COMPARASION OF HEMODYNAMIC CHANGES AND VASOPRESSOR REQUIREMENTS AFTER SPINAL ANESTHESIA IN PREECLAMPTIC AND NON-PREECLAMPTIC PARTURIENTS DURING CESAREAN SECTION IN JIMMA ZONE PUBLIC HOSPITALS, SOUTHWESTERN ETHIOPIA,2022: A PROSPECTIVE COHORT STUDY.

A RESEARCH THESIS SUBMITTED TO THE DEPARTMENT OF ANESTHESIA, FACULTY OF HEALTH SCIENCES, JIMMA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTERS OF SCIENCES DEGREE IN ANESTHESIA.

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JIMMA, ETHIOPIA

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Abstract

Background: The hemodynamic change is a common problem during cesarean section following spinal anesthesia/SA/. The choice of anesthesia in the preeclamptic case is the main concern as they are assumed at increased risk of hemodynamic changes. The hemodynamic changes compromise fetal and maternal well-being if not managed immediately.

Objectives: To compare hemodynamic changes and vasopressor requirements after spinal anesthesia in preeclamptic and non-preeclamptic parturients during cesarean section in Jimma zone public hospitals, Southwestern Ethiopia, from August 15- November 30, 2022.

Methods: The facility-based prospective cohort study was conducted on 126 parturients. The study hospitals were selected by using simple random sampling and proportional sample sizes were allocated to the hospitals. The Consecutive sampling technique was used. Symmetric data were analyzed by an independent t-test, asymmetric data were analyzed by Mann-Whitney U-test, and a chi-square test was used for categorical data. Hypotension was defined as a 20% drop in SBP and HR changes were 20% (decrement or increment) of HR from the baseline value. The P-value <0.05 was considered statistically significant.

Results: The incidence of hypotension after SA was higher in non-preeclamptic (50.8%) compared to preeclamptic (31.7%). The SBP, DBP, and MAP were significantly higher in the preeclamptic group thorough out intraoperative period (P<0.001). The maximum BP fall was significantly higher in the non-preeclamptic compared with the preeclamptic group. The baseline and intraoperative HR were comparable between the groups. The vasopressor requirements were significantly higher in the non-preeclamptic as compared to preeclamptic(P=0.046). The majority of non-preeclamptic developed hypotension within the first 15 minutes. However, the preeclamptic developed hypotension after 15 minutes following SA.

Conclusion and recommendation: The incidence of SA-induced hypotension, the magnitude of BP fall, and vasopressor requirements were less in the preeclamptic group. The intraoperative HR changes were comparable between the groups. The number of episodes of hypotension was higher in the non-preeclamptic. The use of spinal anesthesia in preeclamptic is safe regarding the intraoperative hemodynamic changes for cesarean section if there are no other contraindications.

Keywords: Hemodynamic change, Spinal anesthesia**,** Preeclampsia, Vasopressor requirements

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Acronyms and abbreviations

ASA=American society of anesthesiology

BMI= body mass index

BP= blood pressure

CS=cesarean section

CSF= cerebrospinal fluid

DBP=diastolic blood pressure

ECG=Electrocardiogphy

HR =heart rate

IV =intra-venous

JUMC =Jimma university medical center

LA= local anesthetic

MAP=mean arterial pressure

NIBP = noninvasive blood pressure

PI=principal investigators

RCT =randomized control trial

SA=spinal anesthesia

SBP=systolic blood pressure

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Chapter One: Introduction

1.1 Background of the Study

Spinal anesthesia becomes the popular technique of anesthesia in obstetric care, because of its relatively decreased complication and increased advantages compared to general anesthesia. However, the hemodynamic change after regional block especially after spinal anesthesia is more aggressive than other techniques of regional anesthesia due to rapid and dense neural block associated with subarachnoid injection of local anesthetics (1). Spinal anesthesia-induced hypotension is one of the common hemodynamic changes during cesarean delivery compromising uterine blood flow and fetal circulation since the placental vascular bed has no autoregulation. Thus, resulting in maternal and fetal complications if not adequately managed (2).

Preeclampsia is a multisystem disease which is the specific causes remain unknown and unique to human pregnancy. It is defined as the new onset of hypertension (BP $\geq$ 140/90 mmHg) and proteinuria after 20 weeks of gestation. If there is any sign and symptoms which implies the end-organ involvement such as; persistent epigastric or right upper quadrant pain, persistent cerebral symptoms, fetal growth restriction, thrombocytopenia, or elevated serum liver enzymes preeclampsia should also be considered(3). However, according to the revised diagnostic criterion of the international society for the study of hypertension during pregnancy, proteinuria is no longer used as diagnostic criterion in preeclampsia (4).

Preeclampsia can be categorized as early form with symptoms of onset before 34 weeks of gestation and late form in which the symptoms of onset after 34 weeks of gestation or preeclampsia with severity futures and without severity features (5)

The incidence of preeclampsia increasing with the rate a nearly doubling in recent year due to a variety of causes (4). Preeclampsia occurs in a majority of the case approximately 75% without severity features near term or throughout the intrapartum period. Women with preeclampsia have an increased rate of cesarean section consequent upon the high incidence of intrauterine growth restriction, fetal distress, and prematurity (6).

Hypotension can be defined as a decrement of mean arterial blood pressure by more than 20% (7), systolic blood pressure of more than 20% from baseline or systolic blood pressure of less than 90 mmHg(2). Spinal anesthesia blocks sympathetic nerve fibers which control vascular smooth muscle tone resulting in vasodilatation and hypotension. Studies conducted using noninvasive measures of cardiac output indicate that cardiac output commonly increases after spinal anesthesia. These studies emphasize that spinal anesthesia–induced hypotension is principally related to a marked decrease in systemic vascular resistance, rather than decreased cardiac output (8,9)

The administration of neuro-axial anesthesia for cesarean delivery in women with preeclampsia does not differ greatly from the practice in healthy pregnant women. Severe preeclampsia was considered as they are not a good candidate for spinal anesthesia because of associated significant hypotension. Even though there are disagreements between literature regarding this assumption but most of currently conducted literature recommends spinal anesthesia for preeclampsia (9,10)

When compared with epidural anesthesia Spinal anesthesia is simple, reliable and allows visual confirmation of correct needle placement by visualization of cerebrospinal fluid (CSF) and technically easier to perform(11). The requirement for intravenous analgesia is much less when spinal anesthesia is used because it provides dense, reliable and rapid onset blockage. Given these and other advantages, spinal anesthesia is the most commonly used anesthetic technique for cesarean delivery throughout the world (13,14)

1.2 Statement of the problem

Nowadays the rate of cesarean delivery is significantly increased with an estimated 23 million procedures performed each year worldwide. Even though it is difficult to exactly know the optimal population level cesarean section rate, World Health Organization (WHO) recommended national rates not exceed 10 to 15% per 100 live births. A study conducted in Stanford university in 2015 indicates the optimal cesarean delivery rate for reducing fetal and maternal complications is 19% (14). The rate was greater than 24% in USA, Canada, and Greece. The rate in Africa is 8.8% according to the 2009 world health organization(WHO) survey (15). The study conducted in Ethiopia in 2020 shows 6.1% of indications of CS were preeclampsia(16).

Obstetric anesthesia is generally considered to be one of the higher-risk areas of anesthesia practice. Spinal anesthesia becomes a preferred type of anesthesia, in parturient undergoing cesarean delivery because of its various advantages but the preventable spinal anesthesia-related complication is still high(17). Subarachnoid injection of local anesthesia is technically easy as it is confirmed by the free flow of CSF and compared to general anesthesia maternal mortality rate is reduced in spinal anesthesia.

The incidence of hypotension associated with spinal anesthesia is high (70-80%) without pharmacological prophylaxis during cesarean section(18). Predelivery hypotension is defined as the development of hypotension after administration of spinal anesthesia until delivery of the fetus. Therefore, predelivery hypotension is the time at which both fetus and mother is highly affected by the consequence of hypotension on organ system. Such consequences could include the life threatening event for the mother, such as cardiac arrest, loss of consciousness and minor complication like nausea ,vomiting or fetal compromises (12)

The spinal anesthesia-induced hemodynamic changes is the topic of studies for the last several decades. Some study indicates that preeclamptic patients who undergo Cesarean section under spinal anesthesia are at increased risk of profound hypotension. These studies justify the fact that a preeclamptic mother has significant intravascular volume deficit related to arteriolar vasoconstriction and as the results they might develop sudden hypotension after spinal anesthesia(19,20). There is also studies which indicates the risk of hemodynamic changes were similar in preeclamptic and non-preeclamptic parturient(21)

On the other hand, study conducted by Saha, Ghosh and Bhattacharyya and vialles N, et. al, in France shows preeclamptic patients are at lower risk of spinal anesthesia-related hypotension during cesarean delivery; compared with normotensive parturient. This may be explained by the effects of circulating vasoconstrictors, creating relatively protective effects to the sympathetic block of spinal anesthesia(22,23).

The incidence of hypotension is specifically higher in a parturient undergoing a cesarean section because of: 1) Enlarged uterus can cause the epidural veins to engorge which in turn narrows the subarachnoid space, increased pressure of the cerebrospinal fluid (CSF) facilitating the cephalad spread of local anesthetics; 2) The enlarged uterus can mechanically compress vena cava and aorta reducing the preload as well as afterload, potentiating the incidence of hypotension. Due to these factors, parturient may develop hemodynamic instability during caesarian delivery which is the main challenges of obstetric anesthesia practice(24,25).

A Similar preventive strategies like left lateral tilt to decrease the incidence of spinal anesthesia related hemodynamic change can be used in preeclamptic parturient (26). However, some of the preventive methods for hypotension like fluid challenge and vasopressor prophylaxis are not feasible in preeclamptic mothers since they are at increased risk of hypertension and pulmonary edema which may increase fetal and maternal complications. Therefore preeclamptic are assumed to be at increase the risk of hemodynamic instability once the intrathecal block is undertaken (27).

Even though there are several studies conducted in developed country, however there are limited study done in Africa which address the problem under investigation. This makes difficult to develop local guidelines for the management of hemodynamic changes since the prevention strategy and management protocols for hemodynamic change is different between developed and developing country.

The timely recognizing and management of spinal anesthesia induced hemodynamic changes is paramount important to improve outcomes and to save both lives during cesarean section. Even though a different study conducted to compare hemodynamic change after spinal anesthesia in preeclampsia and non-preeclampsia; there is no study to address the time at which hypotension develop frequently and whether there is difference in time of incidence of hypotension between the groups which our study aimed to address. The anesthetist is concerned about decreased intravascular volume status due to vasoconstriction which is assumed to put preeclamptic parturient at high risk to develop hypotension rapidly.

To my knowledge one study done in our setup which specifically review the problem under study but only include parturient who underwent elective cesarean section. Most of cesarean section done under emergency in our setup which is different from elective surgery that gives time for clinicians to have better clinical decision and minimize complications. Therefore, conducting this study including emergency cesarean section helps to understand the risks in this group and shows the ways for intraoperative managements in these groups. Additionally, in the above study, the vasopressor consumption was not examined which our study aimed to address. above all my clinical experience for the last several years was the main reason that poses the question in to my mind as I had faced hemodynamic challenges while providing spinal anesthesia for preeclamptic parturient.

