ADDIS ABABA UNIVERSITY-COLLEGE OF HEALTH SCIENCES SCHOOL OF MEDICINE, TIKUR ANBESSA SPECIALIZED HOSPITAL

INCIDENCE AND RISK FACTORS OF HYPOTENSION IN ELECTIVE CESAREAN SECTION PATIENTS FOLLOWING SPINAL ANESTHESIA AT TIKUR ANBESSA SPECIALIZED HOSPITAL.

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A RESEARCH PAPER SUBMITTED TO THE DEPARTMENT OF ANESTHESIOLOGY, ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCE, SCHOOL OF MEDICINE IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR SPECIALITY CERTIFICATE IN ANESTHESIOLOGY.

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Declaration of the investigator

I, Dr. Yonathan Abebe declared that this thesis is my original paper work on Incidence and Risk Factors of Hypotension after Spinal anesthesia for elective cesarean section in Tikuranbessa specialized hospital which was done from April 1st to October 1st2019, as partial fulfilment required for specialty certificate in anesthesiology. The thesis was done as methodology described.

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List of abbreviations

ASA- American Society of Anesthesiology

BP- Blood pressure

C/S- cesarean section

HR- Heart rate

MAP- mean arterial pressure

OT- Operation theatre

SA- Spinal anesthesia

SPSS- statistical package for the social science

SVR- Systemic vascular resistance

TAH- Tikuranbessa Hospital

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Abstract

Background and Objectives; Hypotension is the commonest complication of spinal anesthesia. Hypotension may pose serious risk like loss of consciousness and cardiac arrest on mother (3) The objective of this studywas to evaluate theincidence and risk factors of hypotension, severity of hypotension and onset time of hypotension after spinal anesthesia given for cesarean section (C/S) at Tikuranbessa specialized hospital.

Method;a prospective analytic cross-sectional study was conducted on parturientwho underwentelective cesarean section with spinal anesthesia at Addis Ababa University;Tikuranbessa specialized hospital (TASH). Data was collected on Incidence, severity and onset time of hypotension after spinal anesthesia was given and Hypotension was correlated with Age, ASA physical status, Gravidity, Height, Weight, BMI of mothers, amount of preloading volume, type of bupivacaine, dose of bupivacaine, use of spinal additives and use of prophylactic vasopressors.Chi-Square test and multiple logistic regression analysis were used to assess significance of statistical association.

Result;total of 144 mothers' data was collected. 103(71.5%) developed hypotension, severe hypotension occurred in 57(55.3%) mothers, the first five minutes was the commonest time for post spinal hypotension to occur. Maternal age *(p= .01, 95%CI .011, .565*), level of block height (*p= .003, 95%CI .049, .547*) and bupivacaine dose in ml (*p= .046, 95%CI .277, 16.853*)were been found to have significant association with post spinal hypotension.

Conclusion and recommendation; incidence hypotension was 71.5%, implementation of interventions to reduce post spinal hypotension in TASH was quite poor with no protocol to standardize the practice of performing spinal anesthesia. We recommended to have further study on similar topic by being more inclusive and wider sample size, to develop protocol which guides on conducting spinal anesthesia in standardized manner.

CHAPTER ONE

INTRODUCTION

1.1 Background

Spinal anesthesia is a widely used anesthesia technique for caesarean section as it avoids the risks of general anesthesia related to difficult intubation and aspiration of gastric contents(1,4). Anesthesia-related maternal mortality occurs most frequentlywhen using general anesthesia for caesarean delivery (5). Other risks of generalanesthesia include: failed endotracheal intubation, failed ventilation,aspiration pneumonitis, dental trauma, postoperative nauseaand vomiting, delayed breastfeeding, and sedation of the baby. Regional techniques such as epiduralor spinal anesthesia avoid these risks, allow the mother to be awakeat the baby's birth, and may reduce the need for systemic opioid administration postoperatively(3). Spinal anesthesiahas the advantage of simplicity, rapid onset, low failurerate, minimal drug dose, and profound or dense sensory and motor block (6).

Hypotension after spinal anesthesia is defined as drop in MAP by more than 20% from base line(2). Post spinal hypotension remains common despite several measuresused to reduce both incidence and severity(4).Reports of hypotension during spinal anesthesia for elective caesarean delivery are frequent(70-80%) when pharmacological prophylaxis is not used.Hypotension after spinal anesthesia is primarily due to adecrease in systemic vascular resistance secondary to vasodilationwith the blockade of preganglionic sympatheticfibers (4,7,12). Although some physical methods (leg wrapping, thromboembolicstockings) and the prevention of aorto-caval compression (left lateral tilt of the uterus) are useful, mainprevention relies on two pharmacological methods, vasopressor therapy and intravascular fluid loading, generallyin combination(8).Many studies have been conducted concerningprophylaxis and therapy of hypotension after spinal anesthesia. Predictions of these events,however, have been addressed by only a few authors
for spinal anesthesia(9). If we can predictthe risk of hypotension after spinal anesthesia, better andmore effective management can be provided(7.13)

1.2 Statement of the problem

The proportion of cesarean section done under spinal anesthesia has increased dramatically in past two decades(13). There are obvious advantages of regional anesthesia includingavoiding the problems of difficult airway and exposure to multiple drugs of general anesthesia as well as allowing the parturient to be awake to witness the delivery of birthing experience(28). Spinal anesthesia is common used technique because of simple to administer, rapid onset reliable block with adequet muscle paralysis achieved and with good post-operative analgesia for the mother(6). But spinal anesthesia does not come without any risk despite widely used for cesarean delivery in which hypotension being the commonest complication(7). Which can have adverse outcome on mother like hypotension severe enough to cause loss of consciousness, nausea vomiting and even cardiac arrest(3,8).

1.3 Rationale of the study

Spinal anesthesia is the commonly used technique of anesthesia at Tikuranbessa specialized hospital for cesarean section. In the year of 2019 from January to mid-march a total of 210 cesarean section were done at Tikuranbessa Hospital, out of which 193 (91%) done under spinal anesthesia. Spinal anesthesia for cesarean section provides excellent, fast and simple anesthesia with good muscle relaxion and avoids risks associated with general anesthesia. Despite hypotension is the commonest complication with spinal anesthesia; there is no data on the incidence of hypotension and its outcome at Tikuranbessa hospital

- The finding of this study can be used in
    - Predicting the likelihood of developing hypotension after spinal anesthesia
    - Suggest means to reduce incidence and severity of hypotension
    - Provide data for further study in the area and improvement of the service of spinal anesthesia for C/S

CHAPTER TWO

LITRATURE REVIEW

Obstetric anesthesia generally considered to be one of the higher risk areas of anesthetic practice. Change in maternal physiology during pregnancy and care for the mother and fetus present a unique challenge to anesthesiologist(10).

