ADDIS ABABA UNIVESITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE

DEPARTMENT OF ANESTHESIA

RELATIONSHIP BETWEEN ABDOMINAL CIRCUMFERENCE AND INCIDENCE OF HYPOTENSION DURING ELECTIVE CESAREAN SECTION UNDER SPINAL ANESTHESIA IN PUBLIC HOSPITALS OF ADDIS ABABA, ETHIOPIA, JUNE 2024.

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A THESIS SUBMITTED TO DEPARTMENT OF ANESTHESIA, COLLEGE OF MEDICINE AND HEALTH SCIENCES, ADDIS ABABA UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTERS OF SCIENCE DEGREE IN CLINICAL ANESTHESIA.

ADDIS ABABA, ETHIOPIA

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Examiner

Declaration

I, the undersigned, declare that this thesis is my original work in partial fulfillment of the Master of Science degree in Anesthesia. I understand that plagiarism will not be tolerated and all directly quoted idea has been appropriately referenced.

Name: ____________________

Signature: ____________________

Submitted to: Tutor on MSc Department of anesthesia, Addis Ababa University.

Date of submission: ________________________________

This thesis has been submitted for examination with my/our approval as Advisors and Tutors on the Master of Science degree in anesthesia.

Advisors **signature**

1. ____ ____________

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Examiners

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ABBREVATIONS AND ACRONYMS

AC	Abdominal circumference
ASA	American Society of Anesthesiology
BMI	Body Mass Index
CI	Confidence Interval
CSF	Cerebrospinal fluid
DBP	Diastolic blood pressure
IVC	Inferior vein cava compression
LAC	Large abdominal circumference
MAP	Mean arterial pressure
SA	Spinal Anesthesia
SAC	Small abdominal circumference
SBP	Systolic Blood Pressure

Abstract

Background: hypotension is common complication in pregnant mother during cesarean section after spinal anesthesia. Identifying the association between abdominal circumference and the likelihood of developing hypotension following a cesarean delivery while under spinal anesthesia can aid in preventing hypotension.

Objectives: This study aim to investigate the relationship of the abdominal circumference of term pregnant women and the occurrence of hypotension during cesarean section under spinal anesthesia at public hospitals of Addis Ababa, Ethiopia, 2024.

Method: A longitudinal cross sectional study through a simple systematic random sampling technique was conducted on 360 term pregnant patients who underwent elective cesarean section under spinal anesthesia from February 15 to April 31, 2024. Data was collected using a data collection questionnaire and checklist. The data was entered using Epi info 7.2 and exported into SPSS 26. The Patients was categorized by their median of abdominal circumference, <102cm (small abdominal circumference (SAC)) and >=102cm (large abdominal circumference (LAC)). Descriptive statistics including percentage mean and median were used. Chi-square was done. Furthermore, bivariate logistic regression was done, the variables with a p-value ≤0.25 entered multivariate regression to control for all possible confounders. In multivariate variables, p≤0.05 was as statistical significance and odd ratio was used for strength of association.

Result: Among 360 study subjects in this study, incidence of post spinal hypotension was 76.67% with 95%CI [71.9-80.9]. There was significant difference of incidence of hypotension between the groups (LAC 85.6% AND SAC 63.3%). LAC was three times higher likelihood of having hypotension (AOR = 2.98, 95% CI [1.57, 5.65]). The other predictor factors BMI>25kg/m2, (AOR=2.3, 95%CI [1.16-4.6], P=0.018); baby weight> 4kg,(AOR=11.41 95%CI[2.0-64.86]) P=0.006; sensory block of above T6 level (AOR 2.22, 95%CI [1.12, 4.42]).

Conclusions: The study found that there was high incidence of hypotension and significant difference between SAC and LAC groups, and also LAC, BMI, baby weight and sensory block was associated post spinal hypotension.

Key Words: Abdominal circumference, spinal anesthesia, BMI, post spinal hypotension.

CHAPTER ONE

1.1 Background

The ideal anesthetic approach for cesarean delivery is regional administration of anesthesia using local anesthetics[1]. This is because of the proven reduced morbidity and mortality[2], compared to general anesthesia that has a higher occurrence of complications, such as: difficult intubation, rapid desaturation, greater chance of aspiration, and neonatal depression[3], spinal anesthesia was commonly utilized for cesarean section [4-6]. However, the result of elevated abdominal pressure and decreased lumbosacral subarachnoid space volume in parturient and compression of inferior vein cave hemodynamic status of pregnant patient is incredibly variable [7].

Despite the more advantages of regional anesthesia, it is not free of adverse effect, for example, hypotension, difficult puncture, post-Dural puncture headache and total spinal anesthesia. Hypotension was the most complication with an incidence of 15%-30% in general population with spinal anesthesia [8]. In cesarean section, more concerning is hypotension. In addition to having a higher incidence (20-100%) with pregnant, can have catastrophic effects on the mother and fetus, ranging from an increased occurrence of vomiting and nausea to fetal hypoxia became by changes in uteroplacental bloo flow, that leads to fetal acidosis [9].

Most of term pregnant patient developed different grades of abdominal pressure due to their enlarged uteri [10, 11]. However, it is not easy to measure abdominal pressure and try to doso can add the risk of infection. Empirical studies have found associations between larger abdominal circumference (AC) and higher abdominal pressure and level of sensory block[12]. Therefore, it is rational to utilize the AC as surrogate for abdominal pressure in this study. Previous study was shown correlations between increased abdominal pressure , abdominal circumference and degree of sensory block [13].

Empirical research has shown links between increased abdominal pressure, sensory block, and large abdominal circumference [14], which may increase the incidence of post spinal hypotension in obstetric patients. Attention should be given to term pregnant abdominal circumference and associated factors, namely BMI, baby weight and sensory block height those affect abdominal circumference and incidence of hypotension after spinal anesthesia during cesarean section. Additionally, patient's preoperative characteristics (age, weight and

ASA classification), base line hemodynamic status, as well as patient's intraoperative factors (estimated blood loss, duration of operation, vasopressor requirement) should be considered to minimize the incidence of hypotension. The other cause of hypotension after spinal anesthesia was supine hypotensive syndrome, that moments lying supine results from the directly compression of inferior vena cava and descending aorta by enlarged uteri[15].

The compression of the inferior vena cava by an enlarged uterus results in engorgement of the epidural venous plexus which in turn decreases the cerebrospinal fluid volume and can lead to the narrowing of the intrathecal space potentially resulting in more cephalad spread of drug and higher level of spinal anesthesia, and consequently higher degree of sympathectomy leading to more hypotension[16] Physical and physiologic changes in late pregnancy have been suspected as being factors for this mechanism. Larger abdominal circumference (AC) has been linked to increased abdominal pressure and a greater degree of sensory block, according to previous research [3, 17].

Identifying the association between AC and chance of developing hypotension following a cesarean delivery while under spinal anesthesia can aid in foretelling and preventing hypotension. We proposed that the increased frequency of hypotension following spinal anesthesia was connected to the elevated AC, which has previously been linked to elevated abdominal pressure and an enlarged uterus, however there were controversial findings.

1.2 Statement of the problem

Post spinal hypotension was defined 20% decrement of MAP ,clinically more relevant than an absolute value, is associated with decreased organ perfusion and adverse maternal and fetal out comes[18]. The effect of abdominal circumference on mean arterial pressure changes during cesarean section under spinal anesthesia was not fully understood. A major concern is the lack of standardization in measuring abdominal circumference, which can lead to inconsistent results across studies.

Hypotension, a common complication of spinal anesthesia, can have serious maternal-fetal consequences, including dizziness, nausea, vomiting, fetal acidosis and circulatory collapse. Despite its magnitude, there is a lack of understanding regarding the impact of abdominal circumference on the incidence of hypotension. Previous studies have reported varying rates of hypotension, ranging from 15% to 33% in general populations, and up to (20- 100%) in obstetric patients and also reported abdominal circumference was predictor of post spinal anesthesia [19] [20].

The incidence of SA-induced severe hypotension has been documented in various regions, including Germany, Brazil, and Thailand, with rates ranging from 8% to 76.7%.[21] [22] [23]. However, few studies have investigated the relationship between abdominal circumference and incidence of hypotension.

A review of existing studies in Ethiopia has revealed a significant variability in the incidence of severe hypotension induced by spinal anesthesia, ranging from 25% to 64 % [18, 24]. Currently, the tendency is to maintain blood pressure as close as possible to the initial levels. Despite this, there was no research showing the effect of AC on post spinal anesthesia in our population. In an effort to address this gap, this study was conducted at select hospitals in Addis Ababa, Ethiopia, with the aim of investigating the association between abdominal circumference and hypotension during cesarean section under spinal anesthesia.