Most cesarean section is done under spinal anesthesia and it is routinely practiced in obstetric anesthesia in our country. Despite various strategies used to achieve hemodynamic stability during spinal anesthesia for cesarean section, it remains a common problem in obstetric anesthesia(6).

1.3 Significance of the study

Conducting this study in these unique population is important to develop scientific knowledge related to preeclamptic parturient by addressing the issue not covered by other studies. It also helps to improve patient care contributing its part for clinical managements.

Even though most of the study indicated the safety of spinal anesthesia regarding to hemodynamic changes in preeclampsia, there are study which stands against these findings. This contradiction may affect the choice of anesthesia in these group patients. Therefore, the study will contribute its parts in mediation of such controversy.

There is a concern among the anesthetist as the preeclamptic parturient are at increased risk for spinal anesthesia induced immediate hypotension due to the intense vasoconstriction resulting in reduced intravascular volume. As a result, the anesthesia personnel sometimes seemed reluctant in practice to induce spinal anesthesia especially in severe preeclamptic patients. Thus, initiate the conversion anesthesia plan to general anesthesia with its increased complication. Therefore, comparing the incidence of hypotension at different time between the groups helps to mediate such a concern. It helps anesthetist in clinical decision and also alarms to consciously follow patients by indicating the frequent time of hemodynamic challenges. Comparing the incidence of hypotension at different measurements also fills scientific gaps and serve as baseline information for further studies.

There are limited studies done in Africa and in our country as well to address problems under investigation. Since there are major difference between developed and developing country regarding health care provision, conducting this study can strengthen the level of evidence and contribute its part to develop guide line in our setup.

Chapter two: Literature review

The complication associated with general anesthesia is increased as compared with regional anesthesia in obstetric patients because of physiologic changes in pregnancy which rise the incidence of failed intubation and pulmonary aspiration. Regional anesthesia technique mainly spinal anesthesia becomes the preferred technique of obstetric anesthesia because of its simplicity to perform and dense quality of anesthesia, especially in resource limited areas (15). However spinal anesthesia is not free of the risk. Hypotension during spinal anesthesia has been the topic of scientific study for the past five or more decades. Despite these effort the most efficient strategies to maintain hemodynamics stability is remain challenging for anesthesia providers(19).

Obstetric anesthesia needs special attention because of the physiologic change during pregnancy and the concern for two life makes these populations a high-risk group. The practice of obstetric anesthesia shows significant changes recently as the choice of anesthesia shifted from general anesthesia to regional anesthesia which reduces anesthesia related complication. Despite this changes, there are still a high complication rate related to spinal anesthesia during cesarean delivery (28). Various comparative studies were conducted on the incidence of spinal induce-hypotension in preeclamptic and non-preeclamptic parturient but, the hemodynamics change of preeclampsia after spinal anesthesia remains the topic of debate between the literature.

Preeclamptic parturient is considered at high risk of spinal anesthesia-induced hypotension because of the common belief that dense and rapid neural blockage related to spinal anesthesia might result in severe hypotension which can cause feto-maternal compromises(19,28). Various assumptions indicate how spinal anesthesia increases the risk in this group. It is obvious that preeclamptic patient have low intravascular volume which put them at high risk for spinal-induced hypotension. The attempts to prevent or treatment spinal-induced hypotension by fluid loading in preeclamptic patients may be result in pulmonary edema or increase cardiac complication especially in severe cases. The use of indirect acting vasopressor as prophylaxis or for managements of hypotension is hypothesized to increase the risk because of these population are very sensitive for sympathomimetic drugs (29)

Comparative study conducted in Brazil on 2011 by Mendes et. al on elective cesarean section using 2.2 mL of 0.5% hyperbaric bupivacaine with 0.1 mg of preservative-free morphine after 500 ml of fluid preload for preeclamptic as well as the normotensive group. They found the incidence of hypotension, drop in blood pressure, as well as vasopressor requirement and mean total vasopressor dose requirement are not significantly different between these two groups. The mean drop in systolic blood pressure was 27.5% in the PE group and 24.2% in the normotensive group ($P = 0.21$). Diastolic blood pressure decreased by 33.1% and 35.9% in the PE and normotensive groups, respectively ($P = 0.31$). However, this study indicates the preeclamptic group showed significantly higher systolic, and diastolic blood pressure peri-operatively (21)

The prospective study conducted in Iran to determine the hemodynamic effects of low-dose (10mg) hyperbaric spinal bupivacaine with the additive of 2.5 µg fentanyl in two groups of patients after 500 mL crystalloid preload indicate the hypotension incidence was lower among the preeclamptic patients when compared with normotensive group parturient, despite the former group receiving smaller volumes of intravenous fluids ($P < 0.05$). The total vasopressor requirement in preeclamptic were less according to the study when compared with the normotensive group. But, only patients with severe preeclampsia was considered as study participant (30)

A prospective comparative study was done in India on hemodynamic response and vasopressor consumption between normotensive and preeclamptic undergoing cesarean section who were preloaded with 10ml/kg of fluid and spinal anesthesia given using 12.5 mg of hyperbaric bupivacaine. The study indicates the minimum SBP, DPB, MAP, and HR are lower in the normotensive group. The percentage fall of DBP and MAP from the baseline was less in the preeclamptic group when compared with the health group. However, the study shows as this difference was not statistically significant between the two groups. The vasopressor requirement was shown to be higher in the normotensive group (22).

The study conducted in Ethiopia by Alemayehu et al in 2020 which compare the incidence of spinal induced hypotension in preeclamptic and normotensive patients however, shows the higher incidence of hypotension in normotensive group that is statistically significant. The gestational age of most the preeclampsia group of study participant is lower than normotensive group which may affect the finding of the study(31).

A prospective cohort study conducted in France compares preeclamptic with normotensive parturient during spinal anesthesia performed with hyperbaric 0.5% bupivacaine and opioids adjuvants which enrolled 30 severe preeclampsia and 30 normotensive of all undergoing elective cesarean section. This study found the incidence of hypotension was significantly lower in the severe preeclamptic group as compared with the control group (16.6% vs 53.5%). The requirement for vasopressor is also significantly less in the severe preeclamptic group (mean 6.0 vs. 12.5 mg). The mean values of HR did not change significantly in both groups as this study indicated. Most of preeclamptic groups also in this study include parturient with lower gestational age and given a slightly small volume of prehydration which may affect the findings of study(23). The prospective study conducted by Antoine A et.al which is in line with finding of the above study(20,31)

Similar findings were also reported by the study conducted in the Republic of Macedonia on Spinal-induced hypotension in Preeclamptic and normotensive parturient undergo CS indicate the percentage of drop of blood pressure from baseline was significantly higher in the normotensive group compared with the control group (25.8% ± 10.1 vs 18.8% ± 17.0 for SBP, 28.5% ± 8.8 vs 22.5% ± 10.4 for DBP, and 31.2% ± 14.2 vs 18.2% ± 12.6% for MAP, $p < 0.05$). In this study, the incidence rate of hypotension was 25% and 53% ($p < 0.001$) in preeclamptic and normotensive parturient respectively. The dose of bupivacaine used in this study was low which positively influence the spinal induced hypotension thus, limiting the generalizability of this study finding (32)

Another comparative study conducted in India also reported that blood pressure was significantly lower continuously between measurement intervals in the normotensive group compared with the preeclamptic. The study shows the frequency of episodes of hypotension was higher in the normotensive group and the result was statistically significant ($p < 0.05$). The vasopressor requirement is significantly higher in the normotensive group ($P = 0.0005$) (33)

The study conducted later in India shows a major difference in SBP, DBP, and MAP at different points of an interval of measurements between the two groups. This study conclude spinal anesthesia is associated with better perioperative hemodynamic stability, less hypotension and vasopressor consumption compared with the normotensive group (34). The study conducted by Ferrer et al. and similar study by Khatri R et al. on the comparation of hemodynamic change between preeclampsia and normotensive patients also shows similar result with above study(35,36)

The observational study conducted in south Africa 2008 using beat to beat HR; systolic, diastolic, and mean arterial pressure (MAP); stroke volume; and cardiac output were monitored in 50 preeclamptic parturient. The study uses crystalloid as co-loading and all patients received 2.0 ml hyperbaric 0.5% bupivacaine, plus 10 mcg fentanyl, administered at the L3–L4 interspace. According to this study Cardiac output remained stable from induction of SA until the time of request for analgesia. Mean arterial pressure and systemic vascular resistance decreased significantly until the end of surgery. Depending on these finding the study conclude that spinal anesthesia in severe preeclampsia was associated with clinically insignificant changes in cardiac output (10)

Prospective cohort study conducted by Imtiaz and Muzaffar, on 2014, which compare spinal anesthesia induced hypotension in severe preeclampsia normotensive parturient during cesarean delivery indicate that the incidence of hypotension was significantly less (17%) in severe preeclampsia versus (42%) in normotensive group. In this study the intraoperative blood pressure was measured every 2 minutes after spinal anesthesia for 20 minutes and every 5 minutes up to end of surgery. The spinal hypotension was considered when MAP decrease by 20% from baseline or SBP ,100 mmHg. Spinal anesthesia was given using 15 mg of 0.75% of heavy bupivacaine in the study that means there is no dose adjustment depending on the clinical characteristic of the patient which may affects the outcome(37)

Study conducted on elective cesarean section, which compare hemodynamic changes of severe preeclampsia and normotensive parturient indicate that the incidence of hypotension in preeclamptic group lower compared with normotensive group. The study indicates the maximum and average change in SBP, DBP & MAP in normotensive group significantly higher statistically than preeclamptic group. The increase in heart rate significantly higher in healthy group. The study also indicate the vasopressor consumption was significantly higher in normotensive group(38)

A number of prospective clinical trial(RCT) reveals the assumption that a use of lower dose of local anesthesia (8 mg or less) reduce the incidence of hypotension (34,37). Study shows the parturient with increased body mass index (BMI) are more likely to develop spinal-induced hypotension during cesarean section, but the cut-off point of BMI varied from 25 to 29 in these studies (39). Advanced maternal age was also shown to have a strong association with spinal anesthesia-induced hypotension during cesarean section(40,41). Although only one study suggests the maternal age >35 years strong association with spinal anesthesia hypotension (41).

The study conducted in Ethiopia shows that newborn weight >4kg, baseline systolic blood pressure < 120mmHg, Sensory block height >T6, the time interval between spinal induction and skin incision > 6minute and anesthetist experience has been found associated with hypotension (42).

History of hypotension, HR >100 beats/min, and sensory block height >T4 in ($P < 0.05$) identified as risk factors for hypotension(39,43). Intraoperative blood loss >1000 has a strong association with hypotension (40).