Spinal anesthesiapreferred anesthesia regimen for cesarean delivery because of its lower risk ofmaternal complications compared with general anesthesia.Nevertheless, hypotension is a common adverseeffect of spinal anesthesia in these patients(11). Hypotension afterspinal anesthesia is primarily due to adecrease in systemic vascular resistance secondary to vasodilationwith the blockade of preganglionic sympatheticfibers(4,7,12).Since there is no autoregulation for placental vascular bed , prolonged maternal hypotension can be detrimental to the fetus, induce lower fetal Apgar scores, fetal acidosis and hypoxia(13). Identification of associated risk factors with SA induced hypotension might help to prevent and early recognize patients most at risk, to avoid dramatic consequences in mother and neonate(7,13).

Risk factors for spinal anesthesia induced hypotension can broadly classified into two basic groups, maternal and anesthesia related risk factors. Age, body mass index, gravidity, history of hypotension, baseline heart rate and height are maternal risk factors and fluid preloading, sensory block height were anesthesia related risk factors for SA-induced hypotension during cesarean section(C/S)(7,13,14,15)

Advanced age is the factor that has been repeatedly identified in different literature as a predictor of spinal anesthesia (SA) induced hypotension(7,14,15). Maternal age of greater than or equal to 35 years are the cutoff point as predictor of developing hypotension after spinal anesthesia(7,8).Different studies have demonstrated tendency towards a greater decrease in blood pressure in older age groups.The reduction in cardiac reserve and changes in baroreceptorand sympathetic nervous system responses make hypotensionand bradycardia the most common complications inelderly patients undergoing neuraxial blocks(16)

Raised Body Mass index (BMI) is another risk factor which consistently associated with SA

induced hypotension(7,8,17). BMI cut off value of 30kg/m2 wassignificantly associated with SA induced hypotension(17).Evidence is given for the fact that obese women have ahigher 24-h blood pressure profile than slender womenand a higher night/day ratio with a blunted increase insystolic and diastolic nocturnal blood pressure,pointing to a generally higher activity of the sympatheticnervous system. As these nerves are blocked by SA, drop in blood pressure is even more explicit(18).The other explanation of higher incidence of hypotension in obese parturient might be due to higher sympathetic blockade caused by compression of subarachnoid space by gravid uterus (17,18).Also obese pregnant women are susceptible to cardiac contractility defects and conductivity of the cardiac electrical stimulus due to hyperinsulinemia and insulin resistance resulting in fat deposit that might be seen in myocardium(17)

The number of gravidity affect incidence of SA induced hypotension, in which gravidity >4 versus 1 were associate with a more than 5 folds and 7 fold increase in the risk of developing moderate and sever hypotension respectively(13). The magnitude of the decrease in systemic vascular resistance (SVR) is greater in multiparous than nulliparous, explaining higher incidence of hypotension in multiparous than nulliparous associated with spinal anesthesia(19). Not only baseline volume status, base line vascular tone may also have influence on hypotension with spinal anesthesia. Peripheral vascular tone has been shown to be decreased in parturient at term, especially on those who are multiparous(20).

Different study have shown higher drop in blood pressure after spinal anesthesia in parturient with higher base line heart rate(8,20). it is believed that higher baseline HR reflects higher sympathetic tone. Individuals with high intrinsic sympathetic tone might be at greater risk for pronounced drop in blood pressure (BP) as result of spinal sympathectomy(20). Base line heart rate (HR) were obtained in the preoperativeholding area by calculating the average of five independentreadings taken in the lateral supine position(21).Higher base line HR >90bpm were as cutoff(8,20,21)

Crystalloid pre loading has been advocated for multiple decades as means of hypotension prevention after spinal anesthesia. Randomized study of Rout *et al.*60 demonstrated that the incidenceof hypotension was reduced by crystalloidpreloading from 71% to only 55% in patients receiving 20 mL/kg Ringer's Lactate (RL) solution (8). Although intravenous fluid preload became established part of anesthetic practice, it soon became apparent thatit was not completely effective

in preventing hypotension(20).American Society of Anesthesiologists(ASA) clinical practice guideline recommendation concerningspinal anesthesia for cesarean delivery states:"Although fluid preloading reduces the frequency of maternalhypotension, initiation of spinal anesthesia shouldnot be delayed to administer fixed volume of intravenous fluid(22). one reason why crystalloid preload may not be successfully preventshypotension is the short intra-vascular half-life of crystalloid solutionsfluid(23,24). With few unconvincing exceptions any other trials (not included in theCochrane meta-analysis) reached the same conclusionand consequently crystalloid preloadingis no longer recommended by most experts(8,22,24,25)

Various study have revealed that spinal anesthesia induced hypotension occurs at a high incidence after sensory blockade at the level of >T5.(14,17). This finding supported by the fact that nerve fibers affecting the vasomotor tone of the arterial and venous vessels arise from T5-L1 and cardioaccelerator fibers arise from T1-T4(18).

Animal studies under normal physiologic conditions have shown that uteroplacental blood flow exceeds the oxygen requirement of fetal oxygen demand, providing a safety margin in terms of uterine flow fluctuations. As a result, the effect of reduced utero-placental perfusion on the fetus is debatable.(27).Despite very high prevalence of maternal hypotensionduring cesarean sections, term infants tend to tolerate thisplacental blood perfusion challenge without any major sequel(28). Kavak et al, study shows there is no difference between the general and spinalanesthesia groups in terms of average first and fifth-minuteApgar scores(28.29)Mayaan-Metzger et al, found that hypotensionlasting for 3, 5, and even 10 minutesor more was not related to any short termpostnatal complications. The explanation could be due to short duration of hypotension and another explanation is the placenta having its own autoregulation in maintaining adequate perfusion at least for a short period (30).

For spinal anesthesia, whether the height of thepatient influences the block level is controversial. Severalstudies have reported no statistical correlation betweenheight and block level(34). In many studies, the doseof the local anaesthetic is not adjusted according toheight(35).Despite sawopark et al and Kahoro found significant association between maternal height (<155cm) and post spinal hypotension, N. P Ekelef*et* alshowed that the spread of bupivacaine doesn't affected by either maternal height or body weight and recommends no dose adjustment of bupivacaine for height(35).