Instead of AC was associated with post spinal hypotension, there are several gaps in the existing literature. Large sample sizes, multi-center studies, and clinically more relevant definitions of hypotension are needed to confirm and expand upon the relationship between abdominal circumference and hypotension. Furthermore, accounting for potential confounders such as BMI, sensory height block, and baby weight is necessary to ensure accurate results.

1.3 Justification

In spite of previous empirical study reported hypotension is common clinical problem after spinal anesthesia during cesarean section that associated with morbidity for mother (vomiting and nausea) and fetus (fetal acidosis), the prevention and management of maternal hypotension remains a problem. Identifying associated factors that have impact on incidence of hypotension is important to prevent hypotension. Protocols that aim to prevent hypotension may result better outcomes than protocols of treatment after in the resource limited area.

While there are several known risk factors for hypotension AC was not a commonly studied variable, so this study could help to identify a new risk factor that can inform clinical practice and improve patient outcome in the study area.

Ethiopia developing country and genetically different from developed country thus obesity and malnutrition is common which may affect the distribution of body fat and increase the risk of hypotension, therefor this study could inform the development of targeted intervention to prevent or manage hypotension.

Disproving or improving the conflicting studies on the of relationship between the AC and incidence of hypotension can help anesthetists and healthcare providers anticipate and manage hypotension more effectively during cesarean sections, ensuring the safety and well-being of both the mother and the fetus.

The finding of this study could inform policy decision related to anesthesia practice of patient care and also may be reduce cost that invested after complication is happened. As far as my knowledge is concerned, there is no published data from Ethiopia on this topic. Hence, the purpose of study is to assess whether there is relationship between abdominal circumference and hypotension during cesarean section under spinal anesthesia. The findings of this study can be used to change pre anesthesia evaluation and management in the study area.

CHAPTER TWO:

LITERATURE REVIEW

2.1 Incidence of spinal induced hypotension

Post spinal hypotension during cesarean section of elective term pregnant, which can affect 90% of women and result in dizziness, nausea, and vomiting as well as fetal acidosis and, in extreme situations, fetal bradycardia and circulatory collapse, is the primary drawback of spinal anesthesia. Hypotension results from reduced systemic vascular resistance, which is made worse in parturient by inferior vena cava compression. Increased heart rate and stroke volume help to partially offset this hypotension.[25]

The incidence of hypotension was 56.5% in a cross-sectional study conducted in Germany with 503 pregnant that had cesarean deliveries while under spinal anesthesia. [26]. A study conducted at Chulalongkorn University in Bangkok, Thailand, revealed that 76.7% of 772 patients who underwent spinal anesthesia for a cesarean section also experienced hypotension. Conversely, a study conducted at Siriraj Hospital, Mahidol University, Bangkok, revealed that 65.1% of patients experienced hypotension following spinal anesthesia[27]. A research done Brazil reported severe hypotension was 33%[28]. similarly, study done in Rwanda revealed severe hypotension was 40%[29].

However, study done in African countries reported, the number of cesarean sections performed in South Africa has dramatically increased, and this has been associated to a significant incidence of hypotension. It adds 42% to the rate of spinal-related deaths [30, 31].

According to a study conducted in Ethiopia in 2021, 25% of pregnant women who had spinal anesthesia after a cesarean section experienced hypotension[32]. Depending on the cut point and hypotension criteria, the incidence of hypotension differed. When hypotension was interpreted as a drop in systolic blood pressure of more than 20% of the baseline, the incidence was 57.9%. When two criteria (reduction to 20% of baseline value and systolic blood pressure lower than 100 mmHg) were applied, this incidence dropped to 47.9%[18].

2.2. Relation of abdominal circumference with hypotension

The greater MAP drops in pregnant women with greater ACs may be caused by a variety of factors. The uterus is big enough during a term pregnancy to possibly produce aortocaval compression, which would reduce cardiac output and venous return while a woman is lying supine. Since the uterus' size is reflected in a pregnant woman's AC, a woman's MAP reduction is inversely correlated with the size of her AC.

Second, engorgement of the epidural venous plexus can occur from compression of the inferior vena cava by a larger uterus. This narrows the intrathecal space and lowers the volume of cerebrospinal fluid. According to study done in Calgary (2012), cohort, in the third-trimester group compared to the first and second trimester, the epidural space was narrow and density of the vascular network was higher, as explained by epiduroscopy [33, 34]

Higuchi, H., et al comparative cohort study done in japan 2005 reported, due to the larger degree of sympathectomy, and compression of inferior vein-cave by enlarged uteri, there will be hypotension. Additionally, some investigations in non-parturient showed a negative relation between CSF volume and the greatest sensory block level after spinal anesthesia with hyperbaric bupivacaine[35, 36].

A 2014 cohort research by Kuok et al. in Taiwan revealed an association between the AC and the degree of sensory block (left side $\rho = 0.46$, right side $\rho = 0.43$). [14]. According to Zhou et al study done in in China 2014 the main factors influencing the cephalic distribution of spinal anesthesia are the AC and vertebral column length adjusted for age, weight, and height[37].This theory has also been used to explain why twin pregnancies have higher levels of sensory block than singleton pregnancies[38].

Third, Positive correlations have been shown between abdominal pressure and size of the abdomen[39]. randomized, blinded, controlled study in 2014,reported high spinal anesthesia and hypotension have both been linked to high abdominal pressure[40]. Measuring the AC is simple and non-invasive. Another prospective observational study conducted in Taiwan in 2014 revealed that following spinal anesthesia, pregnant women with longer trunks compared to AC had more sensory block.[41].

Conversely, the studies investigated direct impact of AC on hypotension reported, The incidence of hypotension did not differ significantly across the groups, according to the results of the prior cohort study conducted in Thailand in 2020 by Thomard et al (71.42% in the smaller vs. 78.43% in the bigger abdominal circumference group, $p = 0.419$). The larger abdominal circumference group outperformed the smaller group in terms of mean arterial pressure and its percentage change from baseline (change in mean arterial pressure: 28.33 mmHg (18.66-33.67) in the smaller group vs. 36.67 mmHg (23.34-43.34) in the larger abdominal circumference group, $p = 0.004$) [42] .

And also another study found, depending on their median abdomen circumference, patients were split into two groups (<101cm and ≥101cm). A systolic blood pressure of less than 90 mmHg or a mean arterial pressure less than 65 mmHg was considered hypotension [43]. T4 was given a regulated dose of anesthetic. They came to the conclusion that larger ACs, which may be the consequence of enlarged uteri generating aortocaval compression or higher intra-abdominal pressure, was the cause of the decrease in MAP in our study. The absence of abdominal pressure information that could be utilized to explain the mechanism behind this observation was a study restriction[42].

Anadani et al. conducted a cohort study in 2021 that is nearly identical to the study of Thomard et al. a total of 88 women were evaluated. According to the median abdominal circumference (98cm and 98cm), patients were split into two groups. The frequency of hypotension was the same across all groups. However, the bigger than the smaller abdomen circumference experienced a greater reduction in MAP and its percentage decrement from base line [43].

Additionally, Large abdominal circumference during pregnancy is associated with greater decreases in mean arterial pressure from baseline, according to another prospective cohort study conducted in India in 2023 that aimed to compare the total vasopressor (ephedrine) dose required during the procedure and neonatal outcomes and APGAR scores, as well as the relationship between the circumference of the abdomen and the incidence of hypotension during Caesarean section under spinal anesthesia in pregnant patients. Groups SAC and LAC experienced the greatest reductions in mean arterial pressure (mmHg) from baseline, at 26.7% and 34.5%, respectively. This difference was statistically significant, with a p-value of 0.001.

68.8% of patients in group SAC and 76.9% of patients in group LAC, respectively, reported having hypotension. No discernible variation in the incidence [44].

Other association factors such as BMI, weight of baby and height of sensory block also affect the incidence of hypotension in addition to AC. Nani F. et al (2011) found that incidence of hypotension was higher in overweight BMI >25kg/m2 than normal BMI groups [45].

According to the study of Brenck et al, it was identified that the weight of the newborn plays a crucial role in the occurrence of hypotension after spinal anesthesia during cesarean section. Specifically, newborns with a weight of ≥4kg were found to be significantly associated with a higher risk of developing hypotension compared to newborns with a weight of ≤2.4kg[46]. Additionally, the of Shobeiri F. et al. (2006), who found that higher neonatal birth weight was linked to both abdominal circumference and symphysis-fundal height.[47]

According to study of Kim et al. (2021), who discovered a relationship between a sensory block height above T6 and an increased risk of hypotension, with an association value of AOR = 2.230 (95% CI: 1.329-3.741)[48]. Nonetheless, earlier research has shown association between increased abdominal circumference (AC) and increased levels of sensory block and abdominal pressure. Current research is examining the association between the occurrence of hypotension following a Cesarean section performed under spinal anesthesia and abdomen circumference. Predicting and preventing hypotension can be aided by comprehension this relationship.

