ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE DEPARTMENT OF ANESTHESIA

COMPARISION OF THE EFFECT OF GENERAL ANESTHESIA VERSUS SPINAL ANESTHESIA ON NEW-BORN AND MATERNAL OUTCOMES AMONG CATEGORY-1 CAESAREAN SECTION CLIENTS AT GHANDI MEMORIAL HOSPITAL ADDIS ABABA, ETHIOPIA, 2024: A PROSPECTIVE COHORT STUDY.

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

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ADDIS ABAB ETHIOPIA

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Title	Comparison of the effect of general anesthesia versus spinal anesthesia on new-born and maternal outcomes among category-1 caesarean section clients at Ghandi memorial hospital Addis Ababa, Ethiopia 2024: A prospective cohort study
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DECLARATION

This research thesis entitled “Comparison of the effect of general anesthesia versus spinal anesthesia on new-born and maternal outcomes among category-1 caesarean section clients at Ghandi memorial hospital Addis Ababa, Ethiopia 2024: A prospective cohort study” was prepared by Eshetu Tomas. A thesis submitted to the department of Anesthesia School of Medicine College of health science Addis Ababa University as partial fulfilment of requirement for the degree of masters of Science in advanced clinical Anesthesia.

Submitted by:

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This thesis work has been submitted for examination with my approval as an advisor.

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ABBREVIATIONS AND ACRONYMS

CI-Confidence Interval

CS-Cesarean Section

DDI-Decision to Delivery Interval

GA-General Anesthesia

Ho- Null Hypothesis

HA- Alternative Hypothesis

HR-Heart Rate

ICU-Intensive Care Unit

MAP-Mean Arterial Pressure

MSc- Master of Science

NICU-Neonatal Intensive Care Unit

SA-Spinal Anesthesia

SD-Standard Deviations

UIDI-Uterine Incision to Delivery Interval

ABSTRACT

Background- When used for cesarean sections, both spinal anesthesia and general anesthesia have certain advantages as well as disadvantages. Because of time limitations, general anesthesia is still preferred for category-1 cesarean sections despite its drawbacks. Hence, this study aims to compare of general anesthesia versus spinal anesthesia on new-born and maternal outcomes in clients undergoing category-1 cesarean sections.

Objective: To compare the effect of general anesthesia versus spinal anesthesia on new born and maternal outcomes among category-1 caesarean sections clients from February 1/2024 to April 30/2024.

Method: Institutional based prospective cohort study was conducted at Ghandi memorial hospital Addis Ababa Ethiopia. 152 clients who had emergency category-1 cesarean sections included based on inclusion criteria. Clients were subdivided into 2 groups (General anesthesia 91 and Spinal anesthesia 61). A well-structured questionnaire was used to collect the data. New born and maternal outcome were compared between the study groups. Version 26 of SPSS was used for the statistical analysis.

The collected data were entered into SPSS software version 26.0 for analysis. The Chi-square/Fischer exact test was used to compare categorical data and an independent sample t test or Mann–Whitney U test was used to compare continuous data as appropriate. The p-value of 0.05 was taken as a cut-off point to determine statistical significance.

Result: A total of 152 who underwent category-1 cesarean section clients were enrolled in this study and were included for analysis. General anesthesia group (91) and spinal anesthesia group (61). The general anesthesia group's 1- and 5-minute Apgar scores were significantly lower than those of the spinal anesthesia group, with median value of 7(7-8) vs 8(7-8), $p < 0.001$ at 1 min and 8(8-8) vs 9(8-9), $p< 0.001$ at 5 min respectively.

Conclusion and recommendation: In this study, general anesthesia for category 1 CS was associated with a higher risk of unfavourable neonatal outcomes. Our recommendation is to give preference to spinal anesthesia over general anesthesia.

Key words: Category 1 caesarean section, general anaesthesia, spinal anaesthesia, new born outcomes and maternal outcomes.

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CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Pregnant women most commonly undergo Category-1 emergency cesarean section delivery, which is associated with a high rate of maternal and fetal mortality and morbidity worldwide[1].

Pregnant women undergo Category-1 emergency cesarean section deliveries, which are associated with a high rate of maternal and fetal mortality and morbidity worldwide [2].

There are four categories for CS urgency as follow: Category-1: an immediate threat to the life of the mother or the foetus, Category-2: a maternal or fetal compromise that is not immediately life-threatening, Category-3: need early delivery but no maternal or fetal compromise Category-4: at a time that is convenient for the woman and the maternity team [3].

According to a UK survey, 10% of cesarean sections performed were categorised as category-1 cases, which were linked to increased morbidity and mortality. The anesthetic method is determined by a number of variables, such as the urgency and indication of the procedure, any pre-existing medical conditions, and the mother's preference. Therefore, selecting the best technique requires effective collaboration between anesthetists, midwives, and obstetricians [4].

The indications of category-1 cesarean sections include; Foetal distress, Breech presentation, Cord prolapse, Placental abruption, Failed instrumental delivery, Severe antepartum haemorrhage, Other malpresentations, Cephalopelvic disproportion, Uterine rupture, Placenta praevia, Twin pregnancy in labour, Multiple previous CS and Severe preeclampsia/eclampsia [5].

When compared to regional anesthesia (RA), general anesthesia (GA) is known to have a 17-fold higher risk of maternal death. A poorly coordinated team could result in excessively high GA rates [6]. Compared to other categories, category 1 caesarean section has a much higher rate (51%) of GA, which is still a major, direct contributing factor in maternal mortality and morbidity [4].