CHAPTER 3

SIGNIFICANCE OF THE STUDY

Regional anesthesia is the favored methods of cesarean section delivery due to their safety to the mother, simplicity of the technique, lesser maternal risk and satisfactory postoperative analgesic effect. Even though spinal anesthesia is widely used for cesarean delivery;the rapid onset of sympathetic blockademay produce an abrupt decrease in maternal arterial blood pressure(8). Despite hypotension is the commonest complication with spinal anesthesia; there is no data of hypotension incidence and its outcome in Tikuranbessa hospital

- The finding of this study can be used in
    - Predicting the likelihood of developing hypotension after spinal anesthesia
    - Suggest means to reduce incidence and severity of hypotension
    - Provide data for further study in the area and improve the service of spinal anesthesia for cesarean section

CHAPTER FOUR

OBJECTIVES

General objective

To identify the incidence and risk factors of hypotension in elective cesarean section done under spinal anesthesia at Tikuranbessa specialized hospital

Specific objective

- State incidence of hypotension after spinal anesthesia for cesarean section
- Identify risk factors for hypotension after spinal anesthesia for cesarean section
- Determine onset time of hypotension
- Determine severity of hypotension

CHAPTER FIVE

METHODS AND MATERIALS

5.1 Study area and period

- The study was conducted at Addis Ababa University, College of Health Sciences, TikurAnbessa Specialized Hospital. It is the largest public specialized hospital in Ethiopia located at Addis Ababa under the Ethiopian Federal Ministry of Education
- From April 1st to October 1st 2019

5.2 Study design

- Prospective Cross-sectional analytic study

5.3 Study population

5.3.1 Source population- All parturient scheduled for cesarean section

5.3.2 Study population- All ASA 1 and ASA II patients admitted to Tikur Anbessa specialized hospital for elective cesarean section

5.4 Sampling Method and Sample size calculation

5.4.1 Sampling method

Sequential non random sampling of women undergoing elective cesarean section under spinal anesthesia at Tikuranbessa specialized hospital

5.4.2 Sample size calculation

Samplesize calculated by the following formula

Sample size= $Z^2 \times p(1-p)\frac{1}{d^2}$

- Z- standard normal variate (at 5% type 1 error (p,0.05) it is 1.96)

- P- expected proportion in population based on previous studies. The prevalence of hypotension after spinal anesthesia at Kenyatta national hospital in Kenya at 2009 was 64% (26).
- d- absolute error or precision. In this study the precision or absolute error is 5%

sample size= $1.96^2 \times 0.64(1-0.64)\frac{1}{0.05^2}$

= 354.04 which is approximately 354

If the population to be studied in a year is less than 10,000 (In our case 240 which is the number of elective cesarean section patients that undergo spinal anesthesia at the maternity theatre per year), then the next formula, which uses the required sample size got from the above formula will be applied,

Sample size= $\frac{n}{1+\frac{n}{N}}$

Description

- n- the sample size required if the population would have been more than 10,000(354 in our case got from the first formula)
- N- the estimated population size. In our case which is the estimated number of cesarean section that undergo spinal anesthesia in TAH per year which is 240

Sample size= $\frac{354}{1+\frac{354}{240}}$

= 143.03

Hence the estimated number of patients required to achieve the desired sample size for this study is 144.

5.5Variables

5.5.1 Dependent variable

Post spinal hypotension

- Definition; drop in Mean arterial pressure (MAP) by >20%(2).

5.5.2 Independent variables

- ASA physical status
- Maternal age
- Maternal height
- Maternal weight
- Body mass index (BMI)
- Gravidity
- Base line heart rate
- Volume of Crystalloid preloading
- Height of spinal block
- Dose of bupivacaine
- Type of bupivacaine
- Use of prophylactic vasopressor
- Maternal position after spinal anesthesia

5,6 Eligibility criteria and ethical consideration

5.6.1 Inclusion criteria

ASA I and ASA II mothers scheduled for elective cesarean section under spinal anesthesia at Tikuranbessa specialized hospital of maternity OT were included.

5.6.2 Exclusion criteria

- Pregnancy induced hypertension,
- Mothers taking any antihypertensive medications
- Parturient receiving combination of spinal block with any other type of anesthesia
- Unexplained maternal hypotension before spinal anesthesia defined as systolic blood pressure less than 90 mmHg(14).
- Maternal refusal for the study

5.6.3 Ethical consideration

Any specific patient identifiers were not included in the data collection tool and this was assured by using code numbers to each data.

5.7 Data collection

5.7.1 Data collection process - Baseline systolic blood pressure and MAP obtained from the mean of threeconsecutive non-invasive blood pressure recording obtained before spinal anesthesia given. Maternal self-reported pre pregnancy weight was used to calculate weight and BMI.

5.7.2 Data collectors-The data was collected by principal investigator and anesthesiology residents assigned in the obstetric OT and by nurse anesthetist who were assigned in Obstetrics OT by using pre-setquestioners

5.7.3 Quality assurance – The data was checked for completeness every day after collecting questioner papers

5.8Data analysis and interpretation –all parameters were coded and recorded in to SPSS Windows version 24.0. Descriptive statistics were presented as mean, median, standard deviation (SD), maximum, minimum or percentage (%) as appropriate. Chi-Square test was used to assess association between variables in univariate analysis with Odds ratio (OR) and 95% confidence interval. Binary logistic regression was used to determine the effect of each independent variable on outcome variable. P value of 0.05 was used to identify statistical significance. Data will be presented by Frequency tables and figures(pie chart and bar chart).

5.9 Dissemination of the result

The study result will be presented to Addis Ababa University, School of Medicine, Department of Anesthesiology and documents will be disseminated to all responsible bodies in the study area, for the hospital where the study is conducted, FMOH and Addis Ababa university school of Medicine.

