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Original Research Article

A Comparative Study to Evaluate Hemodynamic Effects of Regional Anaesthesia in Preeclamptic Females Undergoing Caesarean Section

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Abstract

Aim: The aim of the present study was to evaluate hemodynamic effects of regional anaesthesia in preeclamptic females.

Methods: The observational study was conducted in the Department of Anaesthesia, Anugrah Narayan Magadh Medical College and Hospital, Gaya , Bihar, India from march 2019 to February 2020. Study population comprised of 100 normotensive ASA grade II parturients planned for LSCS and 100 ASA grade III preeclamptic parturients planned for LSCS.

Results: Mean age in normotensive group was 25.35±4.36 years and in pre- eclamptic group mean age was 24.16±3.07 years. The mean weight at the time of caesarean section was 72.8±6.34 kgs in the preeclamptic group and 74.66±7.53 kgs in preeclamptic. The mean gestational age at the time of caesarean section was 39.14±0.54 weeks in preeclamptic women and 39.07±0.77 weeks in normotensive. Majority of the study participants were nulliparous women in both the group (55% in normotensive group v/s 68% in pre- eclamptic group) while nearly 43% of the participants in the normotensive group and 27% in pre-eclamptic group were primipara. Both groups were comparable in term of mean age, weight, gestational age and parity comparison ($p<0.05$). All the non-preeclamptic parturients were ASA II while, all parturients in the preeclamptic group were ASA III, and this difference was statistically significant between both groups; ($p< 0.001$). The incidence of hypotension in non-preeclamptic parturients (93%) was significantly higher and that of preeclamptic parturients (15%). Similarly, bradycardia was also more commonly observed in normotensive group (32%) compared to pre-eclamptic group (2%).

Conclusion: Subarachnoid blockade is associated with better perioperative hemodynamic stability and lower risk of hypotension and vasopressor requirements in preeclamptic women compared to the rates of healthy subjects. Subarachnoid block can be safely practiced in patients with preeclampsia undergoing caesarean section. The benefit of rapid, dense and reliable subarachnoid block over epidural anaesthesia should be considered for preeclamptics undergoing caesarean section.

Keywords: Subarachnoid blockade, preeclampsia, caesarean section, hemodynamic stability

Introduction

Pregnancy induced hypertension constitutes major cause of morbidity and mortality in developing countries, and it is 5-10% of all pregnancies. [1] Although regional anesthesia (RA) in this group of parturients current clinical experience demonstrated relative safety of regional technique over general anesthesia (GA), among RA, epidural anesthesia (EA) has been the method of choice. Spinal anesthesia is a popular anesthesia technique for cesarean sections because it avoids the risks associated with general anesthesia, such as difficult intubation and aspiration of gastric contents. [2,3] The benefits of spinal anesthesia include its simplicity, rapid onset, low failure rate, low drug dose, and profound or dense sensory and motor block. [4]

A drop in mean arterial pressure (MAP) of more than 20% from baseline is considered hypotension following spinal anesthesia. [5] Despite several attempts to reduce both the incidence and severity of post-spinal hypotension, it remains common. The primary cause of hypotension after spinal anesthesia is a decrease in systemic vascular resistance due to vasodilation caused by the blockade of preganglionic sympathetic fibers. [3,6,7] Cesarean

delivery complicates maternal hemodynamics and may expose the parturient to dangerous cardiovascular problems. Spinal anesthesia-related hypotension affects up to 7% to 89.2% of pregnant women after cesarean delivery. [4,8] Nausea, vomiting, and light-headedness are common symptoms of spinal-induced maternal hypotension. It may also reduce utero placental blood flow, leading to fetal acidosis. [9]

During obstetric anesthesia, maintaining hemodynamic stability is great importance to anesthesiologists, especially women with preeclampsia childbirth planning to have a caesarean section(CS). [8,11] In the United States the case fatality rate from regional anesthesia for caesarean section was 38 per million anesthetics.[12] Whereas the obstetric mortality due to spinal anesthesia hypotension, bradycardia, nausea and vomiting, high spinal anesthesia, and cardiac arrest can be avoided with proper training and resources. [13-15]

The aim of the present study was to evaluate hemodynamic effects of regional anaesthesia in preeclamptic females.

