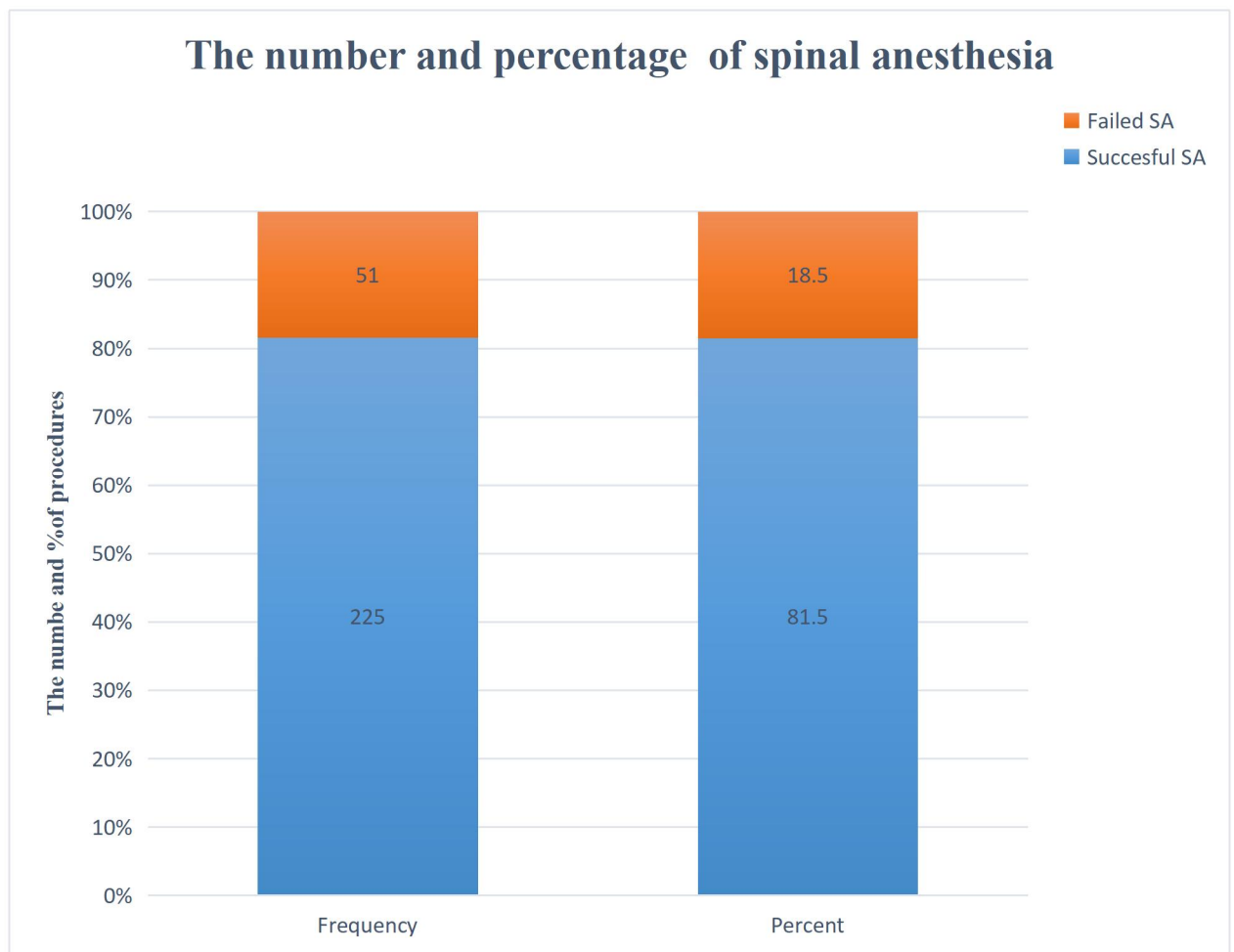


Figure 3 .The incidence of failed spinal anaesthesia in frequency and in percentage. July 1st to November 30th, 2023 at TASH

CHAPTER TEN.

1.Factors associated with failed spinal anesthesia.

