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Spinal induced hypotension in pre-eclamptic and healthy parturients: A randomized comparative clinical study

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Abstract---Background: Preeclampsia/eclampsia is the third leading cause of maternal morbidity and mortality. This study aimed to evaluate the incidence and severity of spinal-induced hypotension in preeclamptic and healthy parturients. Material & Methods: A total of 60 pregnant patients undergoing a C-Section with spinal anesthesia were randomly allocated into two groups. Group I: Preeclamptic 0.5%, 2.5cc (12.5mg) Hyperbaric Bupivacaine group: 30 patients. Group II: Normotensive 0.5%, 2.5cc (12.5mg) Hyperbaric Bupivacaine group: 30 patients. The blood pressure values were recorded before spinal anesthesia and 2.5 minutes after a spinal puncture. Results: The mean age of the study group was 25.17+3.61 years (Mean +S.D.) and range is 18-30Years. The BP falls from baseline were significantly

greater in the healthy parturients compared to those with preeclampsia ($25.8\% \pm 10.1$ vs $18.8\% \pm 17.0$ for SBP, $28.5\% \pm 8.8$ vs $22.5\% \pm 10.4$ for DBP, and $31.2\% \pm 14.2$ vs $18.2\% \pm 12.6\%$ for MAP, $p < 0.05$). The incidence rate of hypotension in preeclamptic was 53% compared to 25% in healthy parturients ($p < 0.001$). Conclusion: The incidence of spinal-induced hypotension associated with patients undergoing C-Section is more in preeclamptic than in healthy parturients.

Keywords---spinal induced hypotension, preeclamptic parturient, healthy parturient.

Introduction

Hypertensive disease is the most common complication of pregnancy. Preeclampsia/eclampsia is her third leading cause of maternal morbidity and mortality. [1] In particular, it is the most common cause of fetal-maternal complications in developing countries. Approximately 40-60% of maternal deaths in these countries are due to pre-eclampsia alone. In Ethiopia, 19% of maternal deaths are caused by hypertensive pregnancy disorders. [2] It is widely believed that spinal anesthesia in preeclamptic patients can result in severe hypotension and decreased uteroplacental perfusion. Several studies have shown that the risk of spinal hypotension observed with spinal anesthesia for pre-eclampsia is not as effective as thought, especially when low doses of spinal anesthetics are used. It has been. [3,4] Some studies have reported an incidence of hypotension between 7% and 89.2% after spinal anesthesia by cesarean section. [5-9] Workers with severe pre-eclampsia experience hypotension less frequently and less severely than healthy workers [10]. All of these concerns can often discourage anesthesiologists from choosing spinal anesthesia for cesarean section in preeclampsia [11]. Keeping this background in the mind this study was planned with the objective to evaluate the incidence and severity of spinal-induced hypotension in preeclamptic and healthy parturients undergoing Cesarean Section.

Materials and Methods

Thirty preeclamptic parturients (group I), and 30 healthy (group II) were selected randomly using a computer-generated random number. Random selection of study subjects and preparation of drugs was done by a colleague to maintain the blindness of the study. Subjects were randomly allocated to one of the following study groups:

- Group I: Preeclampsia 0.5%, 2.5cc (12.5mg) Hyperbaric Bupivacaine group, 30
- Group II: Normotensive 0.5%, 2.5cc (12.5mg) Hyperbaric Bupivacaine group, 30

The co-investigators who were blinded to the above groups carried out the necessary assessments

Study area and study population

This study is a randomized, prospective, controlled study conducted on patients admitted to SNM Hospital affiliated with Ferozabad Medical College. Patients with elective cesarean section were included in the study. Her 60 pregnant women aged 18 to 40 years participated in this study. Detailed informed consent was obtained from all patients before the day of surgery. Patients with asthma, arrhythmias, congestive heart failure, dementia, or other systemic diseases were excluded from the study. Patients underwent a detailed clinical and routine examination before surgery.

Inclusion criteria

Parturient defined as preeclamptic, which means that systolic blood pressure (SBP) of 160 mmHg or higher, or diastolic blood pressure (DBP) of 100 mmHg or higher, or both, associated with proteinuria > 3 g/24 hours.