The current standard of care for women who need an urgent caesarean section is the 30-minute decision-to-delivery interval (DDI)[7]. Since there is an immediate hazard to the woman or the foetus, Category 1 CS should be carried out as soon as possible, ideally within 30 minutes of the decision [8]. Previous reviews have shown poor new born outcomes are linked to category-1 caesarean sections, particularly in relation to admissions to the neonatal intensive care unit (NICU) and morbidity related to the new-born's respiratory and neurological systems [9].

Maintaining a distinct balance between the MAC (Mean Alveolar Concentration) during general anaesthesia may not always be feasible in order to keep the mother from becoming aware of what is happening and to keep the already vulnerable foetus from developing neonatal depression. However, the anesthesia team tends to maintain the mother's adequate level of anesthesia, which may lead to the placental passage of anesthetic drugs (opioids, induction agents, and inhalational agents), which may then have an impact on the newborn's health[10].

The ratios of anesthetic agents to mothers indicate that there is little transfer of the drug across the placenta; but, in cases of category 1 CS, where the foetus is already compromised, it could be sufficient to cause depression in a new-born [11]. The 1- and 5-min Apgar scores of clients being given GA for category 1 CS were significantly lower than those of clients being given SA. Various degree of intra operative hypotension can be observed when spinal anesthesia given for category -1 CS [12].

Insufficient sensory level, conversion to GA, and difficult regional conditions are some more disadvantages of SA, all of which might lengthen the gap between decisions to delivery time and, as a result, impact the outcome for the new born [13]. Because of the physiological changes that result in a higher risk of aspiration, difficulty manipulating the airway, and low oxygen reserve, GA is regarded as high risk in obstetric patients[14, 15].

The appropriate selection of anaesthetic technique is crucial due to limited time and high risk, which makes both maternal and new born outcomes dependent on the anaesthetist's coordinating care [16]. Even though, there are many previous evidences that have evaluated the outcomes for the new born and mother using these two anaesthetic techniques, there are very few evidences that addressed category 1 CS in our country.

Hence, this study aimed to provide valuable insights into the impact of general anesthesia or spinal anesthesia choice on new born and maternal outcomes in Category-1 CS. This research within the regional context of the study area will contribute to the improvement of new born and maternal care practices in our healthcare system.

1.2 STATEMENT OF PROBLEM

According to a UK survey, ten percent of cesarean sections performed were categorised as category-1 cases, which were linked to increased morbidity and mortality. And category-1 CS performed when there is an immediate threat to the life of the mother or the foetus[3, 4]. GA and SA are most common anaesthetic techniques used for Category-1 CS. And decision to use one of them based upon on a number of variables, including urgency, the severity of C/S, the presence of associated health issues, the client's preferences, and the preferences and experience of the anaesthetist and surgeon[17].

General anesthesia causes more new-born and maternal morbidity, spinal anesthesia (SA), which has a Grade-A recommendation from the National Institute of Health and Clinical Excellence (NICE), has become the recommended technique in categories 2, 3, and 4 [6]. But Afolabi and Lesi's meta-analysis of CS for both elective and emergency surgery did not find any evidence to support SA's superiority over general anesthesia[7].

The decision between spinal and general anesthesia can have significant impacts on the outcomes for new-borns and mother[12, 13, 18]. However, the evidence regarding specific effects of these anesthesia techniques on new born and maternal outcomes in category-1 C-sections are limited. There is a need to compare the new born and maternal outcomes associated with these two anesthesia techniques in order to provide evidence-based guidelines for clinical practice.

Understanding the impacts of GA versus SA in category 1 CS is crucial for improving clinical practices and outcomes. New born outcomes including Apgar scores, need for neonatal intensive care unit admission, and short-term morbidity, as well as maternal outcomes such intra-operative hemodynamic, ICU admission, postoperative complications and overall safety are influenced by the type of anesthesia used during category 1 CS[12, 13]. Because clinical practice optimization can significantly improve patient care and resource allocation, this research is especially relevant to Ethiopia, a country with limited healthcare resources.

This prospective cohort study aims to compare effect of general anesthesia versus spinal anesthesia on new born and maternal outcome. By achieving this objective, study aims to improve clinical decision-making, new born and maternal care quality, and the development of standardized protocols for anesthesia use in category 1 emergency CS.

1.3 SIGNIFICANCE OF THE STUDY

The study will offer useful practical experience on the effect of anesthetic method on the new born and maternal outcome in category 1 caesarean sections, which are carried out when the fetal or mother lives are in immediate danger. It will provide more information on the advantages and disadvantage of GA and SA for category-1 CS, which are the most serious and life-threatening circumstances for the new born and mother.

Taking the new born and maternal outcomes as well as the time limitations into consideration, result of this study would help physicians and clients in making evidence-based decisions about the appropriate anaesthetic technique for category-1 CS. It would contribute to the improvement of the quality and safety of obstetric anesthesia and reduce the new born and maternal morbidity and mortality associated with category-1 CS. The result of this study would reduce the client's unnecessary expense on pricey medications and supplies. It will serve as a valuable resource for administrators, policy makers, future researchers, and educational projects.

The study will contribute to the body of knowledge already available on the subject of general anesthesia (GA) versus spinal anesthesia (SA) for category 1 CS. A more precise estimate of the effect size and confidence interval will be provided by the results of this study, which may also help to settle the conflicting evidence regarding the superiority of SA or GA for category 1 CS. The findings of this study would be used to inform clinical practice and policy.

CHAPTER TWO: LITERATURE REVIEW

2.1 CATEGORY-1 CAESAREAN SECTION

A category-1 caesarean section is a subset of cases in which the mother or the foetus are in immediate danger and face life-threatening conditions; in these cases, delivery must take place as soon as possible following the decision [1].