Study conducted in Nigeria comparing lateral and sitting position during administration of spinal anesthesia indicates occurrence of hypotension less frequent in lateral position compared to sitting position(43). Studies in Hong Kong which compare hemodynamic effects of plain and hyperbaric bupivacaine shows the hyperbaric group develop hypotension rapidly and significantly after spinal anesthesia. This study also shows the hyperbaric group peak HR earlier and greater vasopressor consumption (44)

Chapter three: Objectives

3.1 General objective

To compare the hemodynamic changes and vasopressor requirements in preeclamptic and non-preeclamptic parturient after spinal anesthesia during cesarean section in Jimma zone public hospitals, Southwestern Ethiopia, from August 15- November 30, 2022

3.2 Specific objectives

- To compare hemodynamic changes in preeclamptic and non-preeclamptic parturient after spinal anesthesia during cesarean section in Jimma zone public hospitals, Southwestern Ethiopia,2022
- To compare the vasopressor requirements in preeclamptic and non-preeclamptic parturient after spinal anesthesia during cesarean section in Jimma zone public hospitals, Southwestern Ethiopia,2022
- To compare the incidence of hypotension at different intraoperative time in preeclamptic and non-preeclamptic after spinal anesthesia during cesarean section in Jimma zone public hospitals Southwestern Ethiopia,2022

The hypothesis of the study

$H_0$1: There is no difference in hemodynamic changes after spinal anesthesia between preeclamptic and non-preeclamptic parturient.

H_A1: There is a difference in hemodynamic changes after spinal anesthesia between preeclamptic and non-preeclamptic parturient.

$H_0$2: There is no difference in vasopressor requirements after spinal anesthesia between preeclamptic and non-preeclamptic parturient.

H_A2: There is a difference in vasopressor requirements after spinal anesthesia between preeclamptic and non-preeclamptic parturient.

$H_0$3: There is no difference in the incidence of hypotension at different intraoperative time in preeclamptic and non-preeclamptic after spinal anesthesia during cesarean section.

H_A3: There is difference in the incidence of hypotension at different intraoperative time in preeclampsia and non-preeclamptic after spinal anesthesia during cesarean section.

Chapter four: Methods and materials

4.1 Study area and period

This study was conducted in Jimma zone which is one of the zones found in Oromia regional state located in southwestern Ethiopia. There are nine government hospitals including Jimma university teaching and referral hospital, three general hospitals, and five primary hospitals. Jimma university teaching and referral hospital is the largest hospital in southwestern of Ethiopia and provides various health care services for millions of people lives in Jimma zone as well as surrounding zones. Agaro hospital which found Gomma woreda, Limmu Gennet hospital found in Limmu Kossa woreda and Shenen Gibe hospitals found in Jimma town are the general hospitals and the remaining of the hospitals: Diimtu hospital found in Nedii Gibee woreda, Dedo hospital found in Dedo woreda, Sentema hospital found in Sentema woreda, Seka hospital found in Seka Chokorsa woreda and Nadda hospital found in Omo Nadda woreda are primary hospital mainly providing emergency medical and surgical care including cesarean section. The study was conducted from August 15 to November 30, 2022

4.2 Study design: Facility based prospective cohort study was employed

4.3 Population

4.3.1 Source population: All parturient who underwent cesarean section in Jimma zone public hospital under spinal anesthesia

4.3.2 Study population: All preeclamptic and non-preeclamptic parturient at selected public hospitals existing in Jimma zone who underwent cesarean delivery under spinal anesthesia during the study period.

4.4 Inclusion and exclusion criteria

4.4.1 Inclusion criteria

- ASA II& III
- Age >18 years
- BMI<35 kg/m^2
- Term pregnancy

4.4.2 Exclusion criteria

- Patient with chronic/ gestational hypertension
- Patient with recent history of vaginal bleeding.
- Twin pregnancy
- High spinal
- Failed spinal anesthesia
- Any cardiac disease

4.5 Sample size and sampling techniques

4.5.1 Sample size determination

Two population proportion formula was used to determine the sample size for hemodynamic change after spinal anesthesia in preeclampsia and non-preeclampsia

$$sample\ size = \frac{\left[Z\alpha\sqrt{(1+{}^{1}/_{m})P*(1-P1)}+Z\beta\sqrt{P1(1-{}^{P1}/_{m})+P2(1-P2)}\right]^{2}}{(P1-P2)^{2}}$$

$Z\alpha$ = Standard normal variate for the level of significance which is 1.96

m = Number of non-preeclamptic per preeclamptic which is n1/n2 =1

Z_{β} = Standard normal variate for power or type 2 error as explained which is 0.84

p1 = Probability of hypotension in the non-preeclamptic group (0.556)

p2 = Probability of hypotension in preeclamptic group (0.341)

$p* = \frac{p2+mp1}{m+1}$

From the previous study, the incidence of hypotension in preeclamptic was 34.1% and the incidence of hypotension in normotensive was 55.6% during cesarean section(31). So, using the above equation the sample size calculation for 5% of significant level and 80% power with equal number of preeclampsia and normotensive is 65 in each group.

$$sample\ size = \frac{\left[1.96\sqrt{(1+1/1)}0.4485(1-0.556)+0.84\sqrt{0.556(1-0.556/1)+0.341(1-0.341)}\right]^2}{(0.556-0.341)^2}$$

=65 study participants in each group.

4.5.2 sampling technique

Among the nine public hospitals in the Jimma zone; considering the level of education of the staff, the differences of resources and setup of hospitals, the general hospital and JUMC were used as a sampling frame. From the four of these hospitals; JUMC, Agaro, and Shenen Gibe hospitals were selected by simple random selection method. All preeclamptic and non-preeclamptic at selected hospitals who fulfilled inclusion criteria who underwent cesarean delivery under spinal anesthesia during study period were included consecutively until the intended sample size was achieved. The situational analysis of the three months of each hospital showed the number of a case done as follows; JUMC (540) of which 42 are preeclamptic, Shenen gibe hospital (225) of which 17 are preeclamptic, Agaro hospital (208) of which preeclampsia account 14 cases. The proportional sample size allocation was illustrated as follow:

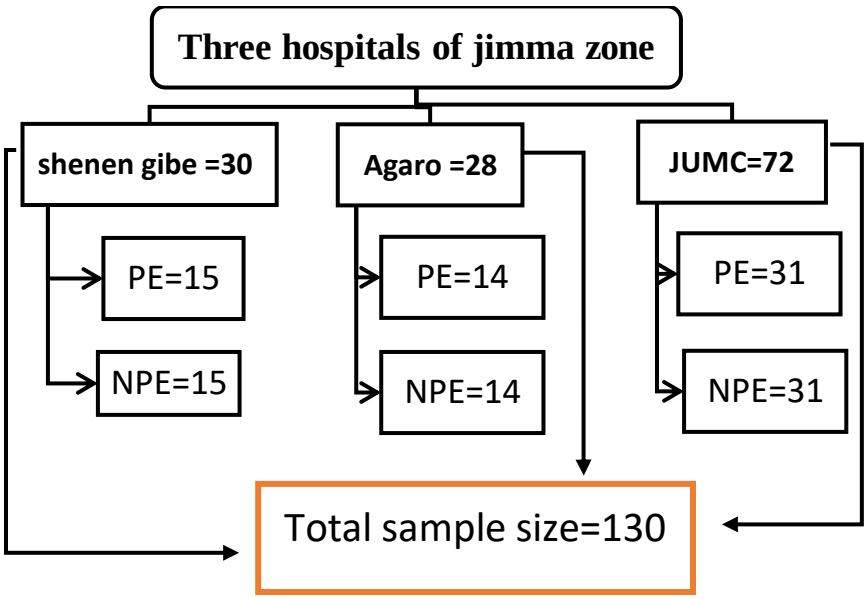

Figure 1: Proportional allocation of preeclamptic (PE) and non-preeclamptic (NPE) parturient who underwent cesarean delivery in three public hospitals of Jimma zone.

4.6. Data collection procedures

After providing training for three BSc anesthetists who were data collectors at JUMC and for two BSc anesthetist who were data collectors at general hospitals, data were collected using 5% pre-tested questionnaire. The data collectors were supervised by the principal investigator. All patients who fulfilled inclusion criteria, who didn't refuse to participate in the study were included. The socio-demographic, clinical characteristics, exposure status, and the medication used were gathered from the patient chart.

The baseline blood pressure, heart rate, and volume of fluid preload were recorded before spinal anesthesia in the operation room. Factors related to anesthesia technique were recorded intraoperatively. After induction of spinal anesthesia, the first BP and HR was recorded within one minute, the next BP and HR was recorded every 3 minutes up to 15 minutes, and every 5 minutes afterward up to 40 minutes. The level of sensory block was assessed by alcohol swab and recorded before skin incision. The dose of vasopressors used, uterotonics agents used were documented intraoperatively. The completeness of the data was checked by the data keeper anesthetist and revised by principal investigator routinely.

4.7 Study variables:

- Hemodynamic variables: Blood pressure, heart rate, incidence of hypotension
- Socio-demographic characteristics**:** maternal age, maternal weight, maternal height, maternal BMI
- Exposure status: preeclamptic, non-preeclamptic
- Maternal & fetal related variables**:** ASA status, baseline blood pressure, baseline heart rate and newborn weight
- Anesthesia-related variables**:** the experience of anesthetist, level of sensory block, the dose of bupivacaine, opioid adjuvants, volume of fluid preload, intraoperative fluid volume,
- Surgery related variables**:** left lateral tilt, blood loss,
- Perioperative drugs: antihypertensive, uterotonic agents and Vasopressor consumption

4.8. Operational definitions

Intraoperative hypotension : The decrement of systolic blood pressure >20% from baseline measurements after induction of spinal anesthesia during cesarean section(7)

Hemodynamic change: when the heart rate decreases or increases from baseline measurements by 20%, systolic blood pressure decreased by 20% from baseline measurements during cesarean section and if one of these events were noticed it is considered as hemodynamic changes

Vasopressor requirement: The total dose of adrenaline given in microgram intraoperatively

Different intraoperative times: two or three consecutive time at which the blood pressures were measured during cesarean section

Repeated episode of hypotension: when SBP drop >20% from baseline measurements in more than three consecutive measurements following spinal anesthesia

Baseline blood pressure: The blood pressure of the parturient measured after preload of crystalloid fluid before administration of spinal anesthesia

Heart rate changes: decrements or increments of heart rate by 20% from the baseline measurements(2,21)

Baseline heart rate: the heart rate of the parturient measured after preload of crystalloid fluid before administration of spinal anesthesia

Severe preeclampsia: blood pressure ≥ 160 /110 mmHg , with or without **severity futures**(45)

Preloading: administering 10-20ml/kg of crystalloid fluid before administration of spinal anesthesia (46)

Failed spinal block: failure of block after intrathecal administration of local anesthetic that result in conversion to general anesthesia(11)

High spinal: when sensory block is above T4(11)

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4.9. Data quality control

The data collection tools were developed after reading different literatures and commented by advisors whether the developed questionnaire measure the objective of the study. After feed-back is obtained the questionnaire was rewritten accordingly. To assure quality of the data, questionnaires were pretested on 5% of the sample size before actual data collection. Data collectors were trained on each item included in the study tools, objective, relevance of study, right of respondents. The data collectors were supervised by principal investigator. In the operation room standard monitoring with non-invasive blood pressure (NIBP), electrocardiogram (ECG) and pulse oximetry monitoring was used. Data were checked also for completeness before running data analysis.