Exclusion criteria

parturient with severe fetal distress or those in labor, placental abruption, placenta previa, cord prolapse or less than 30 weeks gestation, twin pregnancy; signs of hypovolemia, oligoanuria, cerebral or visual disturbances. All the preeclamptic patients were treated with a 4.0 g loading dose of intravenous magnesium sulfate (Mg SO₄), followed by an -1.5 g/h infusion for 48 hours as seizure prophylaxis.

Methyldopa or Nifedipine or both, was given for blood pressure control but this antihypertensive protocol was not standardized and was left to the choice of the obstetrician or anesthesiologist. Mg therapy was discontinued just before the operation; antihypertensive drugs were excluded for at least 4 h before spinal puncture. Before performing the spinal puncture, once after the first call, preoperative IV fluid administration equal to a maximum of 500 ml 0.9% saline for preeclamptic and 15 mL/kg for the healthy group of 0.9% saline was administered over the 15-20 minutes with the patients turned to the left lateral tilt. Under aseptic precautions, lumbar puncture was done using 26G Quincke spinal needle at L2-L3/L3-L4 space. Patients in Group A received Inj. Hyperbaric Bupivacaine 0.5%, 2.5 cc (12.5 mg) intrathecally. Group B patients were administered Inj. Hyperbaric Bupivacaine 0.5%, 2.5 cc (12.5mg) intrathecally.

All of the study subjects in both groups continued to receive 1.000-1.500 ml of 0.9% saline after the spinal puncture and during the operation. The height of the sensory block was assessed, and after achieving an adequate sensory block (T4 level), the procedure was initiated. Patients were monitored with non-invasive automated blood pressure cuffs, ECG, pulse oximetry, and capnography. Heart rate (HR) and blood pressure (BP) were recorded before performing spinal anesthesia and at 2.5-minute intervals for 10 minutes after the puncture, and then every 5 minutes until the end of the surgery. Hypotension was defined as more than a 20% decline in mean arterial blood pressure (MAP) below the baseline in both groups and a decrease of systolic blood pressure (SBP) less than 100 mmHg in healthy parturients.

Hypotension was treated with bolus of 5 mg IV ephedrine and if it persisted, IV phenylephrine 50 mcg was given following 10 mg ephedrine. The total amounts of IV administered fluid, and the total doses of ephedrine (phenylephrine) were recorded as well. The baseline's largest and lowest maternal hypotension and HR values are also recorded and compared.

Statistical analysis

All above variables were recorded in a pre-designed, structured schedule during the pre-op assessment, during surgery, and post-op assessment of the study subjects and recorded in MS excel and Epi data software simultaneously. It was performed using SPSS (Statistical Package for the Social Sciences) for Windows (version 20.0). Categorical variables were described as frequency (percentage), and mean \pm standard deviation was used for continuous parameters. Differences between the two groups were compared by the Student T- test. For non-parametric variables, the data were presented as median (min-max). In this case, the nonparametric Mann-Whitney test was used for statistical comparisons. Categorical variables were compared between two or more groups using the Chi-square test. A two-tailed p-value of <0.05 was considered statistically significant for all analyses.

Results

A total of 60 patients, 30 healthy (group I) and 30 preeclamptic parturients (group II) were included in this study. No subject was excluded because of inadequate analgesia or another reason.

Sociodemographic Profile

The age-wise distribution of study participants showed that the majority of them were below or up to 30 years of age. The mean age of the study group was 25.17 ± 3.61 years (Mean \pm S.D.) and the range = 18-30 years (Table 1).

Table1: Age-wise distribution of study participants

Age group (years)	Pre-eclamptic Parturients		Healthy Parturients		Total (n=60)	
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)
18-30	14	46.7%	19	63.3%	33	55
30-40	16	53.3%	11	36.7%	27	45

When compared among both study groups (Pre-eclamptic and Normotensive), it was seen that there is no significant difference among the groups indicating a similar distribution among the study groups.