According to a report on the CS rate from 1990 to 2018 for nations worldwide, the rate of CS is still increasing in high-, middle-, and low-income countries [19]. In the least and most developed regions, respectively, the caesarean section (CS) rate ranges from 6.0% to 27.2%, with the average rate worldwide being 18.6% [20]. According to the Ethiopian Demographic Health Survey (EDHS) 2019 report, the overall increase in the CS was 0.7% from 1995 to 2019 at 6%. The rate of CS rose from 5.1% in 1995 to 16% in an urban area and from 0.001 in 1995 to 3% in a rural area. AOR = 2.79; 95% CI: 1.92, 4.07) and 34–49 years (AOR = 5.23; 95% CI: 2.85, 9.59) were the age groups with the highest odds of having a CS[21]

Although the rate of caesarean deliveries continues to rise, there are still increased rates of new-born and maternal morbidity and mortality that are associated with both surgical skill and anaesthesia technique used [22]. There is still no one ideal anaesthetic approach to be employed in the category 1 C/S, despite the change in practice toward spinal anaesthetic [23].

Prospective observational study conducted at a tertiary care institute in south India (2018) on 114 clients by Thangaswamy et al. [13] compared spinal anesthesia (SA) with general anesthesia (GA) for category 1 cases. The study revealed one-minute Apgar was significantly lower in GA group when compared with SA group [7 (5–8) vs 8 (8–8), P = 0.02]. However, when the GA group was compared to the SA group, the five-min Apgar score was comparable [9 (8–9) vs. 9 (9–9), P = 0.006].

Another prospective observational study (2014) conducted in India [24] on 173 clients of severe preeclampsia undergoing emergency caesarean section. Of them, 27 patients (15.5%) had general anesthesia (GA) and 146 patients (84.5%) was given spinal anesthesia (SA). Of the different indications, fetal distress accounted for a very high percentage of patients undergoing GA (37% versus 16.4%; $p < 0.05$). Patients administered GA had a lower Apgar score at one minute (7.66 ± 1.27 versus 6.52 ± 1.16 minute; $P < 0.001$), but both groups' 5-minute Apgar scores were comparable.

A prospective cross-sectional study conducted on 70 category-1 clients who underwent category-1 caesareans in Malaysia. GA was used for about 24.3% of category-1 cesarean sections. The main reasons for category-1 caesarean sections overall were fetal bradycardia (84.3%), placental abruption (8.6%), bleeding placenta previa (4.3%), cord prolapse (1.4%), and wound dehiscence (1.4%). They concluded that there was no clinically significance difference between the two groups' Apgar scores [1].

In Australia (2012), Beckmann et al. conducted a retrospective cohort study that comprised data from 533 term babies born with category 1 CS. Babies born under category 1 GA CS had a significantly higher chance of having an Apgar score of less than seven at five minutes (AOR 6.89; 95%CI 1.79–26.55; P = 0.005), even after controlling for covariates [11].

A retrospective cohort study carried out by Junette et al in Douala, Cameroon (2021) [25] enrolled 117 clients who underwent CS for category 1 CS indication concluded that babies born of women who received GA had two-fold increase risk of having a low APGAR score at the first minute compared to babies of women who received SA (RR = 2.00, p = 0.011).

A prospective cohort study conducted by Amin et al. in Egypt in (2022) on total of 74 clients. From them 41 were under the general anesthesia group and 33 under the spinal anesthesia group. The APGAR scores at one minute 6.8±1.7 vs 7.7±1.1, P = 0.009 and five minute 8.9±1.1 vs 9.4±0.7, P = 0.029 showed statistically significant differences between the study groups, with the spinal anaesthetic group showing a high mean [12].

Another prospective cohort study conducted by Ramadan et al. [26] in Egypt (2018) on 180 pregnant women with severe preeclampsia admitted to the operating room for emergency caesarean section. Study concluded that there was a significant increase in APGAR score in spinal anesthesia group more than general anesthesia group at both 1 minute and 5 minutes ($p < 0.05$).

A retrospective cohort study conducted in Australia in 2012 by Beckmann et al. included a collection of data of 533 full-term babies delivered by category 1 CS due to suspected fetal compromise. Under regional anesthesia (RA), 452 babies born by CS and 81 babies born by GA CS were compared. and discovered that babies born with category 1 GA CS had a significantly higher chance of being admitted to a neonatal intensive care unit (AOR 2.24; 95%CI 1.16–4.31; P = 0.016) after confounders were taken into account[11].

An observational study that was prospectively carried out in south India (2018) Thangaswamy et al. reported that NICU admission for babies born by category 1was 24 (35.8%) in general anesthesia group and 10 (21.3%) in spinal anesthesia group, P= 0.095[13]

A prospective cohort study conducted by Amin et al. [12] in Egypt at Benha University found that total of 6 new borns delivered by category 1 CS were admitted to NICU [4 (9.8%) in group GA and 2 (6.1%) in group SA, P = 0.686].

A prospective observational study conducted in south India (2018) Thangaswamy et al. (2018) reported that new born mortality rate was comparable between the groups, 3 (4.5%) in GA group and 2 (4.3%) in SA group, P= 0.317[13].

A prospective observational study conducted in Egypt (2018) reported that GA group experienced a significantly higher rate of neonatal mortality (16.7%) compared to SA group (2.7%); the difference was statistically significant ($p < 0.05$)[26].