4.10. Data analysis procedures

After data were checked manually for completeness and then coded and entered in to the Epi-data version 3.1 and exported to SPSS version 25 for analysis. Descriptive statistics was used to summarize data and tables, graph and figures used to display results. The data were checked for normality distribution using histogram, Shapiro-Wilk and kolmogrove-smirnov test and homogeneity of variance cheeked by levene's test. The independent t-test used for normally distributed variables and Mann -Whitney U test used for non-normally distributed variable. Chi-square test was used for categorical variable. Data were presented as mean± SD for normality distributed data, median (interquartile range) for non-normally distributed data. The level of statistical significance for all tests was $P < 0.05$. The incidence of hypotension was compared at different time between the group by the numbers of parturient whose SBP were decreased >20% from the baseline value. The percentage fall of blood pressure and heart rate were determined by following formula.

Percentage of fall = (baseline SBP-current value)/baseline x 100 (21,30)

4.11. Ethical consideration

The letter of request was submitted to JUMC ethical review board to obtain ethical clearance. After permission for data collection were obtained, brief description about the study was undertaken with OR teams. During data collection process each parturients were asked for informed oral consent to participate in the study after brief explanation about the objectives of the study as well as confidentiality of the personal data by the data collectors. The questionnaire was kept in proper place by the principal investigators. The privacy of every patient's and information were kept confidential. The data were used only for the study purpose.

4.12. Dissemination plan

The result of the study will be disseminated by the hard copy to each hospital in order to recommend the best management of preeclamptic and normotensive parturient having minimal maternal hemodynamic changes after spinal anesthesia for cesarean section. This study on completion could also serve as a reference material to anesthetist, researchers, experts and inputs for policy makers. The result will also be disseminated through publication in peer reviewed local journal and through presenting it in related workshops and seminars.

Chapter Five: Results

5.1 Socio-demographic and preoperative characteristic of parturient

A total of 126 of which 63 preeclamptic and 63 non-preeclamptic parturient who underwent emergency as well as elective cesarean section were included for the final data analysis. There were no statistically significant differences observed between the groups with respect to age, weight, height and BMI. (Table 1)

Table 1: Socio-demographic characteristics of parturient who underwent cesarean section in Jimma zone public hospitals, Southwestern Ethiopia, from August 15- November 30, 2022

Variables	Non-preeclampsia (n=63)	Preeclampsia (n=63)	p-value
Maternal Age (years)[a]	28.17 ± 5.42	28.65±5.30	0.619
Maternal Weight (kg)[a]	70 ± 4.74	71 ± 4.74	0.712
Maternal Height (cm)[a]	164.48 ± 4.85	165.17 ± 3.23	0.344
BMI in (Kg/cm2) (%) [b]			0.229
18.5-24.9	16(25.4%)	12(19%)	
25-29.5	45(71.4%)	51(81%)	
30-34.9	2(3.2%)	0	

a=independent t-test, b= chi-square test, BMI body mass index

In both groups majority of the parturient underwent emergency cesarean delivery which were 73% in non-preeclampsia and 67.7% in preeclampsia. There was no significant difference observed between the groups regarding the types of surgery (emergency versus elective) they underwent. All non-preeclamptic parturient and the majority of preeclamptic (76.2%) were ASA II; the remaining preeclamptic were ASA III (23.8%). Among the preeclamptic group 6(9.5%) parturient took antihypertensive preoperatively. The mean gestational ages in preeclamptic were less than non-preeclamptic and this difference was significant between the groups (P=0.002). However, there was no statistically significant difference observed in the mean weight of newborn between the groups (Table 2).

The baseline SBP, DBP and, MAP was significantly higher in a preeclamptic group (p<0.001). However, there was no significant difference in the mean baseline heart rate between the group (0.100), (Table 2).

Table 2: Preoperative maternal characteristics of parturient who underwent cesarean section and newborn weight in Jimma zone public hospitals, Southwestern Ethiopia, from August 15 – November 30, 2022

Variables	**Non-preeclampsia (n=63)**	**Preeclampsia (n=63)**	**p-value**
Type of surgery [b]			
Elective	17(27%)	21(33.3%)	0.437
Emergency	46(73%)	42(67.7%)	
ASA status [b]			<0.001*
II	63(100%)	48(76.2%)	
III	0	15(23.8%)	
Antihypertensive use [b]			
Yes		6(9.5%)	
No		57(90.5%)	
Gestational age(wks)[a]	38.65± 0.95	37.78±0.95	0.002*
New born weight(kg)[a]	3.24± 0.32	3.19±0.37	0.400
Baseline SBP [a]	122.73± 6.58	148.67±9.15	0.001*
Baseline DBP [a]	72.97± 8.97	95.13± 8.06	< 0.001*
Baseline MAP [a]	87.65± 8.69	110.90± 6.9	<0.001*
Baseline HR [a]	83.46 ± 8.88	85.87 ± 7.38	0.100

*a=Independent t-test, b=chi-square test, *=statistically significant; Systolic blood pressure, DBP Diastolic blood pressure, MAP Mean arterial pressure, Kg kilogram, wks. Weeks, ASA American society of anesthesiologists*

5.2 Comparation of perioperative characteristics and fluid consumption

The higher volume of fluid was preloaded in non-preeclamptic parturient as compared with preeclampsia 750(200) Vs 600(150) respectively (P=0.001). The intraoperative fluid consumptions were higher in non-preeclamptic than in preeclampsia (2465.87 ± 381.405 Vs 2214.29 ± 411.79) respectively and this difference was a statistically significant between the groups(P=0.001). There was no significant difference in the intraoperative blood loss between the groups**.** All parturient in both groups were given Oxytocin alone and the dose of Oxytocin were not significantly different between the groups (0.554). The majority of the parturient did not position to the left lateral intraoperatively in both groups and only 3(4.7%) non-preeclamptic were given atropine intraoperative (Table 3)

Table 3: Perioperative characteristics and fluid consumption of parturient who underwent cesarean section in Jimma zone public hospitals, southwestern Ethiopia, from August 15- November 30, 2022

Variables	**Non-preeclampsia (n=63)**	**Preeclampsia (n=63)**	**p-value**
Fluid preload(ml) [c]	750(200)	600(150)	0.001*
Intraoperative fluid(ml) [a]	2465.87 ± 381.40	2214.29 ± 411.0.79	0.001*
Estimated blood loss(ml) [c]	650(140)	600(200)	0.259
Type of uterotonics used [b]			1.000
Oxytocin (n, %)	63(100%)	63(100%)	
Dose of uterotonics (IU) [c]	10(0)	10(0)	0.554
Left lateral tilt (%) [b]			0.457
Yes	7(11.1%)	10(15.9%)	
No	56(88.9%)	53(84.1%)	
Dose atropine used [b]			
yes	3(4.7%)	0	

*a=Independent t-test, c= Mann- Whitney U- test and b=chi-square test, *=statistically significant; IU international unit, ml milliliters*

5.3. Comparation of anesthetic characteristics between the groups

Isobaric bupivacaine was used for all parturient in both groups. There was no significant difference in the mean dosage of bupivacaine used. The opioid adjuvants were used in the majority of the parturient and there was no significant difference between the group in the uses of opioid adjuvants(P=0.845). The majority of parturient had T5 sensory level of block in both groups and small number of parturient had T8 sensory block level. There was no significant difference in the level of sensory block and experience of the anesthetist between the groups (Table 4).

Table 4: Anesthetic characteristics of parturient who underwent cesarean section in Jimma zone public hospitals, Southwestern Ethiopia, from August 15 – November 30, 2022

Variables	Non-preeclampsia (n=63)	Preeclampsia (n=63)	P-value
Dose of bupivacaine(mg)[a]	10.06 ± 0.89	10.27± 1.16	0.248
Baricity of bupivacaine [b]			
Isobaric	63(100%)	63(100%)	
Opioid adjuvant used [b]			0.845
Yes	44(69.8%)	45(71.4%)	
No	19(30.2%)	18(28.6%)	
Level of sensory block [b]			0.949
T8	9(14.5%)	8(12.7%)	
T6	17(27%)	17(27%)	
T5	37(58.7%)	38(60.3%)	
Anesthetist experience [b]			0.069
1year	3(4.8%)	3(4.8%)	
2years	17(27%)	31(49.2%)	
3years	25(39.7%)	15(23.8%)	
>3years	18(28.6%)	14(22.2%)	

a=Independent t-test, b= chi-square test, mg milligram

5.4: Comparation of hemodynamic characteristics and vasopressor requirements.

The incidence of systolic hypotension after spinal anesthesia was 50.8% in non-preeclamptic group and 31.7% in preeclamptic groups. There was significance difference seen in the incidence of hypotension between the group; (p=0.030). The majority of the parturient in both groups had decreased heart rates intraoperatively and there was no significant difference in the HR rise (P=0.620) or fall (P=0.877) between the groups (Table 5).

Following spinal anesthesia, the SBP, DBP, and MAP decreased from baseline in both groups. however, the minimum records of SBP, DBP and MAP in the preeclamptic group were higher than the corresponding value in the non-preeclamptic group, which was significantly different between the groups(P<0.001). The maximum fall of blood pressure was higher in non-preeclamptic compared with preeclamptic group with p-value of (0.001) for SBP and DBP and (0.009) for MAP. There was no significant difference seen in the minimum record and magnitude of fall heart rate between the groups (Table 5).

Adrenaline was used for the treatments of intraoperative hypotension in both groups after spinal anesthesia. However, the frequency of adrenaline requirement was higher in non-the preeclampsia 8(12.7%) than in the preeclampsia 2(3.2%) groups which was significantly different (P=0.048). The dose of adrenaline used was also higher in non-preeclamptic than in non-preeclamptic (68.75 ± 21.50 Vs 30.0 ± 14.14) respectively and this difference was significant between the groups(P=0.046) (Table 5).

Table 5: Hemodynamic changes, and vasopressor requirements after spinal anesthesia in parturient who underwent cesarean section in Jimma zone public hospitals, Southwestern Ethiopia, from August 15 – November 30, 2022

Variables	Non-preeclampsia (n=63)	Preeclampsia (n=63)	p-value
Incidence of hypotension [b]	32(50.8%)	20(31.7%)	0.030
HR change (n, %) [b]			
HR decrease >20%	51(81%)	49(77.8%)	0.620
HR increase > 20%	4(6.3%)	4(6.3%)	0.877
SBP [a]			
Lowes after SA	94.20 ±10.04	118.20 ± 9.40	<0.001*
Decease from baseline (%)	23.17± 7.59	20.46 ±4.50	0.016*
DBP [a]			
Lowes after SA	50.90 ±4.82	70.77± 6.76	<0.001*
Decease from baseline (%)	29.23 ±10.78	25.43 ±5.82	0.015*
MAP [a]			
Lowes after SA	58.19 ± 4.09	75.8 ± 5.80	<0.001*
Decease from baseline (%)	33.12 ± 7.11	29.97 ± 6.22	0.009*
HR [a]			
Lowest after SA	65.82 ±8.79	67.11 ± 5.20	0.320
Decease from baseline (%)	27.48 ± 9.25	28.06 ±8.18	0.710
Vasopressor used [b]			0.048*
Yes	8(12.7%)	2(3.2%)	
No	55(87.3%)	61(96.8%)	
Dose of adrenaline(mcg)[a]	68.75 ± 21.50	30.0 ± 14.14	0.046*

a= Independent t-test, b= chi-square test, (%) = to show the percentage fall from baseline, *=statistically significant

In both groups the SBP decreased from the baseline after spinal anesthesia. The comparation of mean systolic blood pressure indicates higher measurements value in the preeclamptic group throughout intraoperative time but, the difference was higher relatively at 1,3 and 6 minutes after spinal anesthesia (figure 2).