The variables with p value of less than 0.25 from bi variate logistic regression include the educational level of the anaesthesia provider ,the work experience of the anaesthesia provider, characteristics of CSF appearance, needle size, ASA class, and types of surgery.

And gender, age, height, weight, BMI, position during the procedure, palpability of spinous anatomy, spinal deformity , site of puncture, skin infiltration, brand of the drug and Baricity were not fitted for multiple regression model.

The number of attempts during lumbar puncture , work experience of the anaesthesia provider , and cerebrospinal fluid (CSF) flow appearance has strong association with failed spinal anaesthesia from the multi- variable logistic regression with p value < 0.05.

Table 9 . Bi variate Logistic Regression analysis showing factors associated for failed spinal anesthesia

Variable	spinal anesthesia		COR	95% C.I for exp (B)		P value	
	Failed n %	Success n %					
Number of spinal attempt	>2	37(32.4)	77(67.6%)	5.080	2.589	9.965	0.000002
	< or =2	14(8.6 %)	148 (91.4%)	1			
CSF character	Bloody	21(33.3%)	42(66.7%)	3.050	1.591	5.847	0.0008
	Clear	30(14%)	183 (86%)	1			
Experience of the anesthesia provider	< 2yrs	29 (37.2)	49 (62.8%)	4.587	2.385	8.821	0.000005
	>or=2yrs	22(11.1%)	176(88.9%)	1			
ASA classification	ASA I	20(13.4%)	129 (86.6%)	1			0.004
	ASA II	30(26.9%)	82 (73.1%)	1.578	1.158	2.152	
Needle size in gauge	23 G	29 (16%)	152(84%)	0.633	0.340	1.177	0.149
	24 G	20(22.9%)	67(77.1%)	1.233	0.900	1.691	0.192
	25 G	2(25%)	6 (75%)	1.142	0.663	1.966	0.632
Site of lumbar puncture	L2-L3	8(24.2%)	25(75.8%)	1.488	0.629	3.523	0.366
	L3-L4	38(17.5%)	179(82.5%)	0.867	0.608	1.235	0.428
Brand of the drugs	Marcaine	35(18.6%)	153(81.4)	0.629	0.189	2.093	0.450
	Sakaine	12(16.4%)	61(83.6%)	0.541	0.147	1.987	0.355
	Bupicain	4(26.7%)	11(73.3%)	1			

1.1. Multivariate analysis showing factors associated with failed spinal anesthesia (N = 276).

Work experience of the anaesthesia provider, cerebrospinal fluid (CSF) flow appearance, and the count of spinal attempts had significant association with failed spinal anaesthesia from the multi- variable logistic regression with p value < 0.05(**Table 10**).

The results of a multivariate logistic regression analysis on factors affecting the success of spinal anesthesia. The analysis found that spinal anesthesia administered by anesthesia providers with less than 2 years of work experience was 4.5 times more likely to fail than those with two or more years of experience (AOR = 4.574, 95% CI = 2.231-9.378). Additionally, the appearance of bloody cerebrospinal fluid during lumbar puncture was associated with a three-fold increase in the likelihood of failure compared to clear flow of cerebrospinal fluid (AOR = 3.514, 95% CI = 1.662-7.430). Finally, the analysis revealed that having attempted spinal anesthesia more than two times was associated with a five-fold increase in the likelihood of failure compared to attempting it less than two times (AOR = 4.812, 95% CI = 2.347-9.866).

Table 10. Multivariate analysis showing factors associated with failed spinal anesthesia (N = 276)

Variable		spinal anesthesia		COR(95% CI)	AOR (95%C.I)	P value
		Failed n %	Success n %			
Number of spinal attempt	> 2	37(32.4%)	77(67.6%)	5.080 (2.589-9.965)	4.812(2.347-9.866)	0.000018
	<or =2	14 (8.6 %)	148(91.4%)	1		
CSF character	Bloody	21(33.3%)	42(66.7%)	3.050 (1.591-5.847)	3.514(1.662-7.430)	0.001
	Clear	30(18.7%)	183 (81.3%)	1		
Experience of the anesthesia provider	< 2yrs	32 (41%)	46 (59%)	4.587 (2.385-8.821)	4.574(2.231-9.378)	0.00033
	>or=2yrs	19 (9.6%)	179(90.4%)	1		

COR – Crude odd ratio CI - Confidence interval AOR – Adjusted odd ratio CSF- cerebrospinal fluid

CHAPTER ELEVEN.