We hypothesized that the higher occurrence of hypotension following spinal anesthesia was connected to the elevated AC, which has previously been linked to elevated abdominal pressure and an enlarged uterus. This study's main goal was to assess the association between term pregnant patients' abdomen circumference and the frequency of hypotension after cesarean sections performed under spinal anesthesia.

2.3 CONCEPTUAL FRAMEWORK

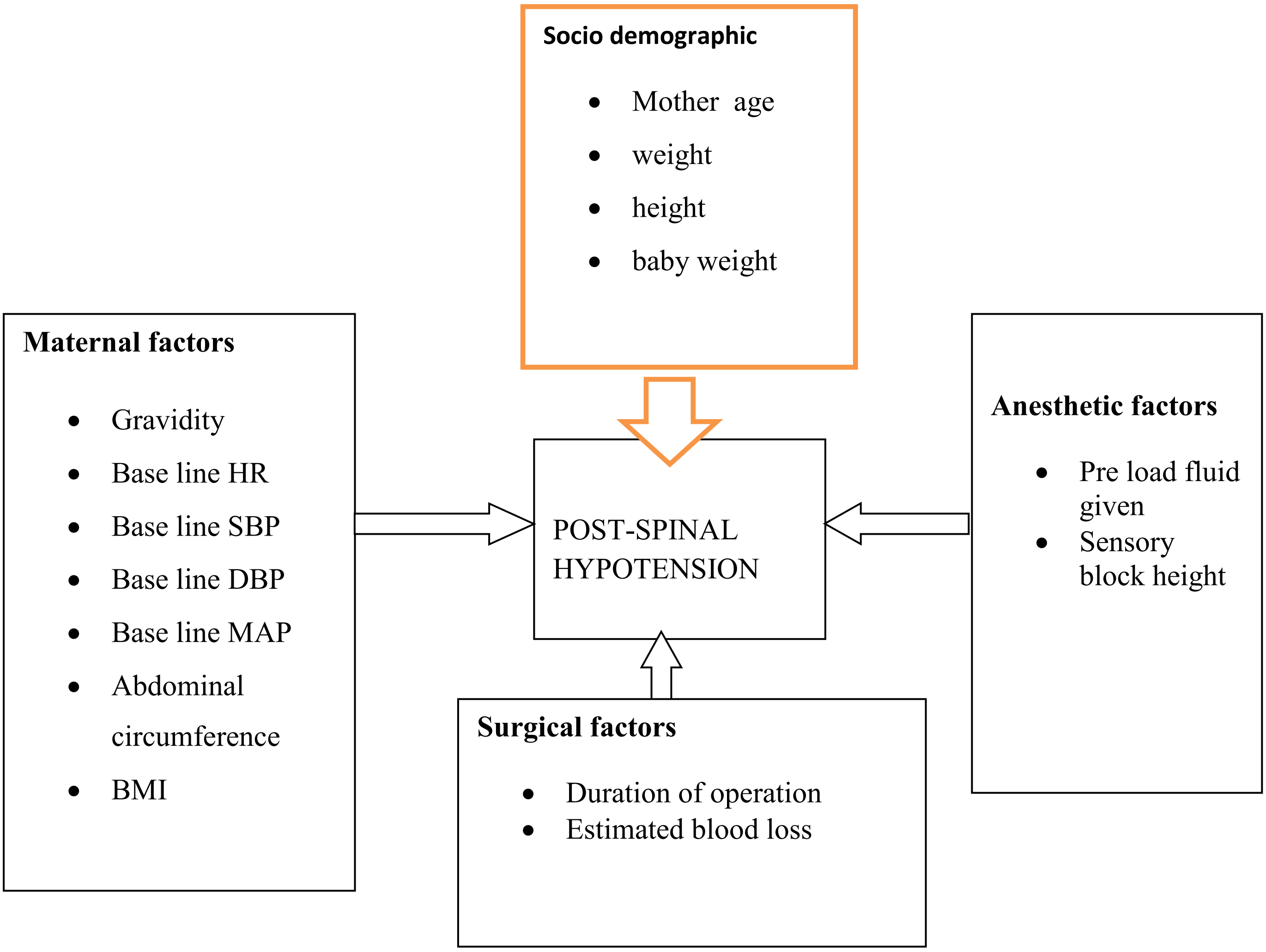


Figure 1: Conceptual frame work relationship between abdominal circumference and incidence of hypotension during elective cesarean section under spinal anesthesia in public hospitals of Addis Ababa, Ethiopia, May 2024. [46][47][48]: developed from literature

CHAPTER THREE

OBJECTIVES

3.1 GENERAL OBJECTIVE

To assess the relationship between abdominal circumference and incidence of hypotension during elective cesarean section under spinal anesthesia in public hospitals of Addis Ababa, Ethiopia, from February to April l 2024.

3.2 SPECIFIC OBJECTIVES

- To determine the incidence of hypotension after spinal anesthesia in term pregnant in public Hospital of Addis Ababa, Ethiopia, from February to April 2024.

- To identify the association between abdominal circumference and hypotension during cesarean section after spinal anesthesia in term pregnant in public Hospital of Addis Ababa, Ethiopia, from February to April 2024.

3.3 HYPOTHESIS

Ho1: There is no difference incidence of hypotension between LAC and SAC.

HA1: There is difference incidence of hypotension between LAC and SAC.

Ho2: There is no relationship between AC and incidence of hypotension.

HA2: There is relationship between AC and incidence of hypotension.

CHAPTER FOUR

4. METHODS AND MATERIALS

4.1 Study area

This was conducted in Addis Ababa, the capital city of Ethiopia. The city has a subtropical highland climate. Apart from this, it also hosts to foreign embassies and heads of diplomatic mission, international, regional and sub-regional organizations and several international NGOs; it is the place of African Union. Likewise it has the central station of the United Nations Economic Commission for Africa and various other international.

The whole city is divided in to 11 sub-cities and 116 woredas with a total area of 520sq.Km. According to 2017 estimation, Addis Ababa has a population of 6.6 Million people. All ethnic groups of the country are represented. In this capital, there are 14 public hospitals, 46 private hospitals, 86 health centers. The study was conducted in three public hospitals.

Frist Gandhi Memorial hospital, is largest maternal and child care center and was established in 1958 by Mohandas Karamchand Gandhi. 4 operating rooms and 120 beds are there. It serves as a teaching Hospital in collaboration with the Addis Ababa University obstetrics and gynecology department and college of health sciences

Second Menilik II referral hospital, give services with different specialty such as obestatrics and gynecology; medicine; general surgery; cardiothoracic; eye; orthopedic and trauma; urology; pediatrics. The hospital offer services with different specialty such as; medicine, general surgery,

Third Zewditu Memorial Hospital is located in kirkos sub city wereda 08, Addis Ababa, Ethiopia. It have 200 beds, 46 are obstetrics, gynecology and postnatal department. Have 2 elective operative theatres, were selected for study areas.

4.2 Study design and study period

A multi-center longitudinal cross sectional study was conducted in public hospitals of Addis Ababa, Ethiopia, from February 2, 2024 to April 30, 2024.

4.3 populations

4.31 source population

The source of population was all pregnant mothers delivered by elective cesarean section under spinal anesthesia in public hospitals in Addis Ababa, Ethiopia.

4.32 study population.

The Selected pregnant mothers who were delivered during the data collection period by elective cesarean section under spinal anesthesia in public hospitals, Addis Ababa, Ethiopia.

4.4 Inclusion and exclusion criteria

4.41 Inclusion criteria

- Term pregnant women aged between 15 to 49 years (WHO reproductive age)
- ASA class II, III.

4.42 exclusion criteria

- High risk pregnancy(placente previa, abruption placentae)
- Eclampsia or pre-eclampsia
- Multiple pregnancies
- Cardiovascular disease
- Prophylactic vasopressor.

4.5 Sample size determination and sampling procedure

4.51 Sample size determination

The sample size was determined using the single population proportion method for the first objective which is the incidence of hypotension after spinal anesthesia in term pregnant women. P=0.5 was used for calculation to get maximum sample size, 95% level of significance, 5% margin of error and 10% for incomplete or as contingency data will used as parameters. These parameters will be used to determine sample size using single population proportion formula.

Formula

$$n= \frac{(Z\ \alpha/2)2\ p(1-p)}{d\ 2}$$

With assumptions; Z=1.96, at 95% confidence level.