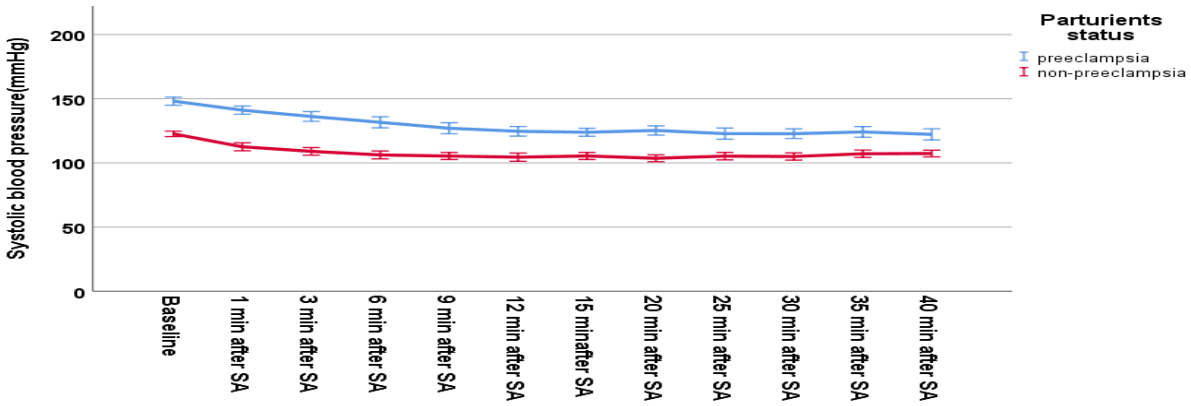

Figure 2: Trends of SBP after spinal anesthesia between the groups in Jimma zone public hospitals, southwestern Ethiopia, from August 15- November 30,2022.

The diastolic blood pressure was lower in non-preeclampsia group throughout intraoperative time. However, the difference was relatively higher at (1,3 and 6) minutes after spinal anesthesia as indicated on the graph (figure 3).

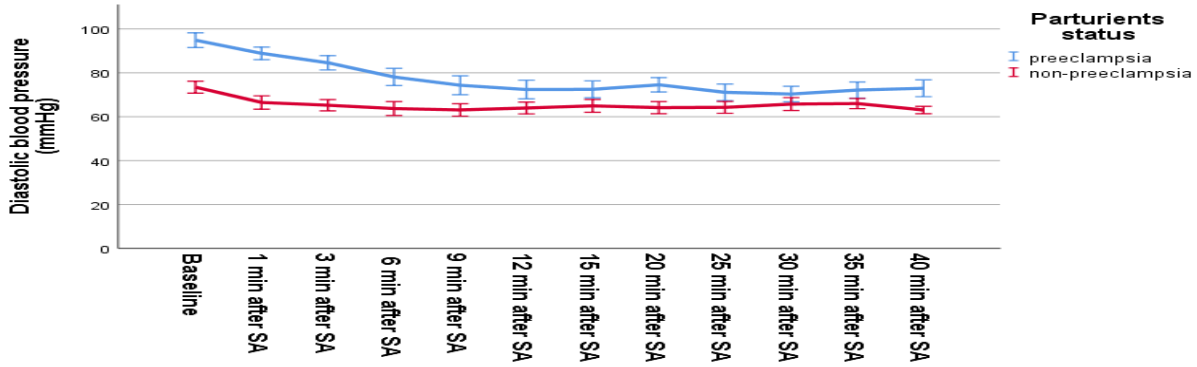

***Figure 3*:** Trends of DBP after spinal anesthesia between the groups in Jimma zone public hospitals from Southwestern Ethiopia, August 15- November 30,2022

The mean arterial pressure was lower in non-preeclampsia group throughout intraoperative time. However, the difference was relatively higher at (1,3 and 6) minutes after spinal anesthesia as indicated on the graph(figure 4)

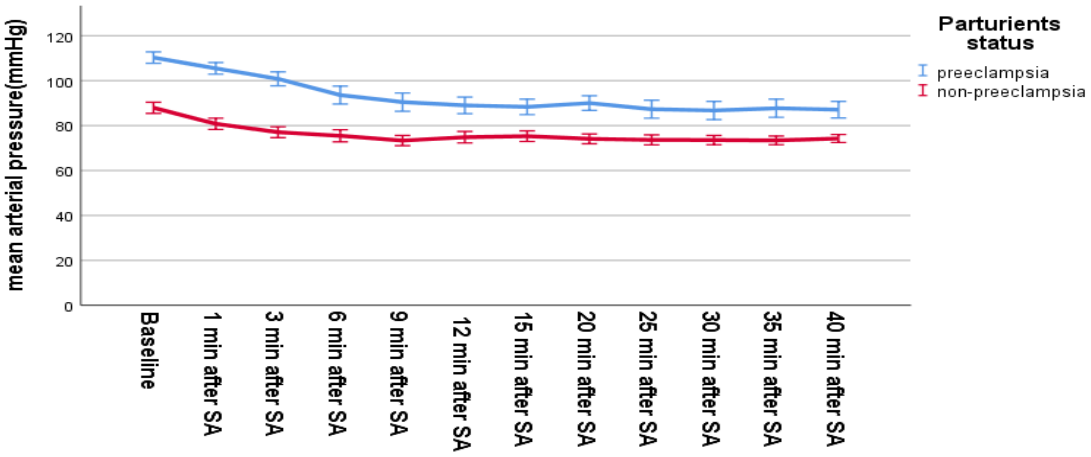

***Figure 4*:** Trends of MAP after spinal anesthesia between the groups in Jimma zone public hospitals, southwestern Ethiopia, from August 15- November 30,2022

The magnitude of fall of SBP was significantly higher in non-preeclamptic group initially at 1, 3 & 6 minutes; $p<0.05$. The magnitude of fall of SBP was insignificant at 9 ,12,15,20,25 & 30 minutes) measurement intraoperatively. However, at 35 and 40 minutes the magnitude SBP fall was significantly higher in preeclamptic groups (Table 6)

Table 6: comparation of magnitude of fall of systolic blood pressure after spinal anesthesia in parturient who underwent cesarean section in Jimma zone public hospitals, Ethiopia, from August 15-November 30, 2022.

Variables over time serious after SA	**Non-preeclamptic (n=63)**	**Preeclamptic (n=63)**	**p-value**
1 min SBP	9.26 ± 7.10	4.80 ± 2.34	<0.001*
3 min SBP	12.43 ±7.74	8.03 ± 4.61	<0.001*
6 min SBP	14.29 ±7.21	11.19 ±5.01	0.006*
9 min SBP	14.13 ±6.56	14.23 ±4.57	0.916
12 min SBP	15.27 ±7.58	15.93 ±4.25	0.549
15 min SBP	13.93 ±7.72	15.95 ±4.09	0.070
20 min SBP	15.42 ±7.54	15.30 ±4.58	0.914
25 min SBP	14.51 ±7.21	16.47 ±5.75	0.095
30 min SBP	14.82 ±8.14	16.25 ±5.02	0.240
35 min SBP	12.49 ±6.91	15.56 ±6.36	0.014*
40 min SBP	12.43 ±6.14	17.42 ±6.66	0.002*

*Independent t-test, *=statistically significant*

There is no significant difference in the HR between the groups throughout time after spinal anesthesia, but relatively greater difference was observed intraoperative at 15 and 20 minutes after spinal anesthesia (Figure 5).

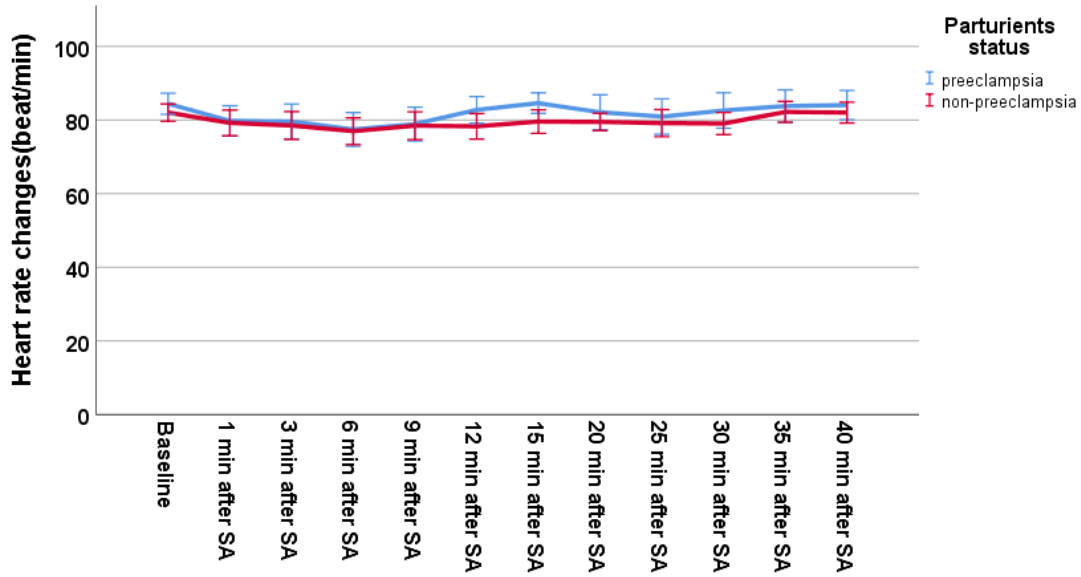

Figure 5: Trends of HR after spinal anesthesia between the groups in Jimma zone public hospitals Southwestern Ethiopia, from August 15 -November 30,2022.

Overall, the majority of the non-preeclamptic parturient developed hypotension within the first fifteen minutes of spinal anesthesia but, the majority of preeclamptic were developed hypotension after fifteen minutes of spinal anesthesia depending on definition of hypotension used in this study. The highest percentage 22.58% of non-preeclamptic parturient developed hypotension at 6 and 9 minutes after spinal anesthesia however, the highest percentage (35%) of the preeclamptic developed hypotension at 20 ,25 and 30 minutes after spinal anesthesia. When compared at 1 and 3 minutes after spinal anesthesia the higher percentage of non-preeclamptic developed hypotension than preeclampsia 5(16.13%) Vs 1(5%) respectively and the difference was significant between the groups (p=0.014) (*figure 6*).

When compared incidence of hypotension at 12 and 15 minutes after spinal anesthesia a higher number of non-preeclampsia (12.9%) develop hypotension than preeclampsia (10%). At 35 and 40 minutes the higher percent of preeclampsia 4(20%) develop hypotension than non-preeclampsia 2(6.45%) which was significantly different(p=0.014). The episode of hypotension was higher in non-preeclampsia than preeclampsia group 9(29.03%) Vs 4(20%) respectively which was significantly different(P=0.003). (*Figure 6*).