1. Discussion.

The study reports a higher failure rate of 18.5% for spinal anesthesia when compared to similar studies conducted in the past. Since previous research showed that the incidence of failed spinal anesthesia ranged from 1% to 17%. Our study had a higher failure rate than studies by Colish, Jane, et al. (2020) at 3.8% and Fuzier et al. (2011) at 3.2%. The result could be due to the involvement of junior anesthesiology residents and those with less than two years of experience in performing spinal procedures, which was a significant factor contributing to the failure of spinal anesthesia. However, the failure rate is lower when compared to studies conducted in our country such as Ashagrie et al. (2020) at 19.5% and Ribka et al. (2021) at 21.01%.

This study indicated that work experience level of the anaesthesia providers is a significant factor in the failure of spinal anesthesia. Spinal anesthesia which was done by anesthesia provider with less than 2 yrs experience has 4.5 x more likely to fail. Of a total of 276 patients, 28.2% of spinal anesthesia were provided by anaesthesia practitioners with less than 2yrs of experience and the failure rate of 41%. This finding is similar to the study done in Nigerian teaching hospital showed by Rukewe et al (2015)(5) that the failure of spinal anaesthesia was highly associated with work experience of the anaesthetist. The possible reason why this high incidence occurred in our study might be due to the fact that our study was conducted in teaching hospitals and there were anaesthesia practitioners which might contribute for the failure. In addition, Ashagrie et al. also reports that failure of spinal anesthesia has significant association with work experience of anaesthesia provider. Experience plays a significant role in every aspect of the spinal anesthesia procedure, including drug selection and the proper positioning of patients during and after the procedure.

This study reveals that the incidence of failed spinal anaesthesia were higher in certain type surgery like orthopedic and urologic surgery each account for 20% rate of failed spinal anesthesia. The high value observed could be attributed to the large sample size were taken from these areas. This might be due to the pain in orthopedic

patients makes optimal positioning difficult as Gill et al., (2020) orthopedic patients have repeated failures due to the fact that these patients calcification of bones and ligaments such as in geriatrics complicates the procedure (18).

This study found that an appearance of bloody mixed CSF characteristic during lumbar puncture increases the likelihood of failure by about three and half times more likely to fail as compared with clear flow of CSF (AOR =3.514 , 95% CI = 1.662-7.430).The study group primarily used the quincke type cutting needle for spinal procedures, which is known for being traumatic. It is also agreed that inaccurate placement of the spinal needle in a blood vessel, as stated by Alabi et al. (2017), is a significant contributor to the failure of spinal blocks.Studies that pointed bloody CSF as a predictor for failed spinal anesthesia were Alabi et al., (2017) , Ashagrie HE et al (2019) , Ribika et al (2021).

Repeated attempts of more than two times has five times more likely to fail than the spinal attempted less than two times (AOR=4.812, 95%, CI=2.347-9.866).This result corresponds to previous studies conducted by Fuzier R et al (2011), Alabi AA et al. (2017), Ribika et al (2021) and Rukewe et al. (2015). The cause of this may be attributed to the inability to precisely access the subarachnoid space due to poor patient positioning, incorrect needle placement, or difficulty palpating the inter-spinous space, which may be related to the skill level of the anesthesia providers.

In this study, we did not find association between failed spinal anesthesia and socio demographic variables like age ,ASA statues and BMI . According to Aavang et al(2018) and Fuzier et al(2011) reported that younger age is significantly associated with failed spinal anesthesia. As Kim et al., (2015) reported, the influence of BMI on spinal anesthesia is still controversial The reason why obesity was not significantly associated with failed spinal anesthesia in case of our study might be there were small number of overweight patients 7% were BMI > 30 kg/m².

In this study, we did not find significant association between failure of spinal anaesthesia and sit of lumbar puncture, use of adjuvants, volume of the drug and position during the procedure. Even though some studies reports that like Nigerian

teaching hospital use of the L4/L5 inter space for lumbar puncture site increase chance of spinal anesthesia failure rate .