Materials and Methods

The observational study was conducted in the Department of Anaesthesia, Department of Anaesthesia, Anugrah Narayan Magadh Medical College and Hospital, Gaya , Bihar, India from march 2019 to February 2020. Study population comprised of 100 normotensive ASA grade II parturients planned for LSCS and 100 ASA grade III preeclamptic parturients planned for LSCS.

Inclusion criteria: Parturients aged 18-45 years posted for elective /emergency caesarean section (ASA grade II and III), Parturients diagnosed with preeclampsia having Systolic blood pressure of 140 mm Hg or more or diastolic blood pressure of 90 mm Hg or more on two occasions at least 4 hours apart after 20 weeks of gestation in a woman with a previously normal blood pressure.[16]

Exclusion criteria: Patients with severe preeclampsia and eclampsia, multiple pregnancies, Gestational diabetes mellitus, Thrombocytopenia (platelets < 100,000 mm^3), requiring tocolytics. Evidence of liver dysfunction (LFTs > 2x ULN), Pre-existing renal disease. Patients with spinal deformity, contraindication to subarachnoid block, known sensitivity to the study drugs. Patient with chronic hypertension, with pre-existing cardiovascular conditions, on anticoagulant therapy. Patient with abruptio placentae/placenta previa/twin pregnancy/severe fetal distress. Those not willing to give consent for the participation in the study

Purpose of the study was explained to the study subjects planned for LSCS during pre-operative examination in the local language and a written informed consent was taken for participation. All the preeclamptic patients were treated with a 4.0 g loading dose of intravenous magnesium sulphate (MgSO4), followed by an -1.5 g/h infusion for 48 hours as seizure prophylaxis. Labetalol or Methyl-dopa and nifedipine or both were given for blood pressure control, but this antihypertensive protocol was not standardised 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. The study population comprised of two groups as:

Group A: Normotensive ASA grade II parturients planned for LSCS

Group B: ASA grade III preeclamptic parturients planned for LSCS.

Patients received oral ranitidine (150 mg) and oral metoclopramide (10 mg) at the morning of the surgery. After receiving the patient in the operating room, documents were checked, a brief clinical examination was done and standard ASA monitors were attached including ECG, pulse oxymetry and temperature probe. A radial arterial line was established with a 20 G radial arterial cannula and invasive blood pressure was monitored. After establishing IV access with a 20 G IV cannula in one of the upper limbs, 20 ml/kg lactated ringer solution (RL) was administered for preloading over the course of 15 - 20 minutes. After proper aseptic precaution spinal subarachnoid block (SAB) was performed by an anesthesiologist blinded to the study in the sitting position, at L2- L3 or L3-L4 intervertebral space through a midline approach by a 26 G Quincke type spinal needle and 2 ml or 8-12 mg of 0.5% hyperbaric bupivacaine (at the discretion of anaesthetist) was administered after confirming needle location and noting free flow of clear CSF.

Surgery was allowed after adequate sensory (T4) and motor block was confirmed. The change in position if required was then allowed. HR, SBP, DBP and MAP were recorded at baseline, immediately after SAB and at 2 min, 5 min, 10 min, 15 min, 20 min, 30 min, 45 min, 60 min, 90 min intervals until the end of the surgery. The duration of surgery, dose of mephentermine consumed in each patient were noted. Separate anaesthesiologists performed the procedure and collected the data and both were unaware of the nature of the study. The data was labelled as group A for normotensives and group B for preeclamptic. Variables like age, height, BMI, ASA status, gestational age, and amount of fluid preloaded, amount of fluid consumed intraoperatively, the weight of the neonate, upper sensory level of the spinal block at the time of skin incision, position during and after the spinal procedure were also documented.

Data was collected by using a structure proforma. Data thus was entered in MS excel sheet and analysed by using SPSS 24.0 version IBM USA. A p value of <0.05 was considered as statistically significant.

Results

Table 1: General characteristics of study subjects

Characteristics	Group A (Normotensive group) (n=100)	Group B (Pre-eclamptic group) n=(100)	P value
Mean age (in years)	25.35±4.36	24.16±3.07	0.05
Weight (kgs)	72.8±6.34	74.66±7.53	0.34
Mean gestational age (weeks)	39.14±0.54	39.07±0.77	0.32
Parity			
P0	55 (55%)	68 (68%)	
P1	43 (43%)	27 (27%)	
P2	2 (2%)	5 (5%)	
ASA grade			
II	100 (100%)	0	
III		100 (100%)	