Margin of error =5%

N= 384

Total sample size 422

4.52 Sampling procedure

After situational analyses were finished for the previous three months at each hospital on elective cesarean sections under spinal anesthesia, a random sample of size n is drawn from each hospital. The population of size N is divided into non-overlapping sub-populations of size Gandhi Memorial Hospital (Ng=368), Minillik 2 Memorial Hospital (Nm=204), and Zewuditu Memorial Hospital (= 272). The sample was chosen using a method known as systematic random sampling by grouping patients by Hospital. Throughout the study period, a systematic sampling procedure was used to get the required sample size. The first research participant was chosen at random, and the remaining participants were chosen based on k=2, and this process was repeated until the desired sample size was reached over the course of the study.

K= N/n, where n= population during the previous three months (846), sampling interval = 846/422=2, and total sample size = 422.

Referred to as proportional allocation given by the formula, the sample size in each hospital was established in proportion to the size of the hospital (the number of patients in the hospital).

$n_i = \frac{n}{N} * N_i$ shown in figure 2.

Where

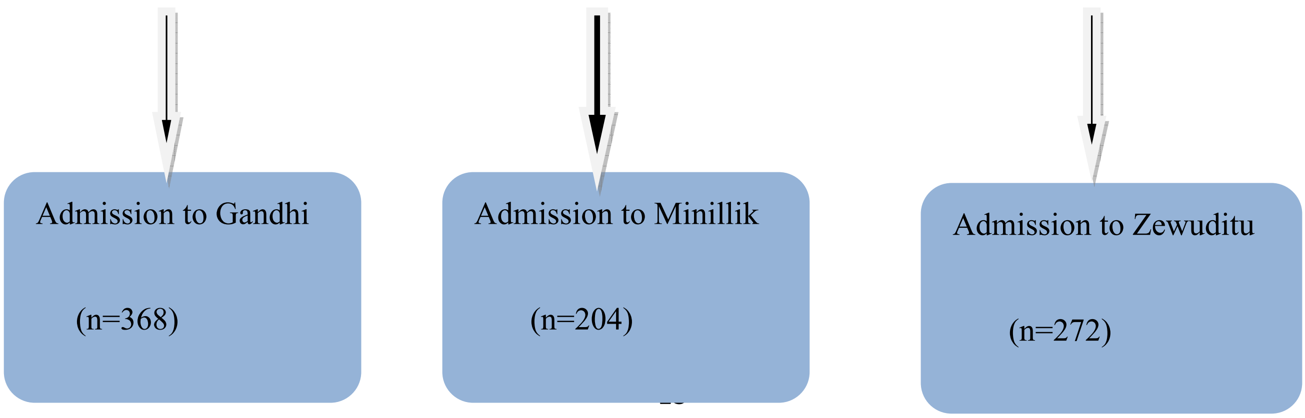
ni = proportional allocation

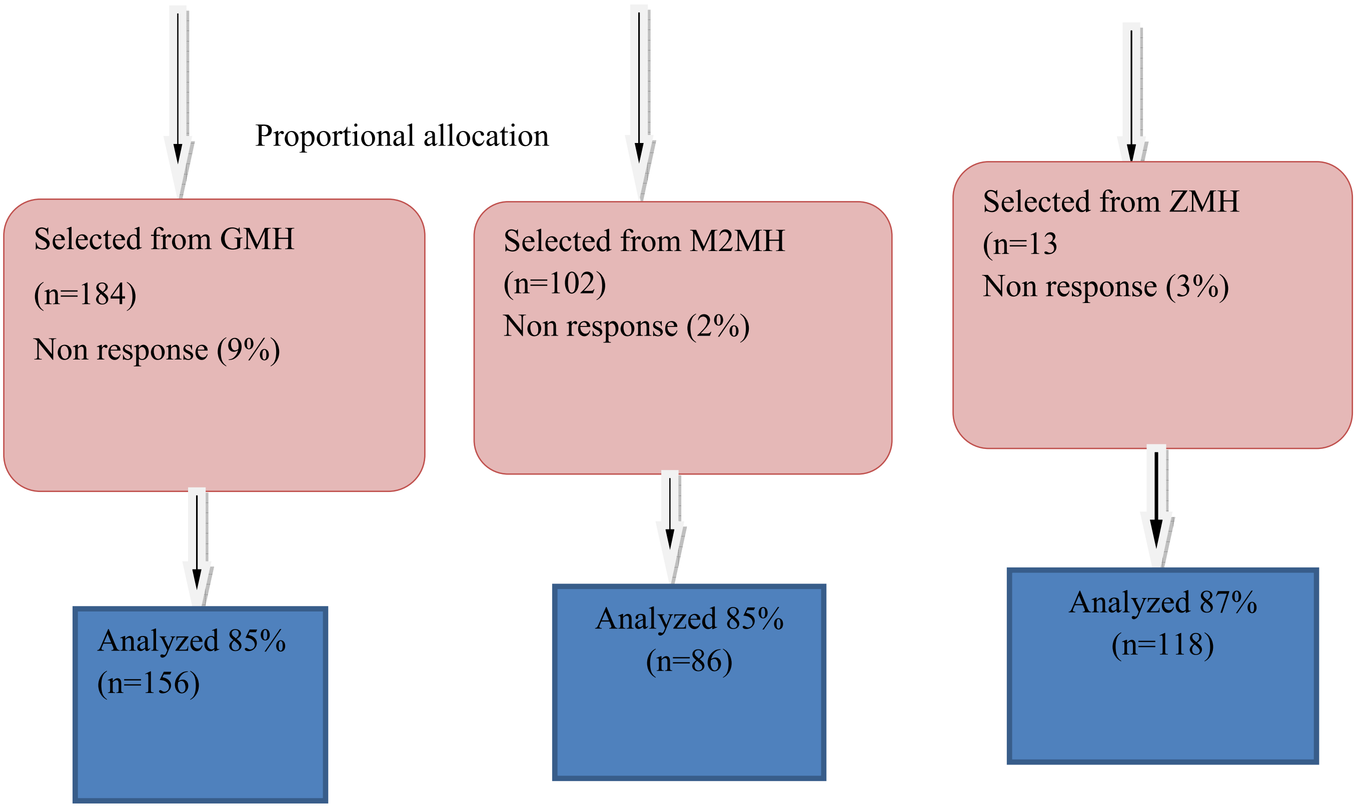
n= total sample size

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

Total cesarean section within 3 month at OR =846

Ni= total number of cases found by institutional analysis in single hospital





Total Sample size analyzed from three hospitals =360

4.6 Variables

4.6.1 Dependent variable4.

- Post spinal hypotension

4.6.2 Independent variables

Socio demographic

- Mother age
- weight
- height
- baby weight

- BMI

Obstetric related factors

Gravidity

Base line HR

Base line SBP

Base line DBP

Base line MAP

Abdominal circumference

anesthesia related factors

Pre load fluid given

Sensory block height

surgical related factors

Duration of operation

Estimated blood loss

4.7 Data collection tool and procedure

4.7.1 Data collection process.

A data collection (tool) checklist and questionnaire was developed in reference to pre-anesthesia evaluation sheets, intraoperative monitoring sheets and other standardized tools from similar studies [43, 44, 49]

To ensure the quality and consistency of the data, a pretested questionnaire was used to collect data. In addition to sociodemographic factors like age, height, weight, BMI, and ASA status, maternal factors like gravidity, baseline heart rate, baseline blood pressure, and AC, anesthetic and surgical factors like sensory block height, fluid preload, baby weight, estimated blood loss, duration of operation, and intraoperative blood pressure every five minutes were also covered in the questionnaire.

All patients' abdominal circumferences (AC) were measured in centimeters (cm) at the umbilical level while they were sitting on the day of operation. Heart rate (beats per minute), systolic blood pressure (mmHg), diastolic blood pressure (mmHg), and mean arterial pressure (mmHg) were among the hemodynamic variables that were measured at baseline.

An attending anesthetist administered spinal anesthesia in the operating room using the standard method. Prior to the administration of spinal anesthetic, all patients had routine monitoring using three-lead electrocardiography and pulse oximetry. The patient was put to sitting position and given of 0.5% hyperbaric bupivacaine for spinal anesthesia. The Quincke-tip spinal needle, gauges 23 and 24, was utilized.

Ten minutes after SA induction, the loss of cold feeling to alcohol swabs was used to evaluate the sensory block height. Surgery began after the proper degree of blockage was established.

4.8 Data processing and analysis

4.8.1 Data quality assurance

To ensure data quality, one day of training was given to data collectors with the aim of the study and the content of the data abstraction format. Pre-testing was conducted at Yekatit 12 Medical College Hospital with 10% of the sample size one week prior to the commencement of actual data collection. The purpose of the testing was to evaluate the data collecting tools' clarity, sequence, validity, consistency, and understandability. A few adjustments were made based on the results

The advisers and professionals in anesthesia were consulted in order to evaluate the validity and usefulness of the data collection format. The suitability and validity of the data collection format were also assessed through discussion with the advisors and anesthesia professionals' experts. The principal investigator and supervisor supervised the data collection process daily to ensure that the data were accurate, consistent, and comprehensive.