Fuzier et al.(2011) also reported in their study that the absence of adjuvants medication with the local anesthetics is a significant predictor factor for failed spinal anesthesia. The use of adjuvants can help patients feel more comfortable and improve the success of the procedure for anesthesia providers. In addition adding adjuvants can potentiate local anaesthetic drugs effect and increased the quality of block so it prolonged the duration of anesthesia.

The brief review indicates that there are both similarities and disparities in the results. The variation in the findings can be attributed to the diverse technical settings and other relevant parameters involved in the study

1.2. Limitation of the study

- The study was limited as the anaesthesia provider responsible for managing the patients were not blinded while collecting data.
- its a cross sectional study and could not establish causality,
- No common concept to define failed spinal anesthesia.
- Different technical factors including level of the surgeon, duration of surgery, needle approach, position after lumbar puncture.

1.3. Strength of the study

- The study tried to find out the incidence of failed spinal anesthesia in particular surgical procedures excluding obstetric and emergency procedures as its associated with high spinal failure rate .
- The first study to consider brand of the local anesthesia effect on failed spinal anesthesia.
- The study met the main objectives.

CHAPTER TWELVE.

1.Conclusion and Recommendations

1.1. Conclusion

According to the study's findings, the rate of failed spinal anesthesia is greater than in previous studies, potentially due to the fact that this particular study was conducted at educational institutions .

1.2.Recommendations

- Simulation training should be given for anesthesia trainees to upgrade their skills and to become competent anesthesia provider..
- It is important to conduct several similar but multicenterd studies to enhance understanding and management of the high incidence of failed spinal anesthesia.
- Anesthesia providers should be informed of the elevated incidence rate to take necessary precautions.
- Advocate in practicing careful techniques at each step of the spinal procedure.

1.3. REFERENCE.

1. Fettes, P.D.W., Jansson, J.R., Wildsmith, J.A.W. (2009). Failed spinal anesthesia: Mechanisms, management, and prevention. *British Journal of Anaesthesia*, 102.
2. Olawin, A.M., & Das, J.M. (2020). Spinal anesthesia. *Stat-pearls*. https://www.ncbi.nlm.nih.gov/books/NBK430789/pdf/Bookshelf_NBK430789.pdf
3. Ashagrie, H.E., Filatie, T.D., Melesse, D.Y., Mustefa, S.Y. (2020). The incidence and factors associated with intraoperative nausea and vomiting during cesarean section under spinal anesthesia, July 2019. An institution based cross sectional study. *International Journal of Surgery Open*, 26(July 2019), 49-54. doi: 10.1016/j.ijso.2020.05.007
4. Fuzier, R., Bataille, B., Fuzier, V., Richez, A.S., Maguès, J.P., Choquet, O., et al. (2011). Spinal anesthesia failure after local anesthetic injection into cerebrospinal fluid: A multicenter prospective analysis of its incidence and related risk factors in 1214 patients. *Regional Anesthesia and Pain Medicine*, 36(4), 322-326. doi: 10.1097/AAP.0b013e3182256409
5. Yüksek, A., Miniksar, Ö.H., Honca, M., & Öz, H. (2020). Incidence and causes of failed spinal anesthesia. *Dubai Medical Journal*, 3(2). doi: 10.1159/000507631
6. Colish, J., Milne, A.D., Brousseau, P., & Uppal, V. (2020). Factors associated with failure of spinal anesthetic: An 8-year retrospective analysis of patients undergoing elective hip and knee joint arthroplasty. *Anesthesia and Analgesia*, 130(1), e19-e22. doi: 10.1213/ANE.0000000000004557