Mean age in normotensive group was 25.35±4.36 years and in pre- eclamptic group mean age was 24.16±3.07 years. The mean weight at the time of caesarean section was 72.8±6.34 kgs in the preeclamptic group and 74.66±7.53 kgs in preeclamptic. The mean gestational age at the time of caesarean section was 39.14±0.54 weeks in preeclamptic women and 39.07±0.77 weeks in normotensive. Majority of the study participants were nulliparous women in both the group (55% in normotensive group v/s 68% in pre- eclamptic group) while nearly 43% of the participants in the normotensive group and 27% in pre-eclamptic group were primipara. Both groups were comparable in term of mean age, weight, gestational age and parity comparison (p<0.05). All the non-preeclamptic parturients were ASA II while, all parturients in the preeclamptic group were ASA III, and this difference was statistically significant between both groups; (p< 0.001).

Table 2: Incidence of hypotension and bradycardia following spinal anaesthesia

	Group A (Normotensive group) n=100	Group B (Pre-eclamptic group) n=100	P value
Incidence of hypotension	93 (93%)	15 (15%)	<0.001
Incidence of bradycardia	32 (32%)	2 (2%)	<0.001

The incidence of hypotension in non-preeclamptic parturients (93%) was significantly higher and that of preeclamptic parturients (15%). Similarly, bradycardia was also more commonly observed in normotensive group (32%) compared to pre-eclamptic group (2%).

Table 3: Magnitude of hemodynamic changes following spinal anaesthesia

	Group A (Normotensive group) n=100	Group B (Pre-eclamptic group) n=100	P value
Lowest SBP (mm Hg)	94.66±4.52	126.64±6.34	<0.001
Lowest DBP (mm Hg)	54.46±6.34	85.15±6.04	<0.001
Lowest MAP (mm Hg)	66.14±5.22	97.63±5.64	<0.001

Mean lowest SBP, DBP and MAP measured among the preeclamptic patients were consistently higher (126.64±6.34 mm Hg, 85.15±6.04 mm Hg and 97.63±5.64 mm Hg respectively) than the corresponding values among the healthy parturients (94.66±4.52 mm Hg, 54.46±6.34 mm Hg and 66.14±5.22 mm Hg respectively).

Table 4: Total dose of mepehentermine used (mg)

Total dose of mepehentermine used (mg)	Group A (Normotensive group) n=100	Group B (Pre-eclamptic group) n=100	P value
Dose of mepehentermine (mg)	9.36±4.16	1.39±3.35	<0.001
Duration of procedure (minutes)	59.61±8.38	59.31±6.46	0.86

Need of mepehentermine was also significantly higher in normotensive women (9.36±4.16 mg) compare to pre-eclamptic group (1.39±3.35 mg). Mean duration of procedure in both normotensive group (59.61±8.38 min) and pre-eclamptic group (59.31±6.46 min) was comparable between both groups.

Table 5: Comparison of neonatal parameters between both groups

	Group A (Normotensive group) n=100	Group B (Pre-eclamptic group) n=100	P value
Neonatal weight (gms)	2838.18±264.26	2834.56±384.16	0.80
APGAR score at 1 minute	7.95±0.46	7.93±0.46	0.42
APGAR score at 5 minute	9.07±0.37	8.96±0.44	0.24

Mean neonatal weight in normotensive group was 2838.18±264.26 gms and in pre-eclamptic group was 2834.56±384.16 gms. APGAR score at 1 minute was 7.95±0.46 in normotensive and 7.93±0.46 in pre-eclamptic group. APGAR score at 5 minutes was 9.07±0.37 in normotensive and 8.96±0.44 in pre-eclamptic group. No statistically significant difference was noted for neonatal weight and APGAR score between two groups (p>0.05).

Discussion

Pre-eclampsia is a multisystem disorder of unknown etiology that is exclusive to human pregnancy. It is characterized by abnormal vascular response to placentation that is associated with increased systemic vascular resistance, enhanced platelet aggregation, activation of the coagulation system, and endothelial cell dysfunction.[16] Pregnancy-induced hypertension (PIH) complicates around 6–8% of pregnancies. It is a multiorgan disease and is classified as mild PIH or severe PIH. [17] Worldwide preeclampsia/eclampsia is the third leading cause of maternal morbidity and mortality. [18] Caesarean section is one of the most commonly performed surgical procedures worldwide and 80–90% of them are performed under spinal anaesthesia.4 During the procedures, maternal hypotension is a major complication with the incidence up to 60–70%. During obstetric anaesthesia, preservation of hemodynamic stability is a big concern for anaesthetists [19], especially for preeclamptic parturients who planned to undergo caesarean section. [19,20]