CHAPTERSIX

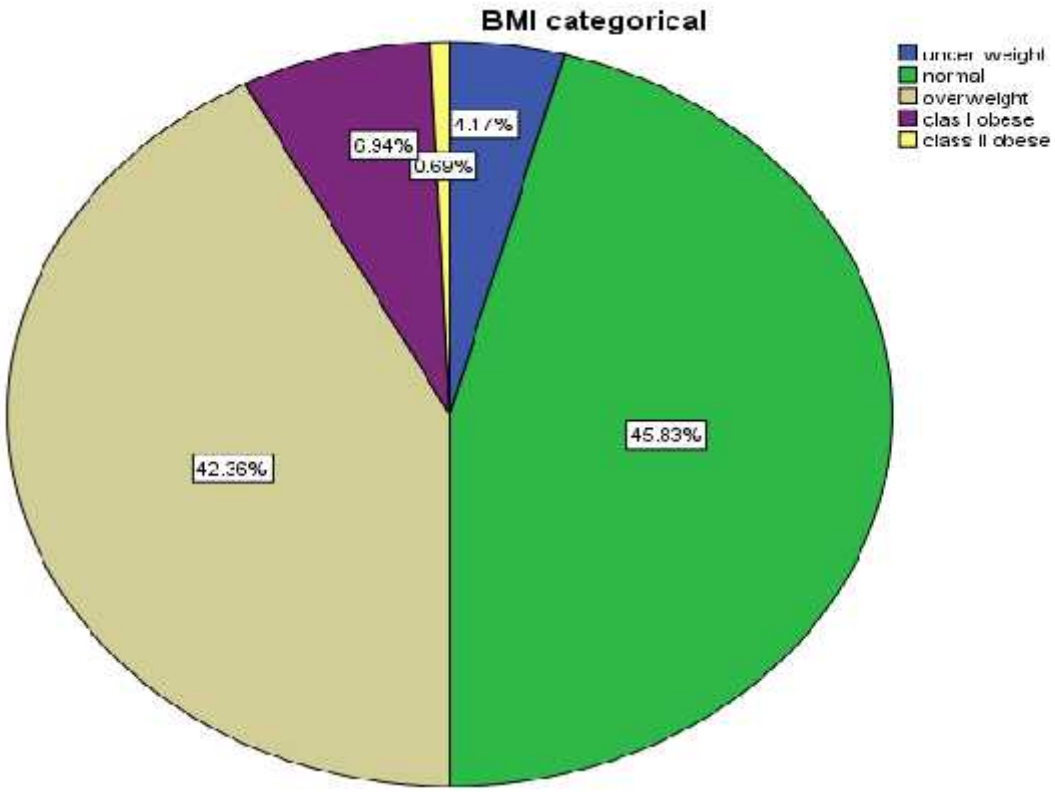
Result

Total of 144elective cesarean sections data were collected during the study period(April 1st to October 1st2019). The demographic data shown in table 1.The age of mothers range from 19 to 41 years with mean age of 28.8. Out of total mother in this research 6(4.2%) are underweight,66(45.8%) have normal BMI, 61(42.4%) are overweight with 10 (6.9%) fall in class I obese and 1(0.7%) falls in class II obese according to CDC classification(picture 1).

Table1;demographic data (n=144)

	Mean±SD	**Median**(min, max)
Age	28.8 ±4.9	29.5 (19, 41)
Height	161.5 ±6.24	164 (143, 175)
Gravidity	I 31(21.5%) II 40(27.8%) III 56(38.9%) >=IV 17(11.8%)	
Weight	64.7±9.2	64 (43, 88)
BMI in Kg/m2	24.8±3.7	24.1 (16.2, 36.5)
ASA Physical status (I%, II%)	81.3, 18.7	
MAP	91.3± 8.8	91 (65, 112)
Base line heart rate(<90, >=90 beat per minute	41% (59), 59% (85)	

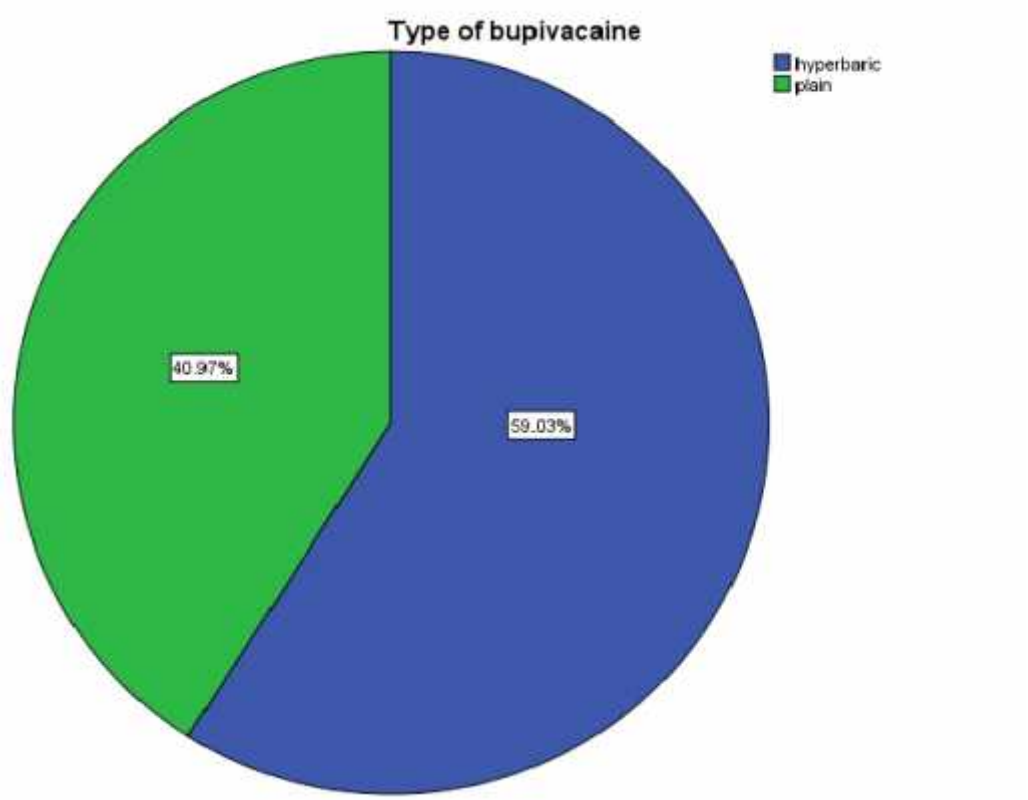
in%)		