7. Kim, H., Kim, W.H., Lim, H.W., Kim, J.A., & Kim, D. (2015). Obesity is independently associated with spinal anesthesia outcomes: A prospective observational study. *Anesthesiology Research and Practice*, 2015, 1-11. doi: 10.1155/2015/908047
8. Rattenberry, W., Hertling, A., & Erskine, R. (2019). Spinal anaesthesia for ambulatory surgery. *BJA Education*, 19(10), 321-328. doi: 10.1016/j.bjae.2019.06.002
9. Sivevski, A.G., Karadjova, D., Ivanov, E., & Kartalov, A. (2018). Neuraxial anesthesia in the geriatric patient. *Frontiers in Medicine*, 5(SEP), 3-6. doi: 10.3389/fmed.2018.00242
10. Eroglu, A., Apan, A., Erturk, E., & Ben-Shlomo, I. (2015). Comparison of the anesthetic techniques. *The Scientific World Journal*, 2015, 2-4. doi: 10.1155/2015/685938
11. Abraham, A.A., & Philip, J. (2013). Failed spinal anesthesia-management by giving a second spinal. *Sri Lankan Journal of Anesthesiology*, 21, 14-19.
12. Guay, J., Choi, P.T., Suresh, S., Albert, N., Kopp, S., & Pace, N.L. (2014). Neuraxial anesthesia for the prevention of postoperative mortality and major morbidity. *Anesthesia and Analgesia*, 119(3), 716-725. doi: 10.1213/ANE.0000000000000320
13. Lin, C., Darling, C., & Tsui, B.C.H. (2019). Practical regional anesthesia guide for elderly patients. *Drugs and Aging*, 36(3), 213-234. doi: 10.1007/s40266-019-00655-114. Pu X, Sun JM. General anesthesia vs spinal anesthesia for patients undergoing totalhip arthroplasty: A meta-analysis. *Medicine (Baltimore)*. 2019;98(16):e14925. Retrieved from <https://doi.org/10.1097/MD.00000000000014925>

14. Parikh KS, Seetharamaiah S. Approach to failed spinal anaesthesia for Caesarean section. Vol. 62, Indian Journal of Anaesthesia. 2018. Retrieved from https://doi.org/10.4103/ija.IJA_458_17

15. Alabi AA, Adeniyi OV, Adeleke OA, Pillay P, Haffajee MR. Factors associated with failed spinal anaesthesia for Caesarean sections in Mthatha general hospital, Eastern Cape, South African Fam Pract [Internet].2017;59(4):128–32. Retrieved from <https://doi.org/10.1080/20786204.2017.1321060>

16. Dohlman LE, Kwikiriza A, Ehie O. Benefits and barriers to increasing regional anesthesia in resource-limited settings. Local Reg Anesthesia. 2020;13:147–58. Retrieved from <https://doi.org/10.2147/LRA.S176634>

17. Jones GW, Samuel RA, Biccard BM. Management of failed spinal anaesthesia for caesarean section. South African Med J. 2017;107(7):611.

18. . Tsegaye, Ribika. incidence and associated factors on Adults Undergoing Elective Surgery in Selected Public hospitals at Addis Ababa: a cross sectional study. Addis Ababa university, june 2021.etd.aau.edu