Table 2: Baseline parameters among study participants

Variables	Pre-eclamptic Parturients		Healthy Parturients		P value
	Mean	S.D.	Mean	S.D.	
Systolic BP	160.57	14.124	130.53	9.573	0.001*
Diastolic BP	98.33	9.193	76.07	8.399	0.001*
MAP	116.60	6.568	90.80	9.007	0.001*

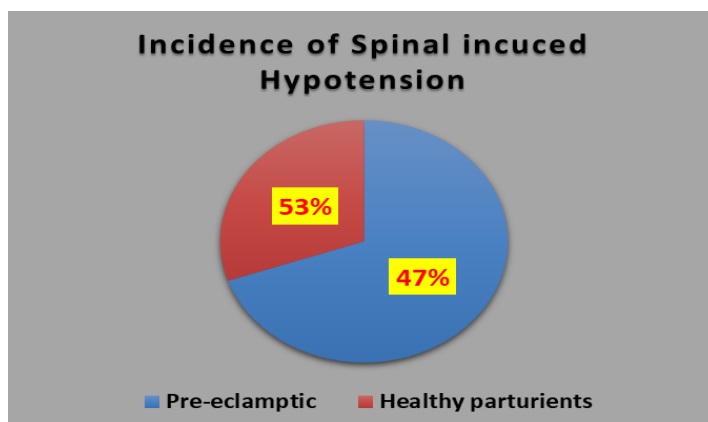
The baseline parameters among study participants are shown in Table 2. When compared among study groups, it was noticed that mean Systolic BP, mean Diastolic BP, and Mean Arterial Pressure was significantly higher in the preeclamptic (group I) as compared to the normotensive (group II), which is as per the objective of the study. In the preeclamptic patients, SBP and DBP were consistently higher than the corresponding values among the healthy parturients, and the same trend was happening to MAP, which was at a constantly higher level in preeclamptic. (Table 2).

Table 3: Decrease in parameters after spinal anesthesia among study participants (n=60)

Variables	Pre-eclamptic Parturients		Healthy Parturients		P-value
	Mean	S.D.	Mean	S.D.	
Systolic BP	25.8	10.1	18.8	17.0	0.001*
Diastolic BP	28.5	8.8	22.5	10.4	0.001*
	31.2	14.2	18.2	12.6%	0.001*

There was decreased BP after the spinal block in both groups, but the BP falls was significantly greater in pre-eclamptic (group I) compared to those with normotensive (Group II): for SBP, DBP, and MAP ($p < 0.05$). [Table 3]

Figure 1: Incidence rate of Spinal induced hypotension among study Groups



The incidence rate of hypotension in the preeclamptic was 53% and was significantly less than that of the healthy parturients (25%), $p < 0.05$. [Figure.1]

Discussion

The study was carried out among 60 women voluntarily consenting to be part of the study. these patients were undergoing elective cesarean section for delivery with no pre-existing or further severe complications. In our study, the majority of study participants were below or up to 30 years of age with the mean age of the study group being 25.17 ± 3.61 years. The BP falls were significantly greater in preeclamptic (group I) compared to those with normotensive (Group II): for SBP, DBP, and MAP ($p < 0.05$) similar to the findings of a study done by Atanas Sivevski et al. [12] Spinal anesthesia-associated hypotension may occur in up to 64%-100% of pregnant women undergoing cesarean delivery according to Aya AG et al. [10] and it is supported by the findings of other studies. [5-9] In contradiction to our result, a study done by Alemayehu et al [13] found that severely preeclamptic patients had a less frequent incidence of clinically significant hypotension compared to healthy parturients (16.6% versus 53.3%; $P = 0.006$).

Moshiri E et al. [14] found that there was no statistically significant difference regarding the occurrence of hypotension after spinal anesthesia between severely preeclamptic and healthy parturients But the incidence rate of hypotension was high in both groups (84and70%, $p = 0.45$). Additionally, some other studies show that parturients with preeclampsia might experience less frequent and less severe hypotension than healthy ones. [16,17] Factors such as the difference in gestational age, the carrying of a smaller fetus, less aortocaval compression, sympathetic hyperactivity, and high vascular tone might have led to this finding. Although there was evidence as early as 1950 that preeclampsia attenuates spinal anesthesia-induced hypotension, clinical trials have taken a long time to demonstrate the safety of spinal and CSE anesthesia in preeclamptic parturients. Recently, after five decades of research, the relationship between spinal anesthesia, pre-eclampsia, and hypotension can be properly acknowledged and put into clinical practice. [16] The limitation of this study was the small sample size, observational study design which was difficult to control all possible co-founders. The use of non-invasive blood pressure measurement in this study might also miss some data that can be noticed in invasive blood pressure measurement.

Conclusion

This study showed a comparison of the effects of spinal anesthesia in pre-eclamptic and normotensive groups. The incidence of spinal cord-induced hypotension associated with patients undergoing cesarean section is higher in pre-eclampsia than in healthy deliveries.

Acknowledgment

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Conflict of Interest: None

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