Another prospective cohort study conducted on 72 clients undergone emergency category 1 CS reported comparable new-born mortality between general anesthesia and spinal anesthesia group, 2 (9.5%) in GA group and 0 in SA group, P= 0.082[27]

Compared to RA groups, the DDI for the GA CS was eight minutes faster[11]. According to a prospective study by Mackenzie IZ et al., for emergency caesarean sections, general anesthesia was substantially linked to a shorter decision to delivery time than regional anesthesia[28]. The DDI was comparable between GA and SA group according to study conducted by Thangaswamy et al.[13] and Amin et al.[12]

A prospective observational study conducted in south India (2018) over one year on 114 clients by Thangaswamy et al. (2018) stated that from clients received spinal anesthesia for category 1 CS 50% developed hypotension[13].

Another a prospective cohort study conducted by Amin et al. in Egypt at Benha University on 74 clients found that there is significant difference between GA and SA groups regarding hemodynamic changes. The mean MAP and HR significantly higher in GA group than SA intra operatively[12].

A prospective observational study conducted in Egypt (2018) on 180 clients undergoing emergency category 1 CS concluded that there was statistically significant difference between GA and SA with higher mean value for MAP in general anesthesia group[26]

Study conducted by Khan et al.in (2019) reported that hypotension was very common on those mothers receiving spinal anesthesia for emergency CS [29]. Another prospective, observational study conducted in (2019) by Arslantas et al [30] reported spinal anesthesia for emergency CS associated with hypotension.

A retrospective comparative cross-sectional study conducted in Addis Ababa (2018) which included total of 170 client concluded that, after administration of anesthesia during the intraoperative period compared to the SA groups, the GA groups had significantly greater , the mean HR and BP [31].

A prospective observational study conducted at a tertiary care institute in south India (2018) over one year on 114 clients by Thangaswamy et al. [13] showed there were 2 (3%) of mothers from those received general anesthesia had to be admitted to ICU postoperatively. But no ICU admission from spinal anesthesia group.

The prospective cohort study conducted by Amin et al. [12] in Egypt on74 clients found that the maternal ICU admission after category 1 CS was [2 (4.9%) in general anesthesia and 1 (3%) in spinal anesthesia P 0.689].

Retrospective cohort study conducted by Wiskott et al [18] in Israel (2020) on comparison GA vs SA on emergency CS reported that general anesthesia is associated with increased maternal ICU admission rates. Which was 5 (6.3%) in general anesthesia and 1 (0.2%) in spinal anesthesia group.

The evidences regarding effect of general anaesthesia and spinal anesthesia on new born and maternal outcomes on clients undergoing category 1 cs are limited in our country.

2.2 HYPOTHESIS TESTING

H01: There is no difference between general and spinal anesthesia on new-born outcome

HA1: There is difference between general and spinal anesthesia on new-born outcome

H02: There is no difference between general and spinal anesthesia on maternal outcome

HA2: There is difference between general and spinal anesthesia on maternal outcome

CHAPTER THREE: OBJECTIVES

3.1 GENERAL OBJECTIVE

To compare the effect of general anesthesia versus spinal anesthesia on new-born and maternal outcomes among category-1 caesarean section clients at Ghandi memorial hospital Addis Ababa, Ethiopia from February 1/2024 to April 30/2024.

3.2 SPECIFIC OBJECTIVES

1. To compare the effect of general anesthesia versus spinal anesthesia on the APGAR scores of new-borns delivered by category-1 caesarean section from February 1/2024 to April 30/2024.

2. To compare the effect of general anesthesia versus spinal anesthesia on NICU admission of new-borns delivered by category-1 caesarean section from February 1/2024 to April 30/2024.

3. To compare the effect of general anesthesia versus spinal anesthesia on maternal morbidity and mortality undergoing category-1 caesarean section from February 1/2024 to April 30/2024.

CHAPTER FOUR: METHODS

4.1 STUDY DESIGN AND PERIOD

Prospective cohort study was conducted at Gandhi memorial hospital Addis Ababa, Ethiopia, from February 1/2024 to April 30/2024

4.2 STUDY AREA

Addis Ababa, the capital city of Ethiopia has 96 health centres, and 12 government hospitals in 11 sub-cities in Addis Ababa. About 3,689,002 people call the city home, according to estimates. Th is study was conducted at the Gandhi Memorial Hospital, one of the biggest maternities and child care facilities located in Addis Ababa. Early in 1958, GMH Hospital was founded, and once its construction was complete, it began accepting patients in 1959, public service. It bears the honourable Mohandas Karamch Gandhi's name. It is supervised by the ministry of health and contains four operating rooms and 120 beds. The hospital selected purposefully b/c it is centre for CS in study area.

4.3 POPULATION

4.3.1 SOURCE POPULATION

Include all clients over 18 years of age who underwent emergency category 1 cesarean sections under general or spinal anesthesia during study period at Gandhi memorial hospital Addis Ababa, Ethiopia.

4.3.2 STUDY POPULATION

Include clients over 18 years of age who underwent emergency category 1 Caesarean sections under general or spinal anesthesia that fulfil inclusion criteria during study period at Gandhi memorial hospital Addis Ababa, Ethiopia

4.4 ELIGIBILIITY CRITERIA

4.4.1 INCLUSION CRITERIA

ASA II clients, Age over 18 years and Emergency caesarean delivery for category 1 CS indication.

4.4.2 EXCLUSION CRITERIA

Clients with neurological impairment

Congenital fetal abnormality

BMI over 40 kg/m2

Sensitivity to one or more drugs used during category-1 emergency cesarean section

4.5 STUDY VARIABLES

4.5.1 DEPENDENT VARIABLES

New-born outcome (APGAR score, NICU admission and New born mortality)

Maternal outcome (maternal hemodynamic changes, maternal ICU admission and maternal mortality)

4.5.2 INDEPENDENT VARIABLES

Exposure variables (GA or SA)

Socio-demographic factors: Age, weight, Height and Body Mass Index.