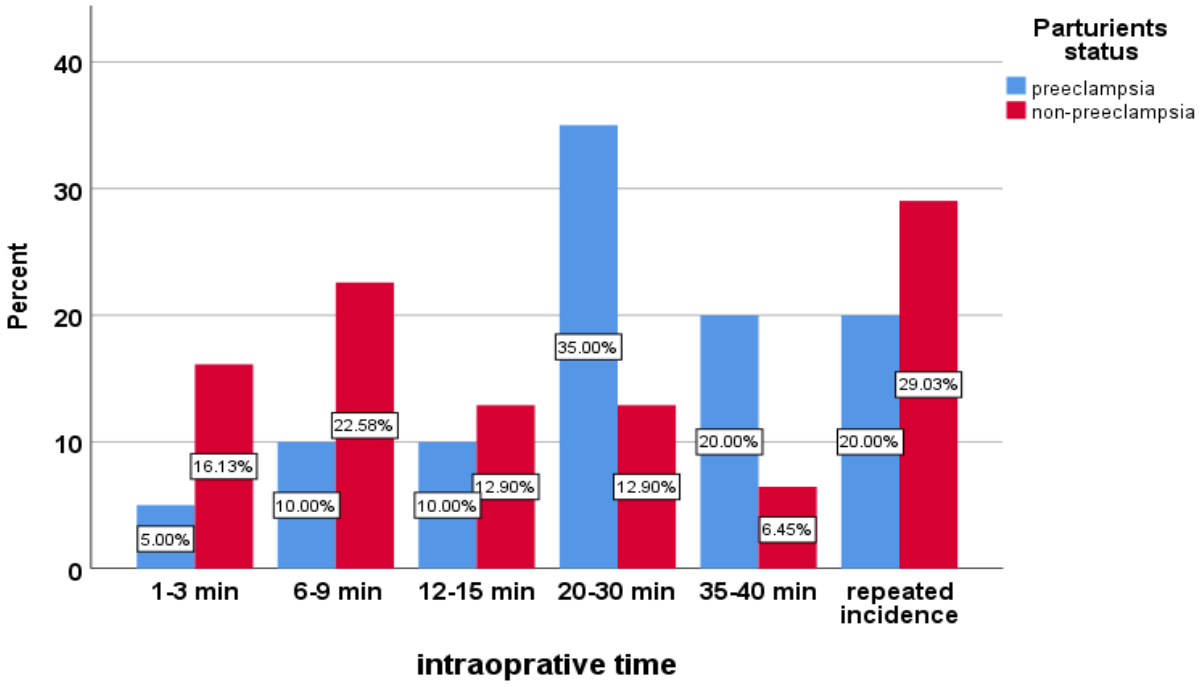

Figure 6: Intraoperative incidence of hypotension at different time after spinal anesthesia between the groups in Jimma zone public hospitals, Ethiopia, August 15-November 30, 2022.

Chapter Six: Discussion

Various studies uses different definition of spinal anesthesia induced hypotension which makes the results of study different and increase the ranges of reported incidence(35,36).

The socio-demographic characteristic such as age, weight, height and body mass index comparable between the groups. The majority of parturient from both groups were underwent emergency cesarean delivery and the types of surgery (emergency versus elective) were comparable between the groups. The gestational ages were significantly lower in preeclampsia (37.78±0.95 Vs 38.65± 0.95) but the new born weigh were comparable between the groups. The conducted in republic of Macedonia by Sivevski et al. found similar results to our study(32)

In this study the overall incidence of hypotension was 50.8% in non-preeclampsia and 31.7% in the preeclamptic parturient, indicating higher incidence of hypotension in non-preeclamptic group. This incidence of hypotension was significantly different between the groups(P=0.030). The study conducted in Iran by Nikooseresht et al. found that the 55.8% incidence rate of hypotension in preeclampsia and 89.2% in non-preeclampsia which was higher than our finding (30). The possible explanation for this discrepancy may be the use of hydralazine intraoperatively in their study to control blood pressure in preeclampsia and the total fluid volume administered were less in both groups in their study.

On the other hand, the result of our study was comparable with study conducted by Alemayehu et.al, as they indicated that the greater incidence of hypotension in non-preeclamptic parturient than preeclamptic (34.1% Vs 55.6%)(31,32). The results of our study were also consistent with the study conducted in France by Ferrer, Robert and Ripart. as they indicated that preeclamptic parturient had less incidence of hypotension compared with non-preeclamptic parturient (16.6% versus 53,3%; P=0.006)(35). The incidence of hypotension was less in preeclamptic group in their study. This difference may be due the lower gestational ages in their study (32.4 ± 2.7) which was (37.78 ± 0.958) in our study.

Our study didn't agree with the result of study conducted in Brasil by Mendes et al. which found there was no significant difference in the incidence of hypotension after spinal anesthesia between preeclamptic and non-preeclamptic parturient during cesarean section (21). The likely explanation for the discrepancy might be intraoperative uses of hydralazine every 20 minutes in preeclampsia in their study which potentiate the hypotension induced by spinal anesthesia and the definition of hypotension used which is 30% decrements of SBP in their study.

The study conducted in India by Saha, Ghosh and Bhattacharyya found that the baseline SBP, DBP, and MAP were higher in preeclamptic group. However, the baseline heart rate was comparable between the group(22). The result of our study was in line with above and other similar study conducted in France by Ferrer, Robert and Ripart, (35).

Following spinal anesthesia, the mean SBP, DBP and MAP was higher in preeclamptic parturient than non-preeclamptic at each point of time and the difference was significant between the group at each measurement($p=<0.001$). The mean heart rate changes were comparable at each point of time after spinal anesthesia. These finding were similar with study conducted in India by Mitra M et al and other similar study which also conducted in India(34,38).

The minimum records of SBP, DBP and MAP were higher in preeclamptic group which was statistically significant for the three variables($p=<0.05$) in this study. This finding was correspondent with study conducted in France by Ferrer, Robert and Ripart,in India by Saha, Ghosh and Bhattacharyya and in India by Khatri, Sethi and Ujawal(22,35,36).

The prospective study conducted in Iran by Nikooseresht M et al. concluded that the maximum fall of blood pressure were significantly higher in non-preeclamptic parturient(30). Another study conducted in India by Saha, Ghosh and Bhattacharyya indicated that maximal blood pressure fall were higher in non-preeclamptic parturient(22). Similarly, Alemayehu et.al found that maximal of fall of blood pressure were significantly greater in the non-preeclamptic parturient compared to preeclampsia(31). The results of our study were comparable with all of the above studies finding.

The systolic blood pressure was decrease from baseline in both groups. However, the magnitude of SBP falls was significantly higher in non-preeclampsia at 1minute (19.26 ± 7.10 Vs 4.80 ± 2.34; P=<0.001), at 3 minute (12.43 ±7.74 Vs 8.03 ± 4.61; P=<0.001) and at 6 minutes (14.29 ±7.21 Vs 11.19 ±5.01; P=0.006). The magnitude of fall was significantly higher in preeclampsia at 35 minutes (12.49 ±6.91 Vs 15.56 ±6.36; P=0.014) and at 40 minutes (12.43 ±6.14 Vs 17.42 ±6.66; P=0.002). This finding was comparable with study conducted in India by Mitra et.al(34)

In both groups the higher percentage of parturient 51(81%) of non-preeclampsia and 49(77.8%) of preeclampsia had decreased heart rate from the baseline measurements by 20% and the decrement was not significant(P=0.620) and 4(6.3%) in both group shows 20% increments of heart rate from baseline. The finding was comparable with study conducted by Alemayehu et al and other similar study(31,36). There was no significant difference in mean value of heart rate between group at each point of time after spinal anesthesia. This finding was comparable with study conducted in Republic of Macedonia by Sivevski et.al and study conducted by khatri et al.in India (32,36).

The result of our study indicated the higher rate of vasopressor requirement in normotensive group 8(80%) than preeclampsia group 2(20%) that was statistically significant(P=0.048). The total doses of vasopressor used for treatments of hypotension were also higher in normotensive group (68.75 ± 21.50mcg) Vs 30.0 ±14.14mcg) which was statistically significant (P=0.046). This finding was similar with the study conducted in Iran by Nikooseresht M et al and other similar studies(17,30,36).

Our study revealed that majority of the non-preeclamptic parturient developed hypotension within the first fifteen minutes of spinal anesthesia but, in the preeclamptic group majority of parturient developed hypotension after fifteen minutes of spinal anesthesia depending on definition of hypotension used in this study. The highest percentage (22.58%) of non-preeclamptic parturient develop hypotension at 6 and 9 minutes after spinal anesthesia however, the highest percentage (35%) preeclamptic develop hypotension at (20 ,25 and 30 minutes) after spinal anesthesia.

When compared at 1 and 3 minutes after spinal anesthesia, the greater percentage of non-preeclamptic developed hypotension than preeclamptic groups 5(16.13%) Vs 1(5%) respectively with p-value of (0.014). Even though no study compares incidence of hypotension at different intraoperative time, the finding support the concept of study conducted in India by Mitra et al which indicate that preeclamptic parturient had more gradual blood pressure changes than non-preeclampsia(34).

This finding may be due to the scientific fact that preeclamptic parturient had increased sympathetic activity of resulting in intense vasoconstriction which relatively compensate the effects of sympathetic blockage. On the other hands due to dysfunction of endothelium mediated vascular relaxation in preeclampsia results in increased vascular resistance(47,48)

The number of episodes of hypotension was higher in non-preeclampsia compared with preeclampsia group 8(26.7%) Vs 4(20%) which was statistically significant between the groups(p=0.014). The study conducted by Khatri, Sethi and Ujawal reported similar finding with our study regarding to episode of hypotension between the groups(36)

The study conducted by Ferrer, Robert and Ripart found that there was statistically significant difference comparing the volume of fluid preload which was higher in non-preeclamptic parturient(1895 ± 150 Vs 1653 ± 331; P=0.005) (35). Our study result was consistent with the above finding. Regarding an intraoperative fluid consumption our study indicated that non-preeclampsia group requires higher intraoperative fluid (2465.87 ml ± 381.405 Vs 2214.29 ml ± 411.0.79) which was statistically significant with p-value 0.001. This result was similar with Nikooseresht M et al(30). The total estimated intraoperative blood loss was comparable between the group with p-value of (0.259). This result was in line with prospective study by Alemayehu et.al(31).

The current study has certain limitation such as the inaccessibility of invasive arterial blood pressure to measurements beat to beat systolic blood pressure which enables continuous follow up and not to miss episodes of hemodynamic changes. The speed of injection local anesthesia which may affect the hemodynamic of the parturients was not measured. This study was conducted at multicenter, therefore the finding from the study may be used to generalize to other centers. Both exposed and unexposed group were selected from the same source population. This study also compared specific time at which incidence of hypotension was developed between the groups which helps for intraoperative managements of anesthesia and fill the knowledge gaps.