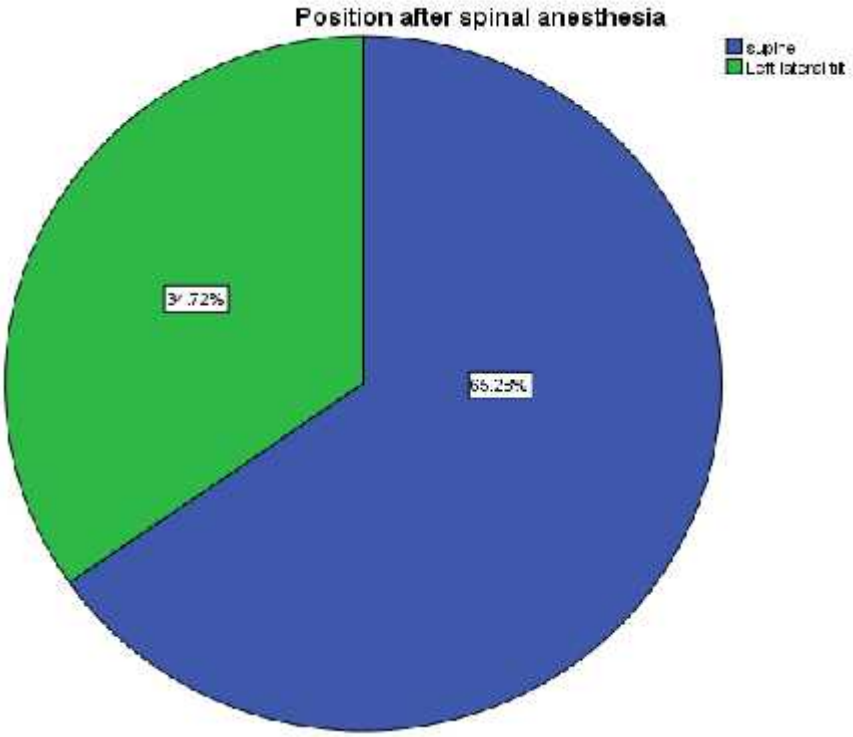
Picture 1 BMI values; under weight less than 18.5kg/m2, normal from 18.5 to 24.9kg/m2, overweight from 25 to 29.9kg/m2, obese above 30kg/m2(class I 30-34.9kg/m2, class II 35-39.9kg/m2, class III above 40kg/m2).(www.cdc.gov/obesity/adult/defining.html)

Hyperbaric bupivacaine was used in 59% percent of the case and remaining 41% done by plain bupivacaine (picture 2). The average volume of bupivacaine used for spinal anesthesia was 2.33 ml with minimum and maximum volume 1.8 to 3 ml respectively. Spinal additive or adjuvantswere used in 26 (18.1%) mothers all were fentanyl 25 microgram. The average pre-loading fluid volume was 518 ml with minimum of zero ml and maximum of 1000ml in which100% of preloading fluids were crystalloids. 0% of the mothers received prophylactic vasopressors. After spinal anesthesia given 50 (34.7%) of mother were placed in left lateral position. The remaining 65.3% mother were kept in

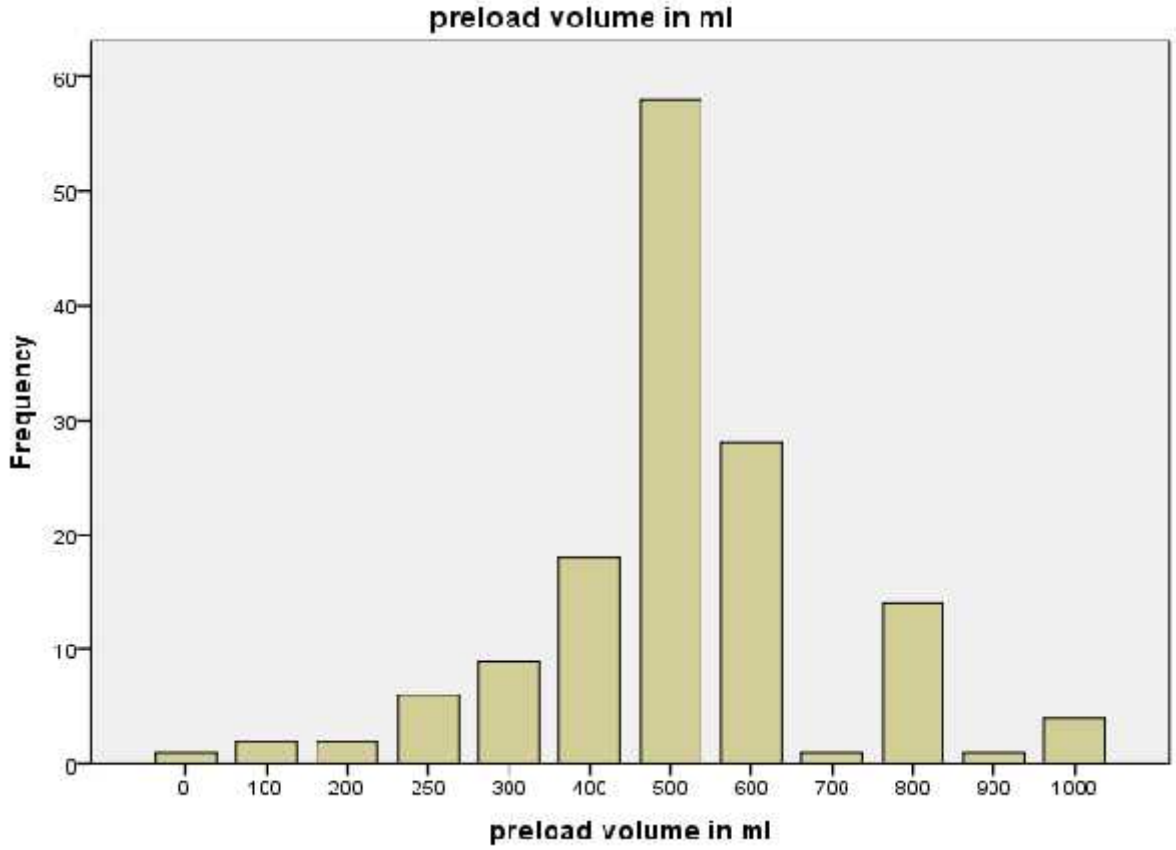
supine position(picture3). After spinal anesthesia given 92 (63.9%) of the mother have spinal block level of below T5 and other remaining 52 (36.1%) achieved block height of T5 and above.