Gestational age

Fetal birth weight

Indication for Category 1 CS

Decision to delivery time

Uterine incision to delivery time

Duration of surgery

4.5.3 OPERATIONAL DEFINITION

Category 1 emergency caesarean section: immediate threat to the life of the woman or foetus which needs delivery of the foetus within 30 min [13]

APGAR: The APGAR (Activity, Pulse, Grimace, Appearance and Respiration) is a quick and comprehensive evaluation of a new-born's health that is taken at one and five minutes after delivery. After delivery, the Apgar scoring system provides a standardized evaluation of new-borns. The Apgar score system is useful in predicting new born adverse outcomes. It can be applied to both singleton and twin pregnancies, as well as different racial/ethnic groups [32].

The new born's physical condition and whether immediate or later medical attention is needed are indicated by the 1-minute Apgar score. The 5-minute Apgar score evaluates the

infant's response to any prior attempts at resuscitation, if any. Each of the five characteristics has a score between 0 and 2, with a maximum final total score of 10 [32].

Adverse new born outcome: A new born outcome with 1 min or 5 min APGAR score of <7, NICU admission or new-born mortality[13]

Adverse maternal outcome: Presence of maternal hemodynamic change, post-operative ICU admission or maternal mortality[13].

4.6 SAMPLE SIZE DETERMINATION

The 5th minute APGAR score mean and standard deviation between two groups (general and spinal anesthesia) was taken from previous study done by Amin et al.[12] in Egypt (2021) on the topic comparison of effect of general anesthesia and spinal anesthesia on fetal and maternal outcome for category-1 caesarean section. G*Power software Version 3.1.9.7. was used to calculate sample size.

Two independent sample size formula based on mean and standard deviation used to calculate sample size for each group. When we checking for sample size by each objective, the largest sample size was obtained when 5th minutes APGAR score between GA and SA group was used. APGAR score at 5 min, mean±SD (8.9, 1.1) on general anesthesia group and mean±SD (9.4, 0.7) on spinal anesthesia group. It was calculated with 3:2 of GA to SA ratio, a 5% significance level, and 90% study power. For GA and SA, the corresponding calculated sample sizes were 91 and 61 respectively.

4.7 SAMPLING AND DATA COLLECTION TECHINQUES

The study participants were chosen using a systematic random sampling technique for each group (general and spinal anesthesia) who underwent an emergency category 1 CS. Situational analysis revealed that four clients per day or 120 clients per month undergo category 1 CS using either general anesthesia or spinal anesthesia as decided by attending anaesthetist. Thus, 360 clients were undergone category 1 CS by either of general or spinal anaesthesia in three months. Using the formula, the sampling interval, K, was calculated: K=N/n; where, n = total calculated sample size, and N = population per 3 months. K = 360/152 ≈ 2.

As a result, there was a two-sampling interval, and a lottery method was used to select the first study client for outcomes follow-up. For each group, this process was then repeated every other case until the calculated sample size was obtained during the study period.

Clients who fulfilled the inclusion criteria were selected. Study participants followed for the outcome variables from decision to be delivered to their discharge from operation room to NICU or nursery room for new born outcome and discharge from operation room to post-anaesthesia care unit or ICU for maternal outcome.

The attending anaesthetist conducted preoperative assessment in the labour room, which comprised physical examination and laboratory assessment. The attending anaesthetist made the choice regarding the type of anaesthetic technique (GA or SA) after discussion with clients.

For spinal anaesthesia, all clients were preloaded with 500 mL of Normal saline. In the sitting position, the clients' back was cleaned with povidone iodine. Following the alcohol-based cleaning of povidone iodine, 2 mL of 0.5% hyperbaric bupivacaine with 20 mcg fentanyl was administered intrathecally using 24 G spinal needle.

For general anesthesia group clients, endotracheal intubation performed following rapid sequence induction using weight-based doses of fentanyl, propofol and succinylcholine.

Indication for category 1 CS, Decision to delivery time interval, Uterine incision to delivery time, MAP (at baseline, then every 10 minutes until 30 minutes) and HR (at baseline, then every 10 minutes until 30 minutes), APGAR score (at 1min and 5 min), NICU admission and other necessary data collected by using an objectively well-structured questionnaire by trained data collector.

As per the standard departmental protocol, all clients were monitored during the surgery on the operating table for hemodynamic parameters (ECG, non-invasive blood pressure, heart rate and haemoglobin oxygen saturation).

4.8 DATA QUALITY CONTROL ISSUE

A pre-test was conducted on 8 clients, or 5% of the sample size, at Zewuditu memorial hospital prior to the start of data collection. The goals of the study, its significance, and respondents' rights were among the topics covered in training provided to supervisors and data collectors.

A data collection tool was translated by experts from a foreign language into local language, and then another expert translated the tool back into the original language to check for any discrepancies. The investigator reviewed each questionnaire to ensure it was appropriate and

comprehensive during the data collection process. Regular supervision of data collection procedures was done. Cross-checking was done prior to SPSS analysis.

4.9 DATA ANALYSIS AND INTERPRETATION

The collected data were coded and entered into SPSS and Statistical analysis was done by using SPSS version 26. Mean ± SD or median with interquartile range was used for continuous data. To compare categorical data between the GA and SA groups, the Chi-square/Fischer exact test was utilized. Independent sample t-test/ Mann–Whitney U test was used to compare continuous variables between study groups based on results of Shapiro-Wilk normality test. The level of significance was determined using a P value of less than 0.05.