4.9 Statistical data Analysis

The collected data were checked for completeness and consistency, as well as arranged, categorized, checked, and coded. The data was entered in to Epi info 7.2.6.0 and exported to SPSS 26 for analysis. Sociodemographic variables and the conditions of peri-operative patients were the subjects of descriptive analyses. The findings were summarized using suitable frequencies, percentages, means, and standard deviations and were displayed in texts, tables, and graphs.

VIF and tolerance were used to assess multi-collinearity for continuous data, and standardized residual tests were used to check for data outliers. The Box-Tidwell approach was utilized to evaluate the linearity of the continuous variables with regard to the dependent variable's logit. The results indicated that all continuous independent variables had a linear relationship with the dependent variable's logit.

The Pearson's chi-squared test was performed to compare between LAC and SAC. Cases with hypotension were compared against the cases without hypotension. The incidence of post spinal hypotension was estimated in LAC and SAC pregnant with a 95% confidence interval and p value.

To assess the association between a single independent and dependent variable, bivariate logistic regression was used. To account for all potential confounders, multivariable regression was used for all variables with p-values ≤0.25. The backward stepwise technique was used to choose the variables in order to determine each variable's impact on the outcome variables.

Hosmer and Lemeshow's goodness of fit test was used to evaluate the model's fit. The results indicate that the model is well-fitting and properly represents the data (p = 0.65); if the value is larger than 0.05, the null hypothesis cannot be rejected. Moreover, Cox & Snell R Square and Nagelkerke R Square were checked (0.45 and 0.66, respectively). Given the set of independent variables; the full model fit explains about 66% of the variations in the incidence of post spinal hypotension. About 82.2% of the observed patients were correctly predicted by the model fit.

Finally, the findings of the multivariable logistic regression analysis were presented using the adjusted odds ratio along with their 95% confidence interval. The level of statistical significance was declared at a p-value < 0.05 and odd ratio used for strength of association.

.4. 10. Operational definition

1. Abdominal Circumference: The measurement of the circumference of the abdomen at the level of the umbilicus using a flexible measuring tape (centimeter).
2. Hypotension: In this study, hypotension can be defined as a MAP pressure decrease of 20% or more from baseline or a MAP below 65 mmHg.
3. Pregnant Women: Women who are currently pregnant and scheduled to undergo an elective cesarean section under spinal anesthesia (e.g., 37-42 weeks).
4. The degree of sensory block: is indicated by the loss of cold or pinprick feeling, which is bilaterally recorded in the midline clavicle or anterior axillary line.
5. Baseline blood pressure: is the measurement made prior to the administration of spinal anesthesia.
6. Preloading: administering crystalloid fluid prior to spinal anesthesia induction.
7. LAC >= 102cm.
8. SAC <102cm.

4.11 Ethical Considerations

After receiving ethical approval from the Addis Ababa Public Health and Emergency Management Directorate, the study was carried out. The Gandhi Memorial Hospital, Minilik Referal Hospital, and Zewuditu Memorial Hospital—where the study was conducted—were also the recipients of a legal letter. Every mother gave written informed consent after being fully told about the study's objectives and methods. The data collection was carried out with the hospitals' consent.

4.12 Dissemination and presentation plan.

The result of the study is presented with figures and tables will be disseminated to the AAU Department of Anesthesiology and the Addis Ababa Health Bureau. It will be presented at workshops and different seminars and finally submitted to a relevant scientific journal for publication.

CHAPTER FIVE: RESULTS

5.1. Socio-demographics and clinical characteristics

From A total of 360 were involved in analysis. All of the study subjects involved in analysis allocated into two groups by their median of abdominal circumference (102cm). All of study participant responded to the interview for socio-demographic characteristics and observed for clinical characters. The majority of pregnant patients, 50.6% (91) of SAC and 70% (126) were age classification range of 25 to 35. Among the sampled pregnant 54(29.2%) SAC and 84(48.0%) LAC had BMI range from 25-29.9kg/m2, and 20(10.8%) SAC and 41(23.4%) LAC had BMI >/= 30kg/m2. Majority of study subjects of SAC and LAC were ASA II, 98.3% (177) and 92.2% (166) respectively. Two third of gravida of SAC and LAC group were gravida one and two (SAC 88(48.9%) and 43(23.9%)) and (LAC 51(28.3%) and 56(31.1%)) respectively. (Table1).

Table 1: PATIENT CLINICAL CHARACTERS

Variables	Categories	Frequency (%)	
		SAC (n=180)	LAC (n=180)
Age of the parturient	15-24	63(35.0%)	22(12.2%)
	25-35	91(50.6%)	126(70.0%)
	36-49	26(14.4%)	32(17.8%)
	Total	180(100%)	180(100%)
BMI of parturient	18.5-4.9kg/m2	111(60.0%)	50(28.6%)
	25-29.9kg/m2	54(29.2%)	84(48.0%)
	>/=30kgm2	20(10.8%)	41(23.4%)
	Total	180(100%)	180(100%)
ASA status	ASA class 2	177(98.3%)	166(92.2%)
	ASA class 3	3(1.7%)	14(7.8)
	Total	180(100%)	180(100%)
Gravida of patient	Gravida 1	88(48.9%)	51(28.3%)
	Gravida 2	43(23.9%)	56(31.1%)
	Gravida 3	39(21.7%)	59(32.8%)
	Gravida 4	9(5.0%)	12(6.7%)
	Gravida above 4	1(0.6%)	2(1.1%)
	Total	180(100%)	180(100%)
Level sensory of block	T4	5(2.7%)	5(2.9%)
	T6	79(42.7%)	109(62.3%)
	T8	19(10.3%)	5(2.9%)
	T10	82(44.3%)	56(32.0%)
	Total	180(100%)	180(100%)
Fluid given in ml	<500	43(23.9%)	44(24.4%)
	500-1000	137(76.1%)	136(75.6%)
	Total	180(100%)	180(100%)
Duration of operation in minute	Mean ±SD	36.36±10.426	36.39±8.274
Blood loss estimation in ml	500-1000	174(96.7%)	171(95%)
	>1000	6(3.3%)	9(5%)
	total	180(100%)	180(100%)
Baby weight in kg	<2.5	32(17.3%)	9(5.1%)
	2.5-4	149(80.5%)	139(79.4%)
	>4	4(2.2%)	27(15.4%)
	Total	180(100%)	180(100%)
Base line HR		83.96±13.71	87.24±12.75
		180(100%)	180(100%)
Base line MAP		79.75±9.45	82.64±10.65
		180(100%)	180(100%)

Majority of sensory block height for both group were T6 SAC 79(42.7%), LAC 109(62.3%) and T10 82(44.3%), LAC 56 (32.0%). two third of preload fluid given was classified in the range of 500-1000 ml for both groups, SAC 137(76.1%) and LAC 136(75.6%). Most of estimated blood loss during the procedure was 500-1000ml, SAC 174(96.7%) and LAC 171(95%).

During study period the majority of the baby weight was classified in 2.5kg to 4kg for both group, SAC 149(80.5%) and LAC 139(79.4%) respectively. Few patients were given vasopressor, SAC 6(33.3%) and LAC 15(8.3%).

Average base line of SBP of both groups was SAC 121.29±12.59 and LAC 126.98±11.81, as well as average base line DBP of both groups was SAC 75.42±11.77 and LAC 77.30±10.95 respectively.

Among sampled patients mean of base line HR were SAC 83.96±13.71 and LAC 87.24±12.75 respectively. From all study participants mean of base line MAP from both groups was SAC 79.75±9.45 and LAC 82.64±10.65 respectively.

5.2 The cumulative Incidence of hypotension among the mother underwent elective cesarean section under spinal anesthesia

The cumulative incidence of post spinal hypotension was 76.67%, 95%CI, [71.9-80.9] Fig.2.

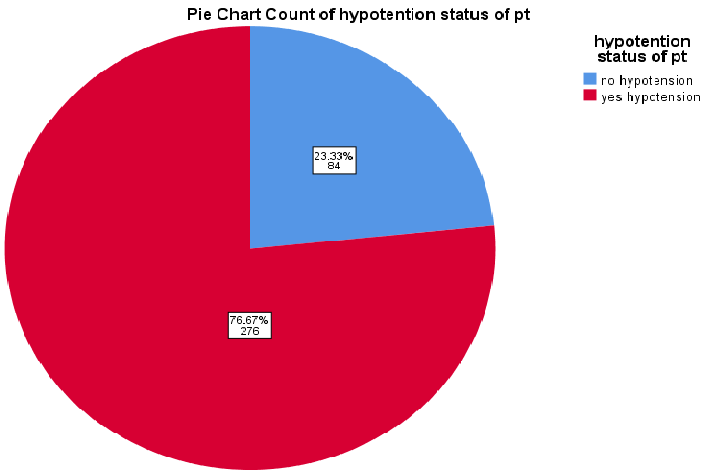


Figure 2: Incidence of post spinal hypotension at public Hospitals, Addis Ababa, Ethiopia, 2024.