Picture 2: type of bupivacaine used



Picture3; position after spinal anesthesia



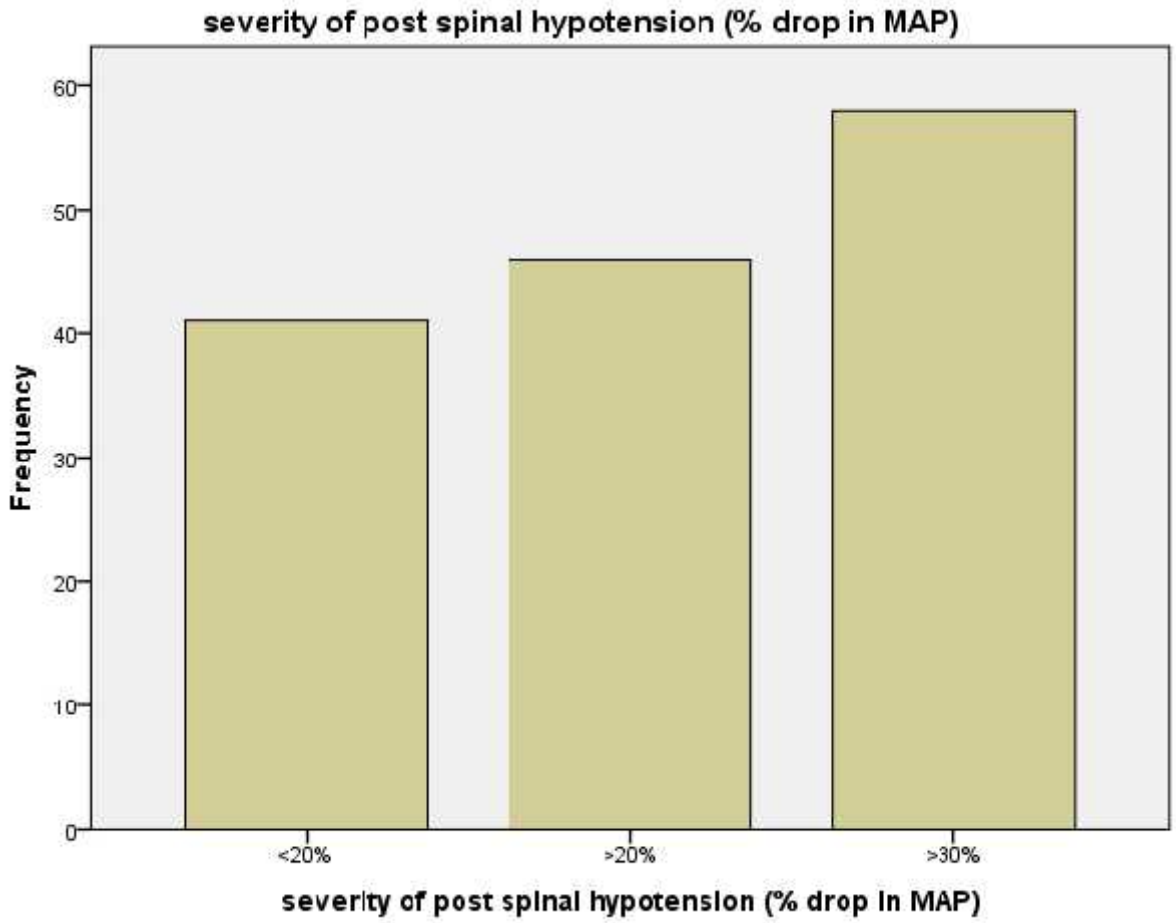
Picture 4; preloading fluid volume

Out of 144 mothers 71.5% or 103 of them developed post spinal hypotension which a drop of mean arterial blood pressure of more than20% of baseline (table 2). With 41(28.5%) having no hypotension after spinal anesthesia. The first five minutes was the commonest time to develop hypotension after spinal anesthesia occurring in 62 43.1% of the cases and 44 (30.6)% occurred within 5 to 10 minutes (picture 6).

Table 2; Incidence of post spinal hypotension

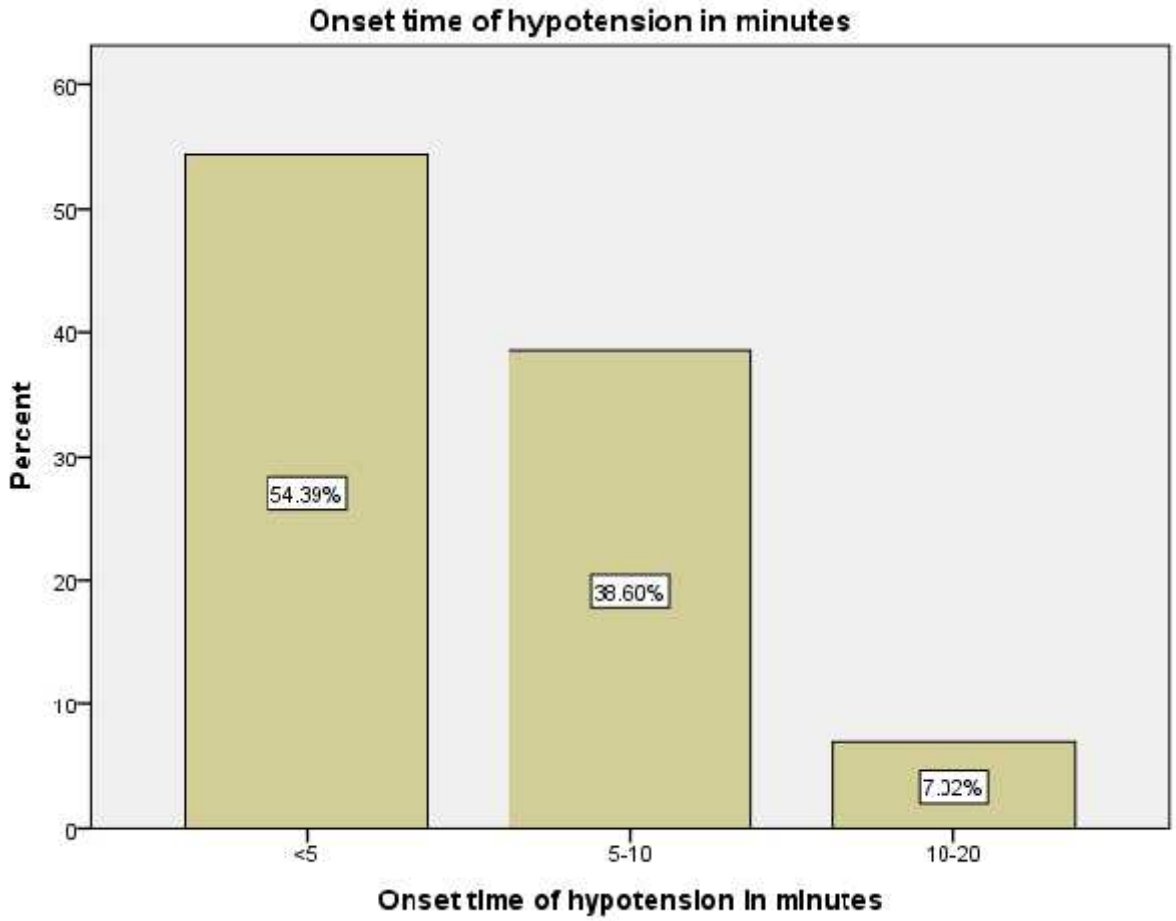
		Frequency	**Percent (%)**
Hypotension	**Yes**	**104**	**71.7**
	No	**41**	**28.3**

Out of 103 mothers who developed post spinal hypotension 57 mothers developed severe hypotension(MAP drop >30%) and 46(31.9%) developed moderate drop in MAP which is 20-30%(picture 5) with no report of cardiac arrest.