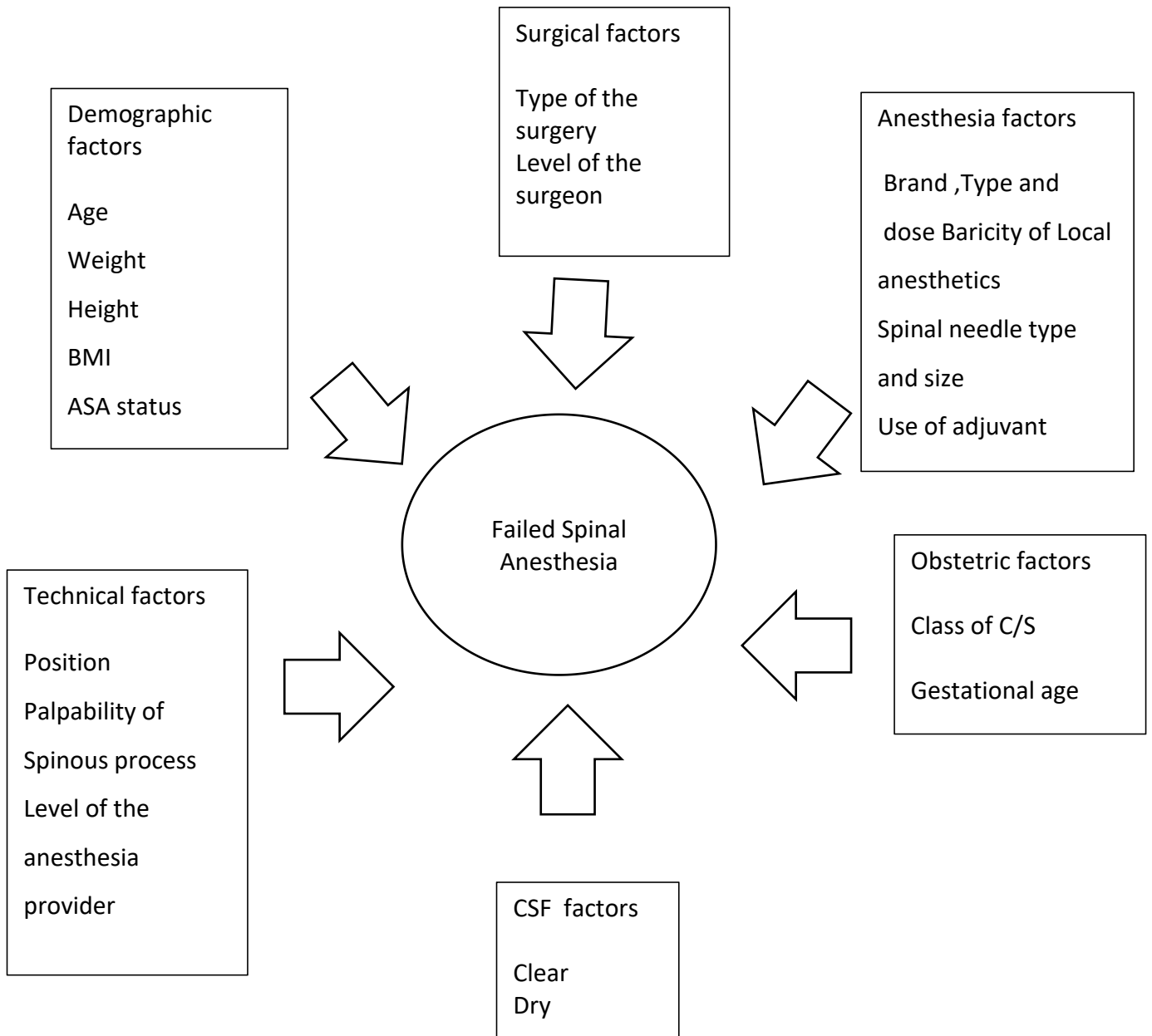
19. Parikh KS, Seetharamaiah S. Approach to failed spinal anaesthesia for Caesarean section. Vol. 62, Indian Journal of Anaesthesia. 2018. Retrieved from https://doi.org/10.4103/ija.IJA_458_17

20. Alabi AA, Adeniyi OV, Adeleke OA, Pillay P, Haffajee MR. Factors associated with failed spinal anaesthesia for Caesarean sections in Mthatha general hospital, Eastern Cape, South African Fam Pract [Internet]. 2017;59(4):128–32.

Retrieved from <https://doi.org/10.1080/20786204.2017.1321060>

21. Kuczkowski, K. M. (2007). Failed spinal anesthesia. In *Anesthesia and perioperative care for aortic surgery* (pp. 303-308). Springer, Boston, MA.
22. Banerjee, A., & Stovall, R. (2020). Failed spinal anesthesia. In *StatPearls* [Internet]. StatPearls Publishing.
23. Agrawal, A., Kaur, T., & Goswami, D. (2017). Failed spinal anaesthesia: causes and management. *Indian Journal of Anaesthesia*, 61(3), 192–195. https://doi.org/10.4103/ija.IJA_728_16
24. 1. Schreiber, K., & Aunspach, M. (2021). Failed spinal anesthesia: analysis, prevention, and management. *Journal of Perioperative Practice*, 31(4), 93-96.
25. Mariano, E. R., Kim, T. E., Wagner, M. J., Funck, N., Harrison, T. K., Walters, T. L., & Ma, C. (2015). A randomized comparison of proximal and distal ultrasound-guided adductor canal catheter insertion sites for knee arthroplasty. *Journal of Ultrasound in Medicine*, 34(9), 1651-1658.
26. Pu X, Sun JM. General anesthesia vs spinal anesthesia for patients undergoing totalhip arthroplasty: A meta-analysis. *Medicine (Baltimore)*. 2019;98(16):e14925. Retrieved from <https://doi.org/10.1097/MD.00000000000014925>

Figure 4. Conceptual Frame Work



1.4. Informed Consent Form

Addis Ababa University College of Health Sciences School of Medicine Department of Anesthesiology, critical care and pain medicine.