Chapter seven: Conclusion and recommendations

7.1 conclusions:

The incidence of spinal anesthesia induced hypotension, and magnitude of blood pressure fall were less in preeclamptic than non-preeclamptic. The intraoperative heart rate changes were similar between the groups. The better hemodynamic stability was observed in preeclampsia group in this study. The vasopressor requirements were less in preeclamptic compared with non-preeclamptic parturients. The number of episodes of hypotension was higher in the non-preeclamptic group than preeclamptic group. The incidence of hypotension was higher in non-preeclampsia initially within 15 minutes and the incidence was higher after 15 minutes in preeclampsia following spinal anesthesia.

7.2 Recommendations:

- We recommend for anesthetist that the use of spinal anesthesia in preeclampsia is safe regarding to intraoperative hemodynamic changes in parturient who undergo cesarean section if there are no other contraindications.
- Since the incidence and severity of hypotension was higher in non-preeclamptic parturient, the anesthetist should have management plan before administration of spinal anesthesia for cesarean section.
- The hospitals are recommended to supply the vasopressors of choice in obstetric for the managements of hypotension since the incidence of hypotension during cesarean delivery was higher.
- We recommend for further study with stronger study design.

References

1. Iddrisu M. Anesthesia for cesarean delivery : general or regional anesthesia — a systematic review. Ain-Shams J Anesthesiol. 2021;7:1–7.

2. Mitra J. Prevention of Hypotension following Spinal Anaesthesia in Caesarean Section - then and now. Kathmandu Univ Med J. 2010;8(3):415–9.

3. Journal TA. Working Group Report on High Blood Pressure in Pregnancy. J Clin Hypertens 75. 2001;III(Ii):75–88.

4. Management A, Anaesthesiologist C, Matjila M. Accepted Manuscript. Best Pract Res Clin Anaesthesiol Receiv. 2017;12(002).

5. Oudejans CBM, Dijk M Van, Oosterkamp M, Lachmeijer A, Blankenstein MA. Genetics of preeclampsia : paradigm shifts. Hum Genet. 2007;120:607–12.

6. Chattopadhyay S, Das A, Pahari S. Fetomaternal Outcome in Severe Preeclamptic Women Undergoing Emergency Cesarean Section under Either General Or Spinal Anesthesia. Hindawi Publ Corp J Pregnancy. 2014;2014:10.

7. Bamberg K. Definitions of hypotension after spinal anaesthesia for caesarean section: literature search and application to parturients ¨. Acta Anaesthesiol Scand Found. 2010;54:909–21.

8. Sibai B, Dekker G, Kupferminc M, Way AS. Pre-eclampsia. Seminar. 2005;365:785–99.

9. Mcdonald S, Fernando R, Ashpole K. Maternal Cardiac Output Changes After Crystalloid or Colloid Coload Following Spinal Anesthesia for Elective Cesarean Delivery: A Randomized Controlled Trial. Soc Obstet Anesth Perinatol. 2011;113(4):3–8.

10. Langesæter E, Dyer RA. Maternal haemodynamic changes during spinal anaesthesia for caesarean section. 2011;

11. Bs GLMB, Uk M, Uk F. Complications associated with regional Correspondence : South African J Anaesth Analg. 1960;15–20.

12. Palahniuk RJ, Riley ET, Cohen SE, Macario A, Ratner EF. Spinal Versus Epidural Anesthesia for Cesarean Section : Int Anesth Res Soc. 1995;80:709–12.

13. Mangin R, Ferrer J, Robert C. Spinal Anesthesia-Induced Hypotension: A Risk Comparison Between Patients with Severe Preeclampsia and Healthy Women Undergoing Preterm Cesarean Delivery. Int Anesth Res Soc. 2005;101:869–75.

14. Uribe-leitz T, Azad T, Shah N, Semrau K. Relationship Between Cesarean Delivery Rate and Maternal and Neonatal Mortality. 2015;94305(21):2263–70.

15. Marye A, Endris B. SPINAL ANESTHESIA FOR CESAREAN DELIVERY AT TWO TEACHING HOSPITALS IN ADDIS ABABA , ETHIOPIA. Ethiop Med J,. 2013;56(2):133–40.

16. Gedefaw G, Demis A, Alemnew B, Wondmieneh A, Getie A. Prevalence , indications , and outcomes of caesarean section deliveries in Ethiopia : a systematic review and meta-analysis. patient Saf Surg. 2020;14(11):1–10.

17. Ankichetty SP, Chin KJ, Chan VW, Sahajanandan R, Tan H, Grewal A, et al. Regional anesthesia in patients with pregnancy induced hypertension. J Anaesthesiol Clin Pharmacol. 2013;29(4).

18. Kee WDN, Khaw KS, Ng FF, Lee BB. Prophylactic Phenylephrine Infusion for Preventing Hypotension During Spinal Anesthesia for Cesarean Delivery. 2004;(6).

19. Santos AC. Spinal Anesthesia for Cesarean Delivery in Severely Preeclamptic Women: Don't Throw Out the Baby with the Bathwater! 2005;(7):859–61.

20. Arinen JK, Äsänen JR, Lahuhta SA, Ouppila RJ, Ouppila PJ. Maternal and uteroplacental haemodynamic state in pre-eclamptic patients during spinal anaesthesia for Caesarean section. Br J Anaesth 1996; 1996;76:616–20.

21. Mendes FF, Hennemann G, Luft A, Farias C, Braga S. Journal of Anesthesia & Clinica l Hemodynamic Effects of Spinal Anesthesia for Cesarean Section are Equivalent in Severely Preeclamptic and Healthy Parturients. J Anesthe Clin Res. 2011;2(6):2–4.

22. Saha D, Ghosh S, Bhattacharyya S. Comparison of hemodynamic response and anaesthesia between normotensive and severe section : A prospective study. J Obstet Anaesth Crit Care. 2013;3(1):23–6.

23. Aya AGM, Mangin R, Vialles N, Ferrer J, Robert C, Ripart J. Obstetric Anesthesia. Surv Anesthesiol. 2004;48(3):127–33.

24. States U, Zealand N, Kingdom U. Editorial 1. Blackwell Publ. 2003;58:833–7.

25. Dg B, Metropolitan P, Care C, Management P. Predicting spinal hypotension during Caesarean section. 2014;20(4):170–3.

26. Drugs V. Management of Hypotension following Spinal Anesthesia for. 1966;45(2):179–82.

27. Morgan PJ, Tarshis J, Halpern SH. The Effects of an Increase of Central Blood Volume Before Spinal Anesthesia for Cesarean Delivery: A Qualitative Systematic Review. Obstet Anesth. 2001;92(April 2000):997–1005.

28. Abdissa Z, Awoke T, Belayneh T, Tefera Y. Caesarean Section under General and Spinal Anesthesia at Gondar University Anesthesia & Clinical Birth Outcome after Caesarean Section among Mothers who Delivered by Caesarean Section under General and Spinal Anesthesia at Gondar University Teaching Hospi. 2013;(March 2014).

29. Randomized A, Comparison D, Spinal LH. Continuous Invasive Blood Pressure and Cardiac Output. Am Soc Anesthesiol. 2008;109(5):856–63.

30. Nikooseresht M, Ali M, Rabiei S, Hajian P, Dastaran R. Comparing the Hemodynamic Effects of Spinal Anesthesia in Preeclamptic and Healthy Parturients During Cesarean Section. Iran Soc Reg Anesth Pain Med. 2016;6(3):6–11.

31. Alemayehu TY, Berhe YW, Getnet H, Molallign M. Hemodynamic changes after spinal anesthesia in preeclamptic patients undergoing cesarean section at a tertiary referral center in Ethiopia : a prospective cohort study. patient Saf Surg. 2020;1–9.

32. Sivevski A, Ivanov E, Karadjova D, Slaninka-miceska M, Kikerkov I. Spinal-Induced Hypotension in Preeclamptic Parturients Undergoing Cesarean Section and Healthy. Open Access Maced J Med Sci. 2019;7(6):996–1000.

33. Tihtonen K, Ko T, Huhtala H, Uotila J. Maternal haemodynamics in pre-eclampsia compared with normal pregnancy during caesarean delivery. BJOG An Int J Obstet

Gynaecol. 2006;l:9–13.

34. Al. MM et. Comparison of the Hemodynamic Alterations in Normotensive and Preeclamptic Pregnant Woman Posted for Cesarean Section Under under Subarachnoid Block. J Cardiovasc Dis Diagn. 2016;4(3):2329–9517.

35. Ferrer J, Robert C, Ripart J. Patients with Severe Preeclampsia Experience Less Hypotension During Spinal Anesthesia for Elective Cesarean Delivery than Healthy Parturients: A Prospective Cohort Comparison. Int Anesth Res Soc. 2003;97:867–72.

36. Khatri RK, Sethi P, Ujawal S. Perioperative hemodynamic response and vasopressor requirement during spinal anesthesia for cesarean section in healthy and severe preeclamptic parturients : a prospective cohort comparison. ANAESTH, PAIN INTENSIVE CARE. 2014;18(2):3–7.

37. Imtiaz M, Muzaffar U. Comparison Of Spinal Anaesthesia Induced Hypotension In Severely Preeclamptic And Normotensive Parturients Undergoing Caesarean Section. 2014;(2):190–4.

38. Block S. Comparison of the Hemodynamic Changes in Normotensive and Severe Preeclamptic Pregnant Woman Posted for Cesarean Section under under Subarachnoid Block. J Med Sci Clin Res. 2018;06(08):246–54.

39. Nani FS, Luis M, Torres A. Correlation between the Body Mass Index (BMI) of Pregnant Women and the Development of Hypotension after Spinal Anesthesia for Cesarean Section. Brazilian J Anesthesiol [Internet]. 2011;61(1):21–30. Available from: http://dx.doi.org/10.1016/S0034-7094(11)70003-4

40. The M, Anesthe- T. Incidence and Risk Factors of Hypotension and Bradycardia after Spinal Anesthesia for Cesarean Section. J Med Assoc Thai Vol. 2008;91(2):181–7.

41. Hospital S. Incidence and Risk Factors of Hypotension During Spinal Anesthesia for Cesarean Section at Siriraj Hospital. J Med Assoc Thai. 2006;87(8):1127–32.

42. Shitemaw T, Jemal B, Mamo T, Akalu L. Incidence and associated factors for hypotension after spinal anesthesia during cesarean section at Gandhi Memorial Hospital Addis Ababa, Ethiopia. PLoS One [Internet]. 2020;15(8 August). Available from:

http://dx.doi.org/10.1371/journal.pone.0236755

43. Javier C, Zapata S. Hypotension and bradycardia before spinal anesthesia. Brazilian J Anesthesiol (English Ed [Internet]. 2017;67(5):535–7. Available from: http://dx.doi.org/10.1016/j.bjane.2014.12.008

44. Ashley EMC, Quick DGC, El-Behesey B, Bromley LM. A comparison of the vasodilatation produced by two topical anaesthetics. Anaesthesia. 1999;54(5):466–9.