4.10 ETHICAL CONSIDERATION

Ethical clearance was given by Addis Ababa health bureau. The study hospital received an official letter of support which was given by Addis Ababa health bureau, and the relevant authorities were asked for permission to collect data. The data collector was explained the significance of the study.

Every participant provided written informed consent prior to participation. By removing identifications and employing codes to identify clients, confidentiality was maintained throughout the course of the study. The study's involvement of participants was entirely voluntary and after written informed consent.

4.11 RESULT DISSEMINATION PLAN

The results would be presented to the department as part of the MSc. advanced clinical anesthesia program. This presentation will occur during the yearly conference, which brings together staff and student researchers. The study's outcomes would also be shared at the annual national meeting organized by the Ethiopian Anaesthetists Association, manuscript will be prepared and published in reputable journal.

CHAPTER 5: RESULT

This prospective cohort study was conducted at Ghandi memorial hospital from February 1/2024 to April 30/2024. A total of 152 clients were included in the study and data analysed for 152 clients. From those included in this study, 91 clients grouped under general anesthesia group and 61 clients grouped under spinal anesthesia group based on attending anesthetist's decision.

Regarding baseline data, no significant variations were found between general anaesthesia and spinal anaesthesia group as shown by table1.

Table 1 Comparison between study groups regarding baseline data at Ghandi memorial hospital from February 1/2024 to April 30/2024.

Parameters	GA group (N=91)	SA group (N=61)	P value
Age (years)	26.58 ±3.870	26.54±3.510	0.947
BMI (Kg/m2)	24.0264±1.21196	23.7164±1.53560	0.168
Gestational age (week)	39 (37-42)	40 (37-42)	0.336
Fetal birth weight(kg)	3.2 (2.7-3.5)	3.2 (2.7-3.5)	0.396
DDT/min	26 (22-30)	27(20-30)	0.162
UIDT/sec	55(50-60)	56(52-63)	0.164
Duration of surgery/min	45.05±5.683	46.26±5.788	0.204
Baseline MAP	81.2308±3.31018	81.2295±3.866	0.998
Baseline HR	76.86±6.526	75.74±5.540	0.318

GA-General Anesthesia; SA-Spinal Anesthesia; BMI-Body Mass Index; DDT-Decision to Delivery Time; UIDT-Uterine Incision to Delivery Time; MAP-Mean Arterial Pressure; HR-Heart Rate; SD-standard deviation. Value presented by mean±SD and median (IQR). P value <0.05 considered as significant.

The Category 1 CS indications are listed in in Table 2, there was no association between type of anesthesia and category 1 CS indication. There were no patients with failed block in the SA (N = 61) group.

Table 2 Indication of caesarean section in study groups at Ghandi memorial hospital from February 1/2024 to April 30/2024.

Indication for category 1 CS	GA group(N=91)	SA group(N=61)	P value
Fetal distress	37(24.3)	26(17.1%)	0.851
Meconium stained liquor	23(15.1%)	19(12.5%)	
Cord prolapse	8(5.3%)	4(2.6%)	
Abruption of placenta	7(4.6%)	2(1.3%)	
Preeclampsia/eclampsia	7(4.6%)	4(2.6%)	
Failed induction of labor	8(5.3%)	5(3.3%)	
Placenta previa	1(0.7%)	0(0%)	
Placenta acreta	0(0%)	1(0.7%)	

CS-Caesarean section; GA-General Anesthesia; SA-Spinal Anesthesia. Value presented by frequency and percentage.

As shown by table 4 a Mann-Whitney U Test revealed significant difference in the APGAR score at 1 min of GA (Md = 7, n =91) and SA (Md = 8, n = 61), U = 1354, z = –5.589, p < 0.001, r = 0.5. And at 5 min of GA (Md = 8, n =91) and SA (Md = 9, n = 61), U = 1805, z = –4.215, p < 0.001, r = 0.3. Chi square test revealed that higher rate of NICU admission in GA group than SA group. There was no new born mortality in our study.

Table 3 Comparison between the GA and SA group regarding new born data at Ghandi memorial hospital from February 1/2024 to April 30/2024.

Data	GA group (N=91)	SA group (N=61)	P value
APGAR score at 1 min	7 (6-7)	8 (7-8)	< 0.001
APGAR score at 5 min	8 (8-8)	9 (8-9)	< 0.001

Data	GA group (N=91)	SA group (N=61)	P value
NICU admission [n (%)]	13 (8.6%)	4 (2.6%)	0.138

GA-General Anesthesia; SA-Spinal Anesthesia; NICU-Neonatal Intensive Care Unit. Value presented by median(interquartile) and frequency(percentage). P value<0.05 is considered as significant.

Table 5 shows Comparison between the GA and SA groups regarding maternal post-operative data. ICU admission was not statistically significant. Post-operatively two mothers from GA group were admitted to the Intensive care unit, their pre-existing comorbidity was the reason for the ICU admission rather than an unfavourable anaesthetic or surgical event. There was no maternal mortality in our study.

Table 4 Comparison between the GA and SA groups regarding maternal post-operative data at Ghandi memorial hospital from February 1/2024 to April 30/2024.

Data	GA group (N=91)	SA group (N=61)	P value
ICU admission	2 (1.3%)	0	0.516

ICU-Intensive Care Unit. Value presented by frequency(percentage).

