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HEMODYNAMIC RESPONSE AND VASOPRESSOR REQUIREMENT AFTER SPINAL ANESTHESIA IN PREECLAMPTIC AND NON-PREECLAMPTIC PATIENTS UNDERGOING CAESERIAN SECTION: A PROSPECTIVE COMPARATIVE STUDY

Anaesthesiology

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ABSTRACT

Introduction: Risk benefit analysis favours spinal anesthesia over general anesthesia in pregnant patients undergoing caesarean section. Hypotension is a known complication after spinal anesthesia. However, it is short lived and easily treatable. The aim of this study is to evaluate and compare hemodynamic response in healthy and preeclamptic patients receiving spinal anesthesia and also to assess ephedrine requirement in both the groups.

Methods: A total of 200 patients were recruited after fulfilling inclusion and exclusion criteria. Patients were divided in two groups depending on presence or absence of preeclampsia. Subarachnoid block was given at L3-L4 level at the time of surgery. Hemodynamic parameters, APGAR score; neonatal birth weight was noted as per protocol. Ephedrine was given to maintain blood pressure more than 90 mmHg.

Results: Demographic variables were comparable in both groups. The decrease in diastolic blood pressure, mean arterial pressure was significantly lower in non preeclamptic group with p value of 0.005 and <0.001 respectively. The APGAR score was 8.88±0.71 in healthy and 8.89±0.40 in preeclamptic group.

Conclusion: Hypotension after spinal anesthesia can be easily treated in preeclampsia and healthy group. So when properly administered, spinal anaesthesia is safe in controlled preeclamptic parturients without having any adverse effect on neonatal outcome.

KEYWORDS

Preeclampsia, spinal anesthesia, ephedrine

INTRODUCTION:

Preeclampsia constitutes major cause of maternal and foetal morbidity and mortality affecting 5-7% of pregnancies(1). Severe preeclampsia is further complicated by eclamptic seizures, intracerebral haemorrhage, pulmonary oedema, renal failure, liver function and coagulation abnormality(2). Preeclamptic parturients generally present for delivery with contracted plasma volume, normal or increased cardiac output, vasoconstriction and chronic placental hypoperfusion. For caesarean section regional anesthesia and general anaesthesia techniques can be used. General anesthesia is usually preferred in eclamptic, obtunded patients with evidence of increased intracranial pressure(3).General anesthesia has disadvantages like difficult airway due to mucosal edema, aggravated response to laryngoscopy and endotracheal intubation which can further rise intracranial pressure and also effects of various drugs on fetus (4). So, unless contraindicated, regional anesthesia is the technique of choice even in preeclamptic patients undergoing caesarean section.

Regional anesthesia techniques among parturients include spinal anaesthesia, epidural analgesia/anaesthesia or combined spinal epidural anesthesia(1). Spinal anaesthesia is associated with higher incidence of hypotension as compared to epidural anaesthesia. However, the hypotension associated is easily treatable and short lived(5). Placing epidural catheter in epidural anaesthesia or combined spinal epidural anaesthesia is time consuming and technically demanding specially with inexperienced hand(6). Concerns with use of spinal anaesthesia are I) hypotension, ii) uteroplacental hypoperfusion and iii) the risk of inducing hypertension or pulmonary edema with subsequent efforts to correct the hypotension(7).

Risk benefit consideration strongly favours neuraxial technique over general anaesthesia for caesarean section. Spinal anaesthesia affords quicker onset of anaesthesia than epidural or combined spinal & epidural anaesthesia, which is a critical advantage in emergency situations. Recent literatures (8, 9, and 10) in preeclampsia mention spinal anaesthesia as a technique of choice in caesarean sections as long as there is no contraindication to spinal anaesthesia. Our study was done with the aim of observing hemodynamic responses in healthy and preeclamptic parturients and ephedrine requirement used to treat hypotension during spinal anaesthesia.

MATERIALS AND METHODS:

Study Design: A prospective, observational comparative study in pregnant patients undergoing caesarean section.

Study Approval: This study was approved by institutional ethics committee and written informed consent was obtained from all patients included in the study.

Study Population: Patients who underwent caesarean section at tertiary care teaching hospital in Western India.

Sample Size: Two hundred patients, hundred in each healthy and preeclamptic group were recruited.

Inclusion Criteria:

1. ASA grade 1 and 2
2. Full term parturient
3. Age between 18 and 35 years
4. Patients with diagnosis of preeclampsia (As per criteria of American College of Obstetrics and gynaecology)

EXCLUSION CRITERIA:

1. ASA grade 3 or more
2. Antepartum haemorrhage
3. Patients with medical co-morbidities (Cardiac disease, Hypertension, Renal disease, Diabetes mellitus or on medication for other diagnosis.)

METHODOLOGY DETAILS:

PRE –OPERATIVE ASSESSMENT

Preoperative evaluation was carried out in all patients with detailed clinical history, general and systemic examination. Spine and airway examination was done. Investigations like haemoglobin, complete blood count, liver function test, renal function test, serum electrolytes were obtained. Fundus was evaluated in all patients. Patients were divided into two groups namely healthy and preeclamptic to study effect of spinal anaesthesia and response to ephedrine.