5.3 The relationship between abdominal circumference and incidence of hypotension

There was strong evidence of relationship between AC and incidence of hypotension (Chi-square = 51.3, df=1 and p<0.001). Thus we reject null hypothesis (Ho) and accept alternative hypothesis (H1).There was statistically significant relationship between AC and incidence of hypotension.

Table 2 : Hemodynamic out comes as to the study group

	SAC(180)	LAC(180)	P VALUE
The incidence of hypotension	123(63.3%)	154(85.6%)	<0.001
Maximal MAP percentage decrease from baseline (percent)	28.62±12.86	35.28±11.65	<0.001
Vasopressors given	3(3.3%)	15(8.3%)	0.49

Data ware presented as number (%) and means (standard deviation), Analyzed by using chi-square test.

In the larger AC group, there was a greater maximal fall in MAP following spinal anesthesia from baseline (see table 2). The incidence of significant hypotension, which is defined as a decrease in MAP of more than 20% from base line, was higher in the larger AC group than in the smaller group, as indicated by the change in MAP percentage according to the study groups shown in Figure 1 (63.3% in the smaller AC group vs. 85.6% in the larger AC group, p <0.001).

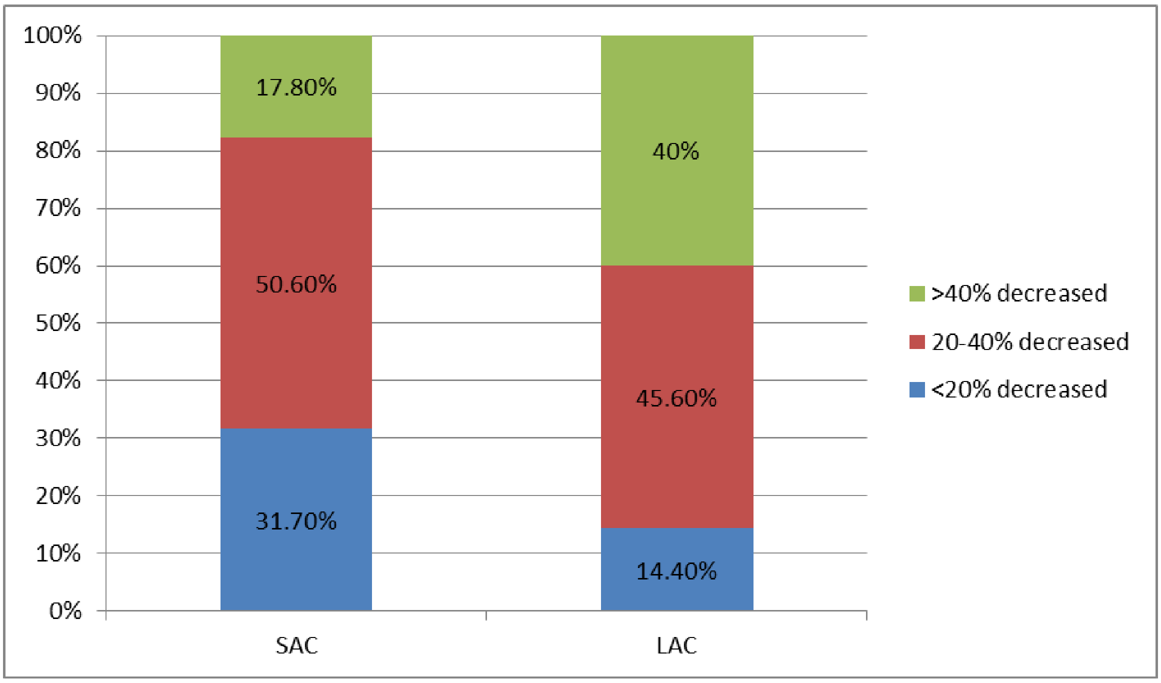


Figure 3: Stratification for each research group based on the percentage drop in mean arterial pressure from baseline.

The data presented as percentages stratified by each study group's mean arterial pressure drop from baseline as a percentage

Percentage decrement of MAP from base line to 20-40% in SAC group was 50.6%, whereas percentage decrement of MAP from base line to 20-40% in SAC group was 45.6%.

MAP decreased from base line to >40% in SAC group by 17.8%, whereas in LAC group decreased by 40%; p value < 0.05.

5.4 Factors associated with hypotension among the mother underwent elective cesarean section under spinal anesthesia

Bivariate binomial logistic regression was done to evaluate the association between a single independent and dependent variable. To account for all potential confounders, multivariable regression was used for all variables with p-values ≤0.25. The backward stepwise technique was used to choose the variables in order to determine each variable's impact on the outcome variables. In bivariate analysis AC, BMI, level of sensory block, baby weight, duration of operation, preload fluid and weight were candidates for multivariate regression Table 4.

Table 3: The Bivariate logistic regression model was to identify factors affecting the incidence of hypotension.

Variables	Category	Hypotension status of pregnant		COR	P value
		<20%/no	>20%/yes		
Age in year	15-24	34(40.0%)	51(60.0%)	1	
	25-35	37(17.1%)	180(82.9%)	3.24(1.85-5.68)*	<0.001
	36-49	12(20.7)	46(79.3%)	2.56(1.18-5.52)*	0.017
ASA	ASA2	82(23.9%)	261(76.1%)	0.199(0.03-1.52)*	0.12
	ASA3	1(5.9%)	16(94.1%)	1	
Height in meter	Mean ±SD	1.62±0.089	1.62±0.08	0.87(.05-15.57)	0.92
Weight in kg	Mean ±SD	66.33±11.453	69.31± 12.23	1.02(1.00-1.04)*	0.05
BMI in kg/M2	18.5-24.9	38(24.7)	116(75.3%)	1	
	25-29.9	43(26.5%)	119(73.5%)	0.14(0.03-0.63)*	0.010
	≥30	2(4.5%)	42(95.5%)	0.13(0.03-0.57)*	0.007
Baseline HR	Mean ±SD	85.04±12.36	85.77±13.61	1.00(0.98-1.023)	0.66
Baseline MAP	Mean ±SD	78.51±8.16	82.00±10.57	1.08(1.01-1.06)*	0.007
abdominal circumference	SAC	57(31.7%)	123(68.3%)	1	
	LAC	26(14.4%)	154(85.6%)	0.364(0.27-0.61)*	<0.001
Level of block	T4	1(16.7%)	5(83.3%)	0.17(0.02-1.36)*	0.095
	T6	50(24.2%)	157(75.8%)	0.28(0.015-5.28)	0.394
	T8	1(5.3%)	18(94.7%)	0.17(0.02-1.34)*	0.093
	T10	31(24.2%)	97(75.8%)	1	
Fluid given preoperatively in ml	<500	12(13.8%)	75(86.2%)	1	
	500-1000	71(26.0%)	202(74.0%)	2.2(1.13-4.28)*	0.021
Duration of operation	Mean ±SD	34.52±5.61	36.93±10.20	1.04(1.00-1.08)*	0.039
Blood loss estimation in ml	500-1000	80(23.2%)	265(76.8%)	1	
	>1000	3(20.0%)	12(80.0%)	0.828(0.23-3.01)	0.77

Baby weight	<2.5	14(42.4%)	19(57.6%)	1	
	2.5-4	67(22.6%)	229(77.4%)	0.094(0.02-0.46)*	0.004
	>4	2(6.5%)	29(93.5%)	0.25(0.06-1.01)*	.052

*->candidate variables in binary regression @ p<=0.25

Using the variance inflation factor (VIF) and the tolerance test for p values less than 0.25, the multi-collinearity effect of the correlation between those independent variables was examined. Multivariate logistic regression analysis revealed a statistically significant correlation between post spinal hypotension and the patient's BMI, AC, degree of sensory block, and infant weight (P-value ≤0.05) (Table 5). Ten of the factors that were statistically significant in bivariate regression, including ASA, age, and base line MAP did not show a statistically significant association with the post spinal anesthesia hypotension in multivariate logistic regression.

LAC was three times higher likelihood of having hypotension (AOR = 2.98, 95% CI [1.57, 5.65]). Obese patients (>30 kg/m2) were more than three times more likely to have hypotension (AOR=3.19, 95%CI [1.09, 9.07]). The odds of having hypotension were more than eleven times higher among patients who had > 4kg baby compared to patients with < 2.5kg baby weight (AOR 11.41, 95%CI, [2.0, 64.86]).