Mean age in normotensive group was 25.35±4.36 years and in pre- eclamptic group mean age was 24.16±3.07 years. The mean weight at the time of caesarean section was 72.8±6.34 kgs in the preeclamptic group and 74.66±7.53 kgs in preeclamptic. The mean gestational age at the time of caesarean section was 39.14±0.54 weeks in preeclamptic women and 39.07±0.77 weeks in normotensive. Majority of the study participants were nulliparous women in both the group (55% in normotensive group v/s 68% in pre- eclamptic group) while nearly 43% of the participants in the normotensive group and 27% in pre-eclamptic group were primipara. Both groups were comparable in term of mean age, weight, gestational age and parity comparison (p<0.05). All the non-preeclamptic parturients were ASA II while, all parturients in the preeclamptic group were ASA III, and this difference was statistically significant between both groups; (p< 0.001). Nikooseresht M. et al [21] in their study reported mean age in normotensive group was 28.1±5 years and in pre-eclamptic group mean age was 29.3±6.6 years (p>0.05). Though the age group was higher as compared to our findings, but there was no difference in the mean age which was consistent with our findings. The incidence of hypotension in non-preeclamptic parturients (93%) was significantly higher and that of preeclamptic parturients (15%). Similarly, bradycardia was also more commonly observed in normotensive group (32%) compared to pre-eclamptic group (2%). Alemayehu TY et al [22] observed that MAP was significantly higher in pre- eclamptic group at all point of time compare to normotensive group (p<0.01) which was consistent with our study findings.

Mean lowest SBP, DBP and MAP measured among the preeclamptic patients were consistently higher (126.64±6.34 mm Hg, 85.15±6.04 mm Hg and 97.63±5.64 mm Hg respectively) than the corresponding values among the healthy parturients (94.66±4.52 mm Hg, 54.46±6.34 mm Hg and 66.14±5.22 mm Hg respectively). Sivevski A et al [23] reported that there was decreased BP after the spinal block in both groups, but the BP falls were significantly greater in the healthy parturients compared to those with preeclamptics: 31.2 ± 14.2 vs 18.2 ± 12.6% for MAP (p < 0.05). Need of mepehentermine was also significantly higher in normotensive women (9.36±4.16 mg) compare to pre-eclamptic group (1.39±3.35 mg). Mean duration of procedure in both normotensive group (59.61±8.38 min) and pre-eclamptic group (59.31±6.46 min) was comparable between both groups. Mean neonatal weight in normotensive group was 2838.18±264.26 gms and in pre-eclamptic group was 2834.56±384.16 gms. APGAR score at 1 minute was 7.95±0.46 in normotensive and 7.93±0.46 in pre-eclamptic group. APGAR score at 5 minutes was 9.07±0.37 in normotensive and 8.96±0.44 in pre-eclamptic group. No statistically significant difference was noted for neonatal weight and APGAR score between two groups (p>0.05).

Preeclamptics have also been reported to require significantly less phenylephrine to treat hypotension. These results were comparable to our findings in that the total doses of IV vasopressor (mephentermine) for treating hypotension were significantly lower for the preeclamptics (6.0±2.0 mg) than for the healthy patients (16.5±8, 6 mg, $p<0.05$). [24] Abate SM et al [25] conducted the meta-analysis which revealed that the vasopressor requirement was higher in normotensive women when compared to preeclamptic counterparts who are in line with all included studies except one study by Mendes et al[26] where the requirement of ephedrine dose requirement didn't show a significant difference between normotensive and preeclamptic women. However, other prospective cohort studies conducted by Clark et al [26] among forty and Aya AG et al [27] among one hundred thirty-six normotensive and preeclamptic women showed a different result where the first APGAR score was not different between the groups.

Conclusion

Subarachnoid blockade is associated with better perioperative hemodynamic stability and lower risk of hypotension and vasopressor requirements in preeclamptic women compared to the rates of healthy subjects. Subarachnoid block can be safely practiced in patients with preeclampsia undergoing caesarean section. The benefit of rapid, dense and reliable subarachnoid block over epidural anaesthesia should be considered for preeclamptics undergoing caesarean section.

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