Table 6 shows maternal intra operative hemodynamic changes between study groups. And there was significant difference between the groups at 10 and 20 minutes, P < 0.05

Table 5 Comparison between the GA and SA groups regarding maternal intra-operative hemodynamic changes at Ghandi memorial hospital from February 1/2024 to April 30/2024.

Hemodynamic changes	GA group (N=91)	SA group (61)	P value	95% CI	
				Lower	Upper
MAP at 10 minutes	75.9670±6.63735	71.4754±6.62220	< 0.001	2.32342	6.65983
MAP at 20 minutes	72.7033±3.29813	71.4262±2.59781	0.009	.28393	2.27021
MAP at 30 minutes	77.8681±3.67638	77.5738±3.21174	0.422	-.84934	1.43807
HR at 10 minutes	81.97±6.638	80.20±5.958	0.117	-0.263	3.803

Hemodynamic changes	GA group (N=91)	SA group (61)	P value	95% CI	
				Lower	Upper
HR at 20 minutes	77.97±6.725	74.98±6.361	0.01	0.827	5.139
HR at 30 minutes	72.89±6.223	71.77±5.775	0.26	-0.858	3.097

GA-General Anesthesia; SA-Spinal Anesthesia; MAP-Mean Arterial Pressure; HR; Heart Rate CI-Confidence Interval. Values presented by mean±SD. P value < 0.05 is considered as statistically significant.

CHAPTER 6: DISCUSSION

This study revealed that the 1 and 5-minute APGAR scores were significantly lower in the general anesthesia group compared to the spinal anesthesia group. This finding is in line with previous study by Thangaswamy et al [13]. Who reported that the 1-min and 5-min APGAR score was significantly lower in group GA when compared with group SA.

Study conducted by Chattopadhyay et al [24] reported that the 1-minute Apgar score was significantly higher for new-borns delivered under spinal anesthesia compared to those delivered under general anesthesia which is consistent with our result.

Our result aligns with similar study conducted by Beckmann et al. [11] who reported that low Apgar scores at 5 minutes were linked to GA for category 1 CS. Additionally, other studies have also reported similar result that Apgar scores were significantly lower in new born whose mothers received GA Shek et al. [33] and Gori et al [34].

However; Adlan et al[1] conducted similar study and concluded that there was no clinically significant difference between new-borns delivered under spinal anesthesia and those delivered under general anesthesia in terms of their APGAR scores. This contradicting conclusion may result from their small sample size which was 72 compared to our sample size.

However, Edipoglu et al [35] reported that there is significantly lower 1 min APGAR score in GA, but 5 min APGAR score was not significant. This difference is likely result of strategies on patient selection, as our study did not include pregnant women who may have fetal suspected fetal abnormalities. Equally, study by Metogo et al [25] reported compared to

babies of women who received SA, babies born to GA-received mothers had a two-fold higher chance to have a low APGAR score at the first minute.

Study carried out by Amin et al [12] showed statistically significant differences between the GA and SA groups showing a high mean of the APGAR scores at one minute (P = 0.009) and five minutes (P = 0.029) which support finding of our study. Additionally, Abdissa et al. [36] concluded that compared to babies delivered under spinal anesthesia, a significant percentage of new-borns delivered under general anesthesia had lower APGAR scores.

The lower APGAR scores in the group under general anesthesia may be explained by the anaesthetic agents used in general anesthesia, such as volatile anaesthetics and intravenous induction agents, which can depress the new-born's central nervous system and respiratory function there by APGAR score[37].

Regarding maternal hemodynamic changes our study revealed that MAP at 10 min, at 20 min, and HR at 20minutes were significantly lower in SA group compared to GA group. similarly, Study by Amin et al. [12] showed statistically significant differences in MAP and HR between the GA and SA groups with lower mean in SA group which aligns with our finding. Similar, study conducted by Kyokong et al [38] also observed hypotension on those mothers received neuraxial anesthesia for CS.

Additionally, prospective observational study conducted by Edipoglu et al [35] found that there is significant MAP and HR difference between two groups with significantly higher in general anesthesia group than spinal anesthesia group. Similarly, our finding also shown statistically significance difference in GA and SA group having higher mean value in general anesthesia group.

Prospective cross sectional study performed by Somboonviboon et al [39] also revealed that significant hypotension intraoperatively on those mothers received spinal anesthesia for CS. Additionally, Wiskott et al [40] reported hypotension on those mother received spinal anesthesia for CS.

Possible reason for decrease in MAP and HR in SA group is due to a sympathetic and parasympathetic imbalance favoring the parasympathetic tone, SA causes bradycardia and a drop-in blood pressure. Cardiac output in SA decrease due to decreased preload and one of the factors contributing to the drop in MAP seen in SA is this decrease in cardiac output[41].

CHAPTER 7: STRENGTH AND LIMITATION OF THE STUDY

7.1 STERENGH OF STUDY

Strength of our study is that study participants are homogenous regarding their socio demographic, indication for category 1 CS, DDI and UIDI between groups. Our study offers a clear analysis of the effects of general anesthesia (GA) versus spinal anesthesia (SA) on both new born and maternal outcomes. Our study provides valuable information that can be applied immediately to clinical practice by directly comparing these two commonly used anesthesia techniques.

7.2 LIMITATION OF THE STUDY

In our study we didn't collected data regarding umbilical cord blood pH. Which is used to determine adverse new born outcome. This is main limitations of our study.

CHAPTER 8: CONCLUSION AND RECOMMENDATION

8.1 CONCLUSION

In our study we observed that for category 1 CS, GA associated with greater new born adverse outcome. Regarding maternal outcome hypotension and bradycardia was not sever to compromise new born outcomes.