45. Uzan J, Carbonnel M, Piconne O, Asmar R, Ayoubi J. and management. Vasc Health Risk Manag. 2011;467–74.

46. Dyer RA, Farina Z, Joubert IA, Toit PDU, Meyer M, Torr G, et al. Crystalloid Preload Versus Rapid Crystalloid Administration after Induction of Spinal Anaesthesia (Coload) for Elective Caesarean Section. Anaesth Intensive Care. 2004;32:351–7.

47. Ans H, Chobel PS, Eiger EG, Chmieder ES. The New England Journal of Medicine PREECLAMPSIA-A STATE OF SYMPATHETIC OVERACTIVITY A BSTRACT. 1996;

48. Bosio PM, Wheeler T, Anthony F, Conroy R, O'Herlihy C, McKenna P. Maternal plasma vascular endothelial growth factor concentrations in normal and hypertensive pregnancies and their relationship to peripheral vascular resistance. Am J Obstet Gynecol. 2001;184(2):146–52.

ANNEXES

Annex-1**:** Afaan Oromo version of information sheet and informed consent form

Yuuniversitii Jimmaatti inistituyuutii saayiinsii fayyaa

Mata duree qorannoo: Hemodynamic change after spinal anesthesia in preeclamptic and non-preeclamptic parturients during cesarean section in jimma zone government hospitals

Akkam jirtuu

Ani maqaan koo_____ jedhamaa. As kanan dhufeef qorannoo mata-dureen isaa dhiibba qorichi hadochaa duguguruu dugadarran hadholii opreshinin dahaniif kennamu adeemsa nanna'u dhigarratti qabu garee dhiibba dhigaa yeroo ulfaa qabaniifi kan hin qabne giddutti qaq-absisu fi sababootaa uummamuu isaa waalin wal qabatan jedhuuf odeeffanoo fuunanuuf. Qoran-noon kunis kan gaggeeffamuu barataa digrii lammaffaa muummee Aniisteeshi'atiin kan gaggeef-famuu yoo ta'u maqaan isaanii obboo Mohamedrebi Bedru jedhamuu.

Kanaafuu gaafiilee tokkoo tokkoo kanan isiin gafadhuun qaba. Kaayyoon qorrannoo kana garaa-garumma qorichi hadochaa duguguruu dugdaarran hadholii opreshinin dahaniif kennamu adeemsa nanna'u dhigaa irratti qabu garee dhiibba dhigaa yeroo ulfaa qabaniifi kan hin qabne giddutti fiduu fi maaltuu akka isaan umamaniif sababa ta'a kan judhu irratti oddeeffannoo haaraa baasuudha. Kunimmoo hadholii yaalii baqaqsaanii yaaluutiin dahaniif akka sirritti yaallamaniif galtee guddaadha. Ati immoo qorrannoo kanaf hirmataa tatee filatamteerta.

Gaffilee qorranoo kana keessatti gafatamtan huundaa deebiisuun fedhii keessaan irratti huunda'aa. Qorrannoo kana keessaa yeeroo barbaaddaan of baasuu dandeessuu. Haa ta'u maalee gaaffilee kana dhugaa irratti huundooftanii yoo nuuf deebistaan immoo rakkoo kana furuu keessaatti ga'e guddaa qaba.

Oddeeffannoon isiin nuuf keenitaan hundi iccitiidhan kan qabamuudha. Maqaan keessaan as irratti hin barreeffamuu, akkasumaas oddeeffannoo isiin nuuf keenitaan kamuu wojjin hidhata hoomaa hin qabaatu.

Balaa guuddaa: qorrannoo kana keessaatti hirmaattes hirmachuu baattees raakkoo guuddon sirra ga'u tokkoollee hin jiraatu.

Faayidaa: qorrannoo kana keessaatti hirmachuu keessaniif faayidaan addaa isiin argattan yookiin dhabdaan hin jiraatu. Garuu qulqullinaa yaalaa baqaqsaanii yaaluu yeroo dahumsaa hadholiif godhamuu foyyessuu keessaatti faayidaa guddaa qabaata.

Waligaltee afaaniin Itti fufuu ni dandeenyaa? Eeyyee _____ Lakkii_____

Maqaa fi mallattoo gaafata/ttuu_____

Annex 2: Amharic version information sheet and informed consent form

የተከበራችሁ የጥናቱ ተካፋዮች

ጤና ይስጥልኝ: ስሜ----------ይባላል። በጅማ ዩኒቨርስቲ አንስቴዥያ ትምህርት ክፍል የምርምር ቡድን ዉስጥ እየሰራሁ እገኛለሁ።ወደዚህ የመጣሁበት ምክንያት_ በቀዶጥ ገና ወሊድ የአንስቴዚያ መድሀኒት በሚሰጥበት ግዜ የሚከሰቱ የደም ግፊት እና የልብ ምት ለውጦች ና መንሴዎች ላይ ለሚደረገው ምርምር/ጥናት መረጃ ለመሰብሰብ ነው፡ ፡ጥናቱን የሚያካሂዱት በጅማ ዩኒቨርስቲ አንስቴዥያ ትምህርት ክፍል የሁለተኛ ዲግሪ (masters) ተማሪ የሆኑት አቶ _መሀመድረቢ በድሩ ናቸው።

ስለዚህ ጥቅት ደቂቃ የሚሆን ጊዜ የሚወስዱ ጥያቄዎች አሉኝ ። እርስዎ ጥያቄዎቹን መመለስ በቀዶ ጥገና ወሊድ የአንስቴዚያ መድሀኒት በሚሰጥበት ግዜ የሚከሰቱ የደም ግፊት እና የልብ ምት ለውጦች ለማዎቅ እና ይህን ችግር ለመፍታት ከፍተኛ የሆነ አስተዋጽሆ ይኖረዋል።ከዚህ የሚገኘው ማንኛውም መረጃ በሚስጥር ይጠበቃል። ለዚህም ሲባል የእርስዎ ሥም አይጻፍም፡ ፡ ለመማለስ ፈቃደኛ ያልሆኑትን ማንኛውንም ጥያቄ አልመልስም ማለት ይችላሉ። በማነኛውም ሰዓት የጥያቄ እና መልሱን ሂደት ማቋረጥ ይችላሉ። ነገርግን ቀደም ሲል እንደተገለጸው እርስዎ የሚሰጡት እውነተኛ ምላሽ በቀዶ ጥገና ወሊድ የአንስቴዚያ መድሀኒት በሚሰጥበት ግዜ የሚከሰቱ የደም ግፊት እና የልብ ምት ለውጦች ላይ ለሚደረገው ምርምር/ ጥናት በከፍተኛ ሁኔታ ያግዛል።

የቃል ሥምምነት

የዚህ ጥናት ዓላማ ተነቦልኝ (አንብቤው) እና ዓላማው ገብቶኝ በጥናቱ ለመሣተፍ

ሀ. ፈቃደኛ ሆኛለሁ---------- ለ. ፈቃደኛ የጠያቂው ሥምና ፊርማ---------- ----------

Annex 1: English version Information sheet and informed Consent Form

Jimma university institute of health science

Research title: Hemodynamic change after spinal anesthesia in preeclamptic and non-preeclamptic parturient during cesarean section in government hospital existing in jimma zone

Hello: My name is ---------- I am working as a data collector for the study being conducting on **Hemodynamic change after spinal anesthesia in preeclamptic and non-preeclamptic parturients during cesarean section in government hospitals existing in jimma** zone by the post-graduate student (MSc in clinical anesthesia) at Jimma University Faculty of Medical Science, Department of Anesthesia. I kindly request you to give me your attention to explain to you about the study and being selected as a study participant.

Participation by answering the questions that we are going to provide you is strictly on voluntary base. You can withdraw yourself from the study at any time you wish. We are going to ask you some questions that are personal and your honest answer to the questions will help us for the quality of the study.

The information you give will be kept completely confidential. Your name will not be written on this form, and will never be used in connection with any of the information you will tell us. And hence no report of the study ever identifies the participants.

Potential risks: There is no potential risk that may cause any harm to study participants. Moreover, it will not affect the service you get from the hospital.

Benefits: No financial benefits offer related to this study. But by participating in this study, you contribute to the study which will be used to improve the quality of health care we are providing for our patients.

Verbal consent, do you want to continue? Yes_____ No_____ Sign_____

Thank you for your help!

Name and contact address of investigator: Name: Mohamedrebi Bedru, Email: mame2bedru@gmail.com cell phone: 0917635584

ANNEX 2: questionary

Instrument prepared for data collection on hemodynamic change after spinal anesthesia in preeclamptic and non-preeclamptic parturients during cesarean section in government hospital existing in jimma zone. Faculty of Medical Science, and Department of Anesthesia,2022

Date_____

Data collector name and profession_____

Signature_____

Part I Socio-demographic characteristics

S.No	Question	Response		Code
101	Maternal Age (years)			X1
102	Maternal Weight (kg)			X2
103	Maternal Height (cm)			X3
104	Maternal BMI in (Kg/cm2)	18.5-24.9 25-29.5 30-34.9	1 2 3	X4
105	ASA status	ASA II ASA III	1 2	X5

Part II: preoperative factors

s.no	Question	Response		Code
201	Type of surgery	Elective Emergency	1 2	Y1
202	Parturients status	Preeclampsia Non-preeclampsia	1 2	Y2
203	Antihypertensive used	A, yes B, no	1 2	Y3
204	If yes which type	Hydralazine Labetalol Methyldopa Others specify	1 2 3 4	Y4
205	Gestational age in week			Y5
206	New born weight in kg			Y6
207	Volume of preload	ml		Y7

Part III: Anesthesia and surgical related factors

s.no	Question	Response		Code
301	Dose of bupivacaine	…….. mg		Z1
302	Baricity of bupivacaine	Isobaric Hyperbaric	1 2	Z2
303	Opioid adjuvants used	A. Yes B. No	1 2	Z3
304	Left lateral tilt during operation	A, yes B, no	1 2	Z4
305	Level of sensory block	Up to T10 UP to T8 Up to T6 UP to T5	1 2 3 4	Z5
306	Experience of anesthetist	1 year 2 years 3 years > 3years	1 2 3 4	Z6
307	Intraoperative fluid volume	ml		Z7
308	Intraoperative blood loss	ml		Z8
309	Type of uterotonic agent used	A, Oxytocin B, Ergometrine	1 2	Z9
310	Dose of uterotonic agent	…….IU or ……..mg		Y10
311	Vasopressor used	A, yes B, no	1 2	Z11
312	Dose of vasopressor	Adrenaline(mg) ---------- mg		Z12
313	Dose of atropine if used	…….mg		Z13

Part IV: intraoperative vital sign

Time	SBP	DBP	MAP	HR
Baseline after preload				
1 minute after SA				
3 minutes after SA				
6 minutes after SA				
9 minutes after SA				
12 minutes after SA				
15 minutes after SA				
20 minutes after SA				
25 minutes after SA				
30 minutes after SA				
35 minutes after SA				
40 minutes after SA				

DECLARATION

I, the undersigned, declare that this thesis is my original work, has not been presented for a degree in this or any other university and that all sources of materials used for the thesis have been fully acknowledged.

Name: _____

Signature: _____

Name of the institution: _____

Date of submission: _____

This thesis has been submitted for examination with my approval as university advisor

Name and Signature of the first advisor _____

Name and Signature of the second advisor _____