Picture 5;severity of hypotension

After spinal anesthesia the mean arterial blood pressure(MAP) was 64.2 mmHg with minimum and maximum of MAP being 21 and 100 mmHg respectively.



Picture 6;onset time hypotension

The commonest onset time for hypotension was with in the first five minutes occurring in 54.9% of the mothers while in next 5 minutes occurred in 38.6% and the remaining 7.5% occurred after 10 minutes which was not included in definition of hypotension after spinal anesthesia.

Table 3;Univariate analysis risk factors of post spinal hypotension

Variable	Grouping	Postspinalhypotension		CrudeOR	95%CI
		Nono. (%)	**Yes** no.(%)		
Age	<35	38 (32.2%)	80 (67.8%)		
	>=35	3 (11.5%)	23 (88.5%)	3.642	1.029,12.88
Height	<155	5 (19.2%)	21 (80.8%)	1.84	.645, 5.275
	>=155	36 (30.5%)	82 (69.5%)		
BMI	<30	39 (29.3%)	94 (70.7%)		
	>=30	2 (18.2%)	9 (81.8%)	1.86	.386, 9.037
Gravidity	I	14(45.2%)	17(54.8%)		
	II	6(15%)	34(85.0%)		
	III	17(30.4%)	39(69.6%)		
	IV	4(23.5%)	13(76.5%)	1.417	.403, 4.980
Baseline HR	<90	24 (40.7%)	35 (59.3%)		
	>=90	17 (20.0%)	68 (80.0%)	2.743	1.3, 5.67
Type of bupivacaine	For spinal	41 (48.2%)	44 (51.8%)	1.932	1.573, 2.372
	Non spinal	0 (0.0%)	59 (100%)		
Maternal position	Supine	20 (21.3%)	74 (78.7%)		
	Left lateral	21 (42.0%)	29 (58.0%)	.373	.177, .788
Level of block height	Below T5	36 (39.1%)	56 (60.9%)		
	T5 and above	5 (9.6%)	47 (90.4%)	6.043	2.19, 16.634

Table 4. multiple logistic regression and variables associated with post spinal hypotension

Variable	Grouping	Pvalue	AdjustedOR	95%CI
Age	**>=35** **<35**	**0.01**	**.079**	**.011, 0.565**
Level of block height	**Below T5** **T5 and above**	**0.003**	**.163**	**.049,.547**
Bupivacaine ml	**<2** **>2**	**0.046**	**2.160**	**.277, 16.853**

The result of binarylogistic regression analysis showed that three of the risk factors which are maternal age, level of block height and bupivacaine dose used in ml showed to have significant association with the outcome of the study which is hypotension after spinal anesthesia. The other risk factor didn't show significant association with the post spinal hypotensionin this study; ASA physical status (p value= .628) Gravidity (p value .375), baseline heart rate (p value .139), Type of bupivacaine (p value .996) preloading volume .152) position after spinal anesthesia (p .766) maternal body mass index (p value .680) maternal height (p value .823) and maternal weight (p .682).

Chapter seven

Discussion

Hypotension was defined as absolute drop in systolic blood pressure or percentage of drop in mean arterial blood pressure in different literatures. Systolic blood pressure less than 100mmHg was used to define hypotension by *Aya et al and Mercier*(1,8) and systolic blood pressure less than 90 mmHg was used as cutoff to define hypotension bythree different authors(2,4,12). Due to this variability in using cut off number to define hypotension,a percentage drop in MAP was used in this study to define hypotension despite its clinical application maynot be as practical as the use of cut off number. For this study drop in MAP more than 20% was used to define hypotension(2,4,12).

The incidence of hypotension at Tikuranbessa hospital among elective caesarean section done under spinal anesthesia was 71.5%. The result was comparable to study done by Saowapark et al at Siriraj Hospital Thailand in 2006 (14) which was 76.7% despite using 100mmHg as cut off value to define hypotension. The result also become more comparable when compared to study done by *Neti et al*in Thailand which was 73.3% which used 20% drop in MAP (36). This study showed lower incidence of hypotension when compared to study done at Gondar University hospital by *Agegnehu et al*at Gondar University hospital in 2017 which was 81.6% (4).

Severe hypotension which is drop in MAP >30% baseline(21) occurred in 57(39.6%) of the mothers but no report of cardiac arrest during the study period.

The current study showed that there was statistical significant association between maternal age and post spinal hypotension in which other studies done by David G Bishop and Mercier(7,8) also showed similar result. Maternal age 35 years was used in this study as well as by David G Bishop and mercier(7,8). The tendency towards a greater decrease in blood pressure in older age groups was explained by reduction in cardiac reserve and changes in baroreceptorresponses making hypotensionand bradycardia the most common complications inelderly patients undergoing neuraxial blocks (16)

The other parameter which showed statistically significant association with hypotension in this study was sensory bock level with p value of .003. as similar as this study sensory block level above T5 showed significant association with post spinal hypotension in studies done by sawopark and Kohoro(12,26). Sensory block height as risk factor for post spinal hypotension is explained by the fact that nerve fibers affecting the vasomotor tone of the arterial and venous vessels arise from T5-L1 and cardioaccelerator fibers arise from T1-T4, blockade of this nerve fibers result in loss of vasomotor tone leading to drop in systemic vascular resistance(18).

The other parameter in this study that showed significant association with outcome which is post spinal hypotension was the dose of bupivacaine used for spinal anesthesia. Bupivacaine 0.5% dose of >=2ml showed significant association with p value of .046. It is also evidenced in study by *Alan Santos et al* about the association of the dose of bupivacaine and risk of hypotension (31).Sawopark and Kohoro showed similar findings in their studies(14,28).

In the present study, there was no statistically significant association between preloading fluid volume and post spinal hypotension which is supported by study done by Hai-Fang Ni et al (2). In support of this study finding, The American Society of Anesthesiologists(ASA) clinical practice guideline recommendation concerningspinal anesthesia for cesarean delivery states:"Although fluid preloading reduces the frequency of maternalhypotension, initiation of spinal anesthesia shouldnot be delayed to administer fixed volume of intravenous fluid (22).