8.2 RECOMMENDATION

We recommend that the spinal anesthesia (SA) be considered as preferred type of anesthesia for category 1 CS. Further study with large sample size and/ or umbilical cord blood pH will be necessary.

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ANNEX I: CONSENT FORM

Identification

Name of the Institute _____

Address of the Institute _____

Hello! How are you? I am_____ here to collect information about the

research study aimed at comparing the effect of general and spinal anesthesia for category-1 caesarean section on maternal and foetal outcomes. A study will be conducted by Eshetu Tomas, a Master of Science student in department of Anesthesia School of Medicine College of health science Addis Ababa University, Ethiopia, 2024.Your response to the study items will highly contribute to the success of the study. Therefore, you are kindly requested to give candid response to each of the items. I have been briefed that your identity would be kept confidential and the information will be used for the intended purpose only.

Are you willing to participate in the study?

1.Yes

2.No

Thank you for your participation!

Amharic version of consent form

ጤና ይስጥልኝ! _____እባላለሁ። እዚህ የተገኘሁት በአዲስ አበባ ዩንቨርስቲ አንስትዚያ ት/ቤት የጥናት ቡድን አባል ለሆነው ለ አሼቱ ቶማስ መረጃ ለመሰብሰብ ነው።የጥናቱ ዋና አላማ የአጠቃላይ እና የአከርካሪ ማደንዘዣ ለክፍል-1 C/S በእናቶች እና በ አራስ ላይ ያለውን ተፅእኖ ለማነፃፀር የታለመ የምርምር ጥናት። የተመረጡትም በዚህ ሆስፒታል ቀዶ ጥገና ስለተደረገልወት ብቻ ነው። ቃለመጠይቁን በማንኛውም ሰአት ማቋረጥ ወይም ጥያቄዎችን አለመመለስ ይችላሉ። ለጥያቄዎች የሚሰጧቸዉ መልሶች በሚስጥር የሚጠበቁ ሲሆን የእርሶ ስም ወይንም እርሶን የሚለይ ማንኛውም መረጃ አይገለጽም። እንዲሁም የሚሰጡት ምላሽ ከርሶ ማንነት ጋር በማንኛውም መልኩ አይያያዝም። ስለዚህ በጥናቱ ላይ በፍቃዶ እንዲሳተፉ በአክብሮት እጠይቃለሁ።

ANNEX II: QUESTIONNAIRE

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

Data code: _____

Section 1: Maternal demographic data

1.Age _____Years

2. Educational level

A. No formal education B. Primary school C. Secondary school D. Collage/university

3. Weight _____Kg

4. Height _____M

5. BMI (Kg/m2) _____

6. ASA physical status _____

7. Gestational age (weeks) _____

8. Fetal birth weight (kg) _____

Section 2: Indication of category 1 caesarean section.

[A] Foetal distress [B] Abruption of placenta [C] Meconium stained liquor [D] Cord prolapse [E] Pre‑ eclampsia [F] Failed instrumental delivery [G] Rupture uterus [H] Polyhydramnios [I] Intra uterine growth retardation [J] Chorioamnionitis [K] Placenta praevia [L] [M] Placenta accrete. If other specify _____

Section 3: Anesthesia Type during category-1 caesarean section?

1. General Anesthesia

2. Spinal Anesthesia

Section 4: Premedication

1. Premedication before General anesthesia A. Yes B. No

2. If your answer for no 1 is yes what premedication given? A. Metoclopramide_____mg, B. Ranitidine_____mg. If other Specify _____

3. Induction agents used for general anesthesia

Fentanyl_____mg, Propofol _____mg, Ketamine _____mg, Thiopental_____mg, Suxamethonium_____mg. If other specify _____

4. Premedication before spinal anesthesia A. Yes B. No

5. If your answer for no 4 is yes what premedication given? A. Metoclopramide.
If other Specify _____

6. Preloading before Spinal anesthesia A. Yes B. No

7. If your answer for question no 6 is yes what type of fluid? A. Normalsaline B. Ringer lactate____ml. If other Specify _____

8. Dose of 0.5% hyperbaric bupivacaine for spinal anesthesia _____mg

9. Additive added to 0.5% hyperbaric bupivacaine for spinal anesthesia?

A. Fentanyl_____mcg. If other specify

10. Spinal needle gauge _____

Section 5: Duration of surgery & anesthesia.

1.Decision to delivery time _____min

2. Uterine incision to delivery time _____sec

3. Duration of surgery _____min

4. Duration of anaesthesia_____min

Section 6: New born data

1.APGAR score at 1 min_____

2.APGAR score at 5 min_____

3.NICU (Neonatal Intensive Care Unit) admission A. Yes B. No

4.If your answer to question no 3 is yes what is the reason for NICU admission?

A. Respiratory distress B. Poor muscle tone. If other specify_____

5. New born mortality A. Yes B. No

Section 7: maternal intra operative hemodynamic data

1. BP and MAP at 0 minutes _____ at 10 minutes _____ at 20 minutes _____

at 30 minutes_____

2. HR at 0 minutes_____ at 10 minutes_____ at 20 minutes_____ at 30 minutes_____

Section 8: Maternal Outcomes

1. ICU (Intensive Care Unit) admission A. Yes B. No

2. If your answer to question no 1 is yes what is the reason for ICU admission?

A. Pre-existing comorbidity B. Adverse event during anesthesia and surgery.
If other specify_____

3. Maternal mortality A. Yes B. No

4. If yes for 3 what was reason for mortality?

Data collector Name_____ Signature _____ Date_____
Investigator Name_____ Signature _____ Date_____