ANAESTHETIC PROCEDURE:

After confirming adequate starvation, patients were taken for surgery. Continuous ECG and BP monitoring was done. Oxygen saturation was monitored with saturation probe with MINDRAY multichannel monitor. Baseline hemodynamic variables [HR, SBP, DBP, and MAP] were recorded. Patient was given iv fluid Ringer Lactate solution at the rate of 10 ml/kg body weight over 10-15 min. In sitting position

after following all aseptic precautions sub-arachnoid block was given in L3-L4 intervertebral space with 25G quincke's spinal needle. Free, clear and continuous flow of CSF and negative aspiration of blood was confirmed before giving Spinal drug inj. Bupivacaine 0.5% (heavy) 2cc(10 mg). Patient was given supine position with wedge below right buttock immediately, after sub-arachnoid block. Surgery was allowed as soon as upper level of sensory block T6 is reached and the highest spinal level achieved was T6. HR, SBP, DBP, MAP were recorded every 2 min for 10 min & thereafter every 10 minutes till level regressed to L1. In case of hypotension (which was defined as <90 mmHg Systolic / >20% of change in systolic blood pressure whichever is low.) Inj. Ephedrine hydrochloride 6 mg was given IV bolus and dose repeated at 5-min interval if required to maintain systolic blood pressure above 90 mm Hg. Bradycardia (HR < 60 beats/min) was treated with 0.6 mg IV atropine sulphate. Oxytocin 10-20 IU was given in ringer lactate solution slowly over 30 min immediately after delivery of the baby. The total dose of ephedrine hydrochloride required to treat hypotension was noted. Apgar score at 1 and 5 min, birth weight of the baby were also observed. Follow up was done after 24 hours of each patient for postoperative complications like nausea, vomiting, postdural puncture headache, postpartum convulsions, subdural hematoma, delayed altered consciousness. All the cases with inadequate block and other causes requiring conversion of spinal anaesthesia into general anaesthesia were excluded from the study.

Statistical Analysis:

Data was expressed as mean ± standard deviation. Demographic data and complications were analysed by using chi square test. HR, SBP, DBP, MAP were analysed using student's unpaired t Test. P value of <0.05 was considered significant.

RESULTS:

Total 200 patients were available for analysis. 100 patients in each of group A and group B. Age of patients was 26.01± 4.01 years. There was no statistical difference in between patients' age and gestational age in two groups. Of the total 200 patients, 44.5% were primigravida. In preeclamptic patients most common indication for caesarean section (CS) was failure of induction. However, in normal patients it was previous caesarean section.

Table 1: Maternal and neonatal characteristics

	Healthy patients	Preeclamptic	P value
Age (Mean±SD)	25.94±4.09	26.07±3.95	0.82
Gestational Age (Mean±SD)	37.03±1.27	37.37±1.82	0.127
Primigravida	36	53	

Table 2: Changes in hemodynamic parameters after spinal anesthesia

	Healthy patients	Preeclamptic Patients	P value
Baseline HR (per/min)	87.52±8.71	91.54±10.83	0.0042
Lowest HR (per/min)	73.77±11.67	77.8±9.8	0.01
Decrease from baseline(%)	15.38±12.76	14.52±10.08	0.59
Baseline SBP (mmHg)	114.83±7.4	149.46±8.74	<0.001
Lowest SBP	91.49±11.2	116.47±13.63	<0.001
Decrease in SBP from baseline (%)	20.03±11.58	21.99±8.54	0.17
Baseline DBP (mmHg)	75.67±6.27	94.06±7.66	<0.001
Lowest DBP (mmHg)	53.65±8.03	71.75±11.66	<.001
Decrease in DBP from baseline (%)	28.88±10.29	23.71±10.49	0.0005
Baseline MAP	88.72±5.83	112.53±6.86	<0.001
Lowest MAP (mmHg)	66.85±8.16	87.86±11.70	<0.001
Decrease in MAP from baseline (%)	24.49±9.14	21.95±8.79	0.04

34 patients from preeclamptic group and 43 patients from healthy group required ephedrine. Dose (in mg) of ephedrine in healthy and preeclamptic group was 13.67±5.44 and 11.65±4.89 respectively. The dose was not significantly different (P=0.0940). The APGAR score was 8.88±0.71 in preeclampsia group and 8.89±0.40 in healthy group, at 1 min. There was no statistical difference between APGAR scores of neonates in both groups at 1 min as well as 5 mins. There were 66(33%) neonates having birth weight < 2.5 kg. 44 neonates from Preeclampsia group and 22 neonates from healthy group had weight less than 2.5 kg. (P=0.025). In our study 16 parturients from healthy group and 8 parturients from preeclampsia group experienced nausea and vomiting. The difference between two groups was not statistically significant. None of the patient from study population experienced other complications like postdural puncture headache, postpartum convulsions, subdural hematoma and delayed altered consciousness after 24 