Left lateral tilting theoretically explained to decrease aorto-caval compression which decrease risk of hypotension during cesarean section, despite recent Cochrane data review reported there is no adequate evidence to support any positioning protocol for prevention of post spinal hypotension(32). Despite the theoretical explanation only 50(34.7%) of the mothers were placed in left lateral positioning which is quite lower when compared to Kenyatta national hospital where 100% were placed in left lateral positioning.

The use of prophylactic vasopressor is the key recent advance in prevention of spinal hypotension especially with intravenous phenylephrine despite controversies in method of administration as bolus or infusion(33). Despite ample of evidences in using prophylactic vasopressors none of the mothers in this study received prophylactic vasopressor which is quite low when compared to similar study done at kenyatta national hospital for whom 82.1% were received prophylactic ephedrine.

The present study did not show significant association between maternal body mass index and post spinal hypotension despite other studies showed it has strong association with post spinal hypotension. BerdHertmann et al showed BMI of more than 30 kg/m2 showed to have association with post spinal hypotension(37).

Despite this study did not show statistical significant association between maternal height and post spinal hypotension, study done by Kohoro showed statistical significant association of maternal height and post spinal hypotension(4).

The other parameters which did not show statistical significant association with post spinal hypotension were maternal base line heart rate and gravidity. In study done sawopark et al showed that both of the risk factors were found to have association with post spinal hypotension(14).

This present study didn't show statistical significant association between the type of bupivacaine used and post spinal hypotension which is supported by study done by Bulent Serhan et al which tried to compare the effect of using hyperbaric or isobaric bupivacaine on hypotension(38). The study showed no association btween baricity of bupivacaine and post spina hypotension.

Another parameter that didn't show statistical significant association with post spinal hypotension was ASA physical status of the mother. The studies done by *sawopark* and *berdhartmann et al* showed there was statistical significant association between ASA physical status of mother and post spinal hypotension(14,37).

Conclusion

We found that three of the risk factors found to have significant association with post spinal hypotension including maternal age, level of block height and bupivacaine dose. There was no hospital guideline or protocol to be used for prevention of post spinal hypotension at Tikuranbessa hospital.

Chapter Eight

Strength and limitation of the study

8.1 Strength of the study

The study tried to address the commonest complication of spinal anesthesia which was not been studied in our hospital previously

The study tried to identify women at risk of developing hypotension which can help anesthesia providers to work on prevention of hypotension from occurring.

The study tried to address areas to improve to decrease the incidence of hypotension

8.2 Limitation of the study

The study period collides with time of reconstruction of the obstetrics Operating theatre limiting the case variety that used to be operated in Tikuranbessa hospital

Bias can't be avoided in some of the cases as the anesthesia provider might fill undone activities as being done just to make it to the standard of practice

Chapter 9.

Recommendations

National or hospital protocol should be developed to address or minimize complications associated with spinal anesthesia and to create standard of practice when performing spinal anesthesia

Hypotension should be taken as serious complication and work must be done on prevention by anticipating risks and using commonly available vasopressors as prophylaxis

According to this study mothers whose age is above 35 years and for whom bupivacaine dose of more than 2 ml used are tend to develop post spinal hypotension more than mothers who are younger than 35 years and bupivacaine ml of less than 2 used. Anesthesia provider should be more cautious when encountered with those mothers and when using bupivacaine more than 2 ml for spinal anesthesia.

Further study in the field recommended with larger sample size and more inclusion criteria

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Annexes

Annex 1: American Society of Anesthesiologist (ASA) Physical status Classification.

- Class I: A normal healthy patient.
- Class II: Patient with mild systemic disease.
- Class III: Patient with severe systemic disease that is not incapacitating.
- Class IV: A patient with incapacitating life threatening systemic disease.
- Class V: A moribund patient who is not expected to survive for 24 hours with or without operation.
- **Class E**: A patient undergoing an emergency operation (the 'E' added to the classification number)

Annex 2: definition of post spinal hypotension

- Drop in MAP of >20% from base line or drop of absolute systolic blood pressure <100mmHg within 10 minutes administration of spinal anesthesia and not more than 30 minutes(2)

Annex 3: Severity of hypotension

- **Moderate:** drop of MAP by >20%(21)
- **Severe:** drop of MAP by >30%(21)

Annex 4: Consent explanation

I Dr. Yonathan Abebe, a final year anesthesiology resident at Addis Ababa University. I am the principal investigator of a study, of which you are about to be explained to you in full details before agreeing to participate in the study.

Study

The study aims to assess the incidence and risk factors for hypotension during spinal anesthesiafor cesarean section at Tikuranbessa hospital. Spinal anesthesia is very safe, fast and very reliable type of anesthesia but has side effect like hypotension. Hypotension is drop in blood pressure which commonly occurs after spinal anesthesia which is going to be given to you. Since hypotension is common side effect of hypotension this study tries to assess how common it is at our hospital and helps to improve the interventions used to decrease the severity of hypotension.

Participation in the study

Participation to this study is fully voluntarily. You have the right to refuse not to involve in the study and right to leave from participating in the study at any time during the study. No treatment will be withheld for refusing to participate. Participation in the study willnot cost you any extra expense, no complicationsare expected to occur as result of participation in the study.

Confidentiality

Participant’s identity will be protected. Only codes will be used as reference.

Thank you.

Annex 5; Questioner

No…… date……

Diagnosis

Age……

Gravidity

I. II. III. ≥IV.

Weight……Height--……

2. Systolic blood pressure reading before spinal anesthesia given(three readings in 5 mins)

I……(MAP)……II……(MAP)……III……(MAP)……

3. Heart rate before spinal anesthesia given

I. <90 bpm II. >=90 bpm

4. Spinal anesthesia given

I. Time……

II. Bupivacaine (ml)……

A. Type of bupivacaine used

i. For epidural/ non spinal

ii. For spinal

B. Any spinal additives specify……

III. Fluid preload volume……ml, type of fluid……

IV. Prophylactic vasopressor

A. Yes B. No

B. If yes drug……dose……..

V. Position after spinal anesthesia given

A. Supine ◻ B. Left lateral tilt ◻

VI. Is there hypotension after spinal anesthesia given (Systolic BP <100)

A. Yes B. No

VII. If yes what is the lowest Systolic blood pressure after Spinal Anesthesia given(incircle correct one and write the mean arterial pressure(MAP)**).**

A. 100-90mmHg.

B. 90-80mmHg

C. <80mmHg

VIII. What is MAP (Mean arterial pressure) after spinal anesthesia……..

IX. Time lowest BP recorded

A. Within 5 min

B. 5-10 min

C. 10-20min

D. 20-30min