The odds having hypotension were two times higher among patients who had sensory height block of above T6 level (AOR 2.22, 95%CI [1.12, 4.42]). As, the weight of the patient increase by one kg the incidence of hypotension was 0.96 times less likely to have hypotension (AOR 0.96, 95% CI, [0.92-0.98]). Pre-operative 500-1000ml fluid loading was 0. 42 times less likely, to have hypotension compared to 500ml pre-loading (AOR 0.42, 95% CI, [0.2-0.89]). The duration of operation, as increased by one minute incidence of hypotension increased by two approximately (AOR 1.08, 95% CI, [1.03-1.13]).

Table 4: Multivariate logistic regression model was to identify factors affecting the incidence of hypotension after spinal anesthesia.

Variables	Category	Hypotension status of pregnant		COR, 95% CI	AOR, 95% CI	P value
		<20%/no	>20%/yes			
Level of sensory block	T10	42(30.4%)	96(69.6%)	1	1	
	T8	8(33.3%)	16(66.7%)	3.93(0.48-32.08)*	8.07(0.9-72.39)	0.062
	T6	33(17.6%)	155(82.4%)	2.05(1.22-3.46)*	2.22(1.12-4.42)	0.023
	T4	1(10.0%)	9(90.0%)	0.87(0.35-2.2)	2.18(0.75-6.35)	0.15
Weight in kg	Mean ±SD	66.33±11.45	69.31±12.23	1.02(1.00-1.04)*	0.96(0.92-0.98)	0.006
BMI in kg/M2	18.5-24.9	38(24.7)	116(75.3%)	1	1	
	25-29.9	43(26.5%)	119(73.5%)	0.14(0.03-0.63)*	2.3(1.16-4.6)	0.018
	≥30	2(4.5%)	42(95.5%)	0.13(0.03-0.57)*	3.19(1.09-9.07)	0.034
abdominal circumference	SAC	57(31.7%)	123(68.3%)	1	1	
	LAC	26(14.4%)	154(85.6%)	0.364(0.27-0.61)*	2.98(1.57-5.65)	0.001
Fluid given preoperatively in ml	<500	12(13.8%)	75(86.2%)	1	1	
	500-1000	71(26.0%)	202(74.0%)	2.2(1.13-4.28)*	0.42(0.2-0.89)	0.023
Duration of operation	Mean ±SD	34.52±5.61	36.93±10.2	1.04(1.00-1.08)*	1.08(1.03-1.13)	0.002
Baby weight	<2.5	14(42.4%)	19(57.6%)	1	1	
	2.5-4	67(22.6%)	229(77.4%)	0.094(0.02-0.46)*	4.08(1.79-9.25)	0.001
	>4	2(6.5%)	29(93.5%)	0.25(0.06-1.01)*	11.41(2.0-64.86)	0.006

**->a candidate variables in binary regression @ p<=0.25. ** = indicates statistically significant in multivariable logistic regression @p<=0.05*

CHAPTER SIX

DISCUSSION

In this study, the cumulative incidence of post spinal hypotension was 76.67% with 95%CI [71.9-80.9] from total of 360 pregnant mothers. The incidence between groups were 63.3% in the smaller AC group vs. 85.6% in the larger AC group, p <0.001. There was significant association between LAC and post-spinal hypotension (AOR = 2.98, 95% CI [1.57, 5.65]). The other predictors that independently associated with post spinal hypotension were BMI, baby weight, sensory block height.

The primary finding of this study was 76.67% with 95%CI [71.9-80.9] [cumulative incidence of hypotension. This result almost comparable with 56% reported in study done in Germany[26], also they used the same definition of hypotension with our study. 76.7% incidence of hypotension found in previous study done in Thailand by the same definition of hypotension [27] and similarly the study done Ethiopia revealed 64% however the little differences were due to different definition of hypotension they used[46].

In contrast, study done in Brazil reported 33%[28], study done Rwanda revealed 40% of incidence of severe hypotension that defined SBP decrease 30%from base line[29], and another research assessed incidence of hypotension without considering the impact of AC on incidence of hypotension done in Ethiopia reported 25%[32].

The incidence of hypotension varied throughout the groups. In the same way, the bigger AC group saw a greater maximal fall in MAP following spinal anesthesia from baseline (see table 3). According to the study group, the MAP percentage decrement of mean was 28.62±12.86 in SAC and 35.38±11.65 in LAC, with a p-value of less than 0.001, as indicated in Table 3, the results are also comparable with previous study done in India (2023) shown MAP percentage decrement ware 26.7±4.15
(CI, 95% [24.15-28.93]) in SAC vs. 34.5±5.89 (CI, 95%[31.14-37.84]), P<0.001[50].

The incidence of significant hypotension, defined as a decrease in MAP of more than 20% from base line, was higher in the larger AC group than in smaller group (63.3% in the smaller AC group vs. 85.6% in the larger AC group, p <0.001), this results are not comparable with previous study done by Thomson P. et al. shown (71.42%in SAC vs. 78.45%in LAC, p=0.419) as well as study done by Sofi, B.R., et al. shown[44, 49].

There are numerous ways to lower blood pressure throughout a term pregnancy. The large gravid uterus in a term parturient might result in aorto-caval compression, which lowers cardiac output and venous return when the patient is supine. The size of the uterus is reflected in the measurement of abdominal circumference during pregnancy; therefore, the higher the AC, the greater the fall in MAP. Additionally, because of increased IVC compression and thus greater epidural venous plexus distension, parturients with higher AC had lower lumbosacral CSF volumes. Higher levels of sensory blockage and sympathectomy will result [51].

The results of our study are consistent with earlier research supporting the decline in MAP, which suggests that compression of the inferior vena cava by an enlarged uterus causes engorgement of the epidural venous plexuses, which in turn causes a decrease in the volume of cerebrospinal fluid and narrows the intrathecal space, which in turn causes the spreading of spinal anesthesia cephalad and, ultimately, hypotension. [33].

Since the goal of our study was to maintain the level of spinal anesthesia at T4, we did not look at the impact of the degree of spinal anesthesia with big AC. A study by Kuok et al. discovered a relationship between sensory block level and AC (left side P=0.46, P=0.003; right side P=0.43, P=0.005) [14].

The occurrences of hypotension, which is defined as a drop in blood pressure of ≥30% from baseline, and AC were not shown to be correlated by those researchers. The AC from the Kuok study was 98.4 ± 6.8 cm, while it was somewhat bigger in our study at 102.79 ± 10.31 cm. While Kuok's study sought to examine the effects of anesthesia level, we managed the anesthesia level to ascertain the occurrence of hypotension. In comparison to our study, the Kuok study had a smaller sample size, a lower AC, and distinct goals.

The result of our study are consistent with previous studies regarding the hypothesis of large abdominal circumference has relation with incidence of hypotension, but is not comparable with regarding of incidence of hypotension with in a group.

A study conducted in 2020 by Thomson P. et al. found that after spinal anesthesia, a larger abdominal circumference in pregnancy is linked to a greater decrease in mean arterial pressure from baseline. The study included only 100 pregnant women in its sample, and the change in mean arterial pressure was 28.33 mmHg (18.66–33.67) in the smaller abdominal circumference group and 36.67 mmHg (23.34–43.34) for the higher abdominal circumference group (p = 0.004). However, the incidence of hypotension was the not significantly different in both groups (71.42% in the group with a lower abdomen circumference vs. 78.43% in the larger group, p = 0.419).

In order to improve the control of hypotension, they additionally incorporated parameters such as blood loss (per milliliter), intravenous fluid (per milliliter), diastolic and systolic blood pressure, and body mass index [49].

Similarly, (Anadani BH et al 2021) also found that, with a sample size of 88 pregnant women, there was a greater decrease in mean arterial pressure from baseline in the larger abdominal circumference group and no significant difference in the incidence of hypotension between the larger and smaller abdominal circumference groups [43].

The incidence of hypotension was not statistically significant (p-value of > 0.05), despite the fact that the change in mean arterial pressure did reveal a significant change. This was found with a total sample size of 100 pregnant patients and 102 cm of AC, which was equivalent to the median AC of our study. There were reports for 68.8% of patients in group SAC and 76.9% of patients in group LAC. [50].

The discrepancy to our study may be due to the small sample size. However, they recommend including abdominal circumference parameter to assist anesthetist to prepare for hypotension events after spinal anesthesia in pregnant women

The abdominal circumference and abdominal pressure have a positive correlation. It's been demonstrated that high spinal anesthesia and hypotension can result from elevated abdominal pressure [20, 25]. We did not take an abdominal pressure reading for this investigation.