Welcome to My Survey ,

I amdata collector for the study. Thank you for participating in this survey. Your feedback is important.

Please answer the following questions as honestly as possible. These questions concern about failed spinal anesthesia.

The purpose of this survey is to help the researcher measure incidence and associated factors of failed spinal anesthesia. I do not anticipate that taking this survey will contain any risk or inconvenience to you. Furthermore, your participation is strictly voluntary and you may withdraw your participation at any time without penalty.

All information collected will be used only for my research and will be kept confidential. There will be no connection to you specifically in the results or in future publication of the results.

If you have any questions please ask investigator:

Thank you for taking part in the survey!

Signature of the observer..... Date/...../.....

For further questions Investigator :-

Dr.Abraham Eshete

Email > abrahameshete@gmail.com

Mobile:- 0920 80 27 98

1.5. Survey Questionnaire

Principal Investigator:- Dr.Abraham Eshete (ACCPM RESIDENT)

- Advisors:**
1. Dr.Birhane Tesfaye (assistant professor of anesthesiology ,critical care and pain medicine)
 2. Dr.Blen Ayele (assistant professor of pediatric anesthesiologist)

Study Title: Incidence and associated factors of failed spinal anesthesia on adults undergoing elective surgery in TASH at Addis Ababa, Ethiopia .

Part I :- Patient Information

Card Number : _____

Age in years : _____ Sex : Male Female

weight in kg : _____ Height in cm _____ BMI _____

Part II :- Clinical Status ASA Classification

ASA I ASA III
ASA II ASA IV

Part III Level of Education and experience

Status of Anesthesia provider

- a) Anesthesiology Resident.....
- b) Anesthesiologist
- c) BSc Anesthetist
- d) MSc Anesthesia student.....
- e) MSc Anesthetist
- f) BSc Student.....

Experience

- a) Less than two years
- b) Two to five years
- c) Greater than 5 year

Part IV :- Type surgery

- Orthopedic surgery
 - General surgery
 - vascular surgery
 - Urologic surgery
 - gynecologic surgery
-

PART V :Technique

I Position

- Sitting Position
- l Position

II Palpability of Spinous process

- Easily palpable
- Non palpable
- Poorly palpable

III .Site of lumbar puncture:

- L2 - L3
- L3 - L4
- L4 - L5

IV .Spinal anatomy

- Normal
- Deformed

V . Needle size gauge—

VI. local anesthesia infiltration performed before attempt?

- YES
- NO

PART V . CSF characteristics

- Clear
 - Dry tap
 - Bloody
-

PART VI local anesthetic drug

Brand of the drugs -----.

Dose Bupivacaine (0.5%) ----- ml

Lidocaine (5%) _____ ml

Lidocaine (7.5%) _____ ml

Adjuvants, if yes, specify 1 _____ 2 _____

Baricity Hyperbaric Hypobaric Isobaric

PART VII Number of spinal attempts

1 Attempt 2 Attempt > 2 Attempts

PART VIII Sensory level assessed

using Temperature sensation
Light touch
Pin prick
Not assessed

PART IX Sensory block using a modified Hollmen scale

Grade 1 = full sensation
Grade 2 = weak sensation
Grade 3 = Recognized as light touch
Grade 4 = Loss of sensation

PART X Degree of Motor blockade based on modified Bromage scale ;

1= .Unable to move legs or feet. / complete block
2= .Free movement of feet only./ almost complete block
3= .Just able to flex knees./partial block
4= .Free movement of legs and feet/ no block

PART XI Was the spinal block adequate for surgery?

Yes No

PART XII If the answer is No for the above question, is it?

Partial failure
Complete failure