Furthermore, the current study discovered that significant association between several factors and post spinal hypotension.

In our study LAC was three times higher likelihood of having hypotension (AOR = 2.98, 95% CI [1.57, 5.65]) compared to SAC. This result is comparable with the studies of Thomson P. et al and Sofi, B.R., et al found LAC odd ratio 3.67, 95% CI (1.01–13.28) and 4.19, 95% CI (2.97-9.84) respectively. This implies that post spinal hypotension care and intervention strategies relating to elective cesarean section term pregnant with large abdominal circumference should be strengthened.

Our finding shows that a BMI of > 25kgm2 were three times more likely to develop hypotension found to be one of the significant predictors of post spinal hypotension. This result is consistent with Nani F. et al (2011) found that incidence of hypotension was more in over weight than normal groups[45]. However our result did not correlate with previous study that found BMI had no significant association with incidence of hypotension an odd of (1.07 (0.74-1.75)) with p value of 0.591[44].

In this study we have also found that baby weight >=4kg were eleven times more likely to develop hypotension. This finding is similar with study by Brenck et al, it was identified that the weight of the newborn plays a crucial role in the occurrence of hypotension after spinal anesthesia during cesarean section. Specifically, newborns with a weight of ≥4kg were found to be significantly associated with a higher risk of developing hypotension compared to newborns with a weight of ≤2.4kg[46].

Additionally, our research aligns with that of Shobeiri F. et al. (2006), who found that higher neonatal birth weight is linked to both abdominal circumference and symphysis-fundal height[47]. According to this, there is a greater chance of hypotension with increasing infant weight because of things like the gravid uterus compressing the major arteries and inferior vena cava, which lowers venous return and causes hypotension[49].

Our results show that there is a two-fold increase in the likelihood of developing hypotension for sensory height blocks above T6, with an odd of (AOR = 2.22 (95% CI: 1.12-4.42)). These results are in line with those of Kim et al. (2021), who discovered a relationship between a sensory block height above T6 and an increased risk of hypotension, with an association value of AOR = 2.230 (95% CI: 1.329-3.741)[48]. The possible reason was due to vasodilation effect of local anesthetics as well as spreading of high level dermatome associated to enlargement of abdominal circumference.

The present finding shows incidence of hypotension with in a group is significant difference. Aorto-caval compression brought on by an enlarged gravid uterus during a term pregnancy might result in reduced cardiac output and venous return when the patient is supine. The size of the uterus is reflected in the measurement of abdominal circumference during pregnancy; therefore, the higher the AC, the greater the fall in MAP. Additionally, because of increased IVC compression and thus greater epidural venous plexus distension, parturients with higher AC had lower volumes of lumbosacral CSF. A greater degree of sensory blockage and sympathectomy will result. The other confounding factors like BMI and baby weight also have relation to cause hypotension during cesarean section after spinal anesthesia.

6.2. Strengths and Limitations of the Study

The study's strengths were being multi-center study and large sample size.

There are certain limitations to our study as well. Firstly, we did not measure abdominal pressure and ratio between trunk lengths and AC. In addition, we did not follow up with those patients who had developed hypotension over an extended period to identify any further problems or to ascertain the patient's fate.

6.3 Conclusion

The incidence of hypotension was high and significant association between LAC and hypotension. As well as, incidence between the groups was difference. MAP of LAC significantly decreased from base line. BMI>30 kg/m2, baby weight > 4kg and sensory block height above T6 ware significantly associated to post spinal hypotension while elective cesarean section.

6.4 Recommendation

Based on the findings of this study

1. Consider measuring abdominal circumference as part of the preoperative evaluation to identify patients at high risk of developing hypotension.

2. An anesthesia provider should increase monitoring of blood pressure and other vital signs in patients with large abdominal circumference to identify early signs of hypotension.

3. Consider using fluid administration, blood pressure support or vasopressor.

4. Consider conducting further studies to on this topic, including exploring other factors like ratio of trunk length and abdominal circumference, and direct abdominal pressure that may influence this relationship.

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8. ANNEXES

ANNEX I

INFORMATION SHEET

Title of the Research Project: "THE RELATIONSHIP BETWEEN ABDOMINAL CIRCUMFERENCE AND INCIDENCE OF HYPOTENSION DURING CESAREAN SECTION UNDER SPINAL ANESTHESIA"

Name of principal investigator: WAKJIRA BIRHANU

Name of the organization: Addis Ababa University, College of Medicine and health science, Department of Anesthesia

Introduction: Greetins! My name is Wakjira Birhanu. I am a student at Addis Ababa University, College of Medicine and health science in MASTERS OF SCIENCE (MSc) in clinical Anesthesia. As part of this degree I am undertaking a research on the topic of "the relationship between abdominal circumference and incidence of hypotension during cesarean section under spinal anesthesia."

Purpose of the Research Project: The purpose of this research is to evaluate the relation between the circumferences of the abdomen the occurrence of hypotension following spinal anesthesia during elective cesarean sections in Addis Ababa, Ethiopia. Clinical recommendations will be made using the data gathered from this study.

Procedure: The Gandhi Memorial, Menilik 2 Memorial, and Zewuditu Memorial hospitals will be the sites of the data collecting. A standard questioner was created to get the required data from the written document, the monitoring equipment utilized in the operating room, and the working anesthetist during data collection.

Risk and/or Discomfort: Patients won't be harmed because data will be obtained from them, their anesthesia chart, and a vital sign monitoring equipment.

Benefits: If practitioners use the study's findings, there will be an indirect advantage for caesarian section delivery patients whose information is abstracted.

Confidentiality: The patient's name was not entered into the questionnaire during data collection. Every questionnaire that was gathered was kept private. The data gathered was only applied to research projects. The thesis will be posted on the university website and library, and it will be submitted to the department of anesthesia at Addis Ababa, University's College of Medicine and Health Sciences. It is also the intention of this study to be submitted for publication in academic journals

Right to refusal or withdraw: Before any data is collected, participant and hospital manager approval is needed.

Person to contact: Please get in touch if you have any more inquiries or would like more details about the project.

1. Wakjira Birhanu(principal investigator) :+251912294142

ADVISORS: 1. Mrs. MISRAK WELDEYOHANS (Assistant Professor, Ph.D. fellow)

2. Mrs. SENIEYT AWOKE (Assistant Professor)

Thank you for reading the information sheet and asking any questions that you have!

ANNEX II:

QUESTIONNAIRE

Informed consent form (English version)

<u>Identification</u>

Name of the institute ______________________

Address of the institute ______________________

Hello! How are you? I am______________________ here to collect information about the research study aimed to assess the relationship between abdominal circumference and incidence of hypotension during elective cesarean section under spinal anesthesia in public hospitals of Addis Ababa, Ethiopia, from February to April 2024. Wakjira Birhanu, a Master of Science student in the Anesthesia School of Medicine College of Health Science at Addis Ababa University, will undertake a study. The success of the study will be greatly influenced by your response to the study items. As a result, we respectfully ask that you respond honestly to each question. I've been informed that the information will only be used for that reason and that your identity will remain private.

Are you willing to participate in the study?

1/ yes　　　　　2/ no

Thank you for your participation!

For more information and question contact the investigator. Wakjira Birhanu

Tel: +251912294142

Email: wakjirabirhanu@ gmail.com

Table I: Socio-demographic characteristics of term pregnant women in public Hospitals of Addis Ababa, Ethiopia, May 2024.

Date --------------------- Card number---------------------- Bed no --------

Serial number	Questions	Response	Code
101	Age of the parturient		
102	Height		
103	Weight		
104	BMI		
105	ASA status	Class 2	1
		Class 3	2

Table two: pre-operative data of term pregnant women in public Hospitals of Addis Ababa, Ethiopia, 2024

Serial number	Questions	Response	Code
201	Base line heart rate	(………………..)bpm	
202	Base line blood pressure	(……………..)mmHg	
203	AC	(…………………..)cm	
204	Gravidity	One	
		Two	
		Three	
		Four	
		Above four	

Table three: intra operative data of term pregnant women in public Hospitals of Addis Ababa, Ethiopia, 2024

Serial number	Questions	Response	
301	Duration of operation		
302	Estimated blood loss	500-1000ml	
		>1000ml	
303	Sensory block height	T10	1
		T8	2
		T6	3
		T4	4
304	Amount of crystalloids preload	500ml	1
		1000ml	2
305	Weight of baby		
306	APGAR score at 1min		
307	APGAR score at 5min		
308	Vasopressor		

Table four: intra operative vital sign of term pregnant women in public Hospitals of Addis Ababa, Ethiopia, May 2024.

Vital sign	SBP	DBP	MAP
Base line			
At induction			
1min			
5min			
6min			
7min			
10min			
15min			
20min			
25min			
30min			
35min			
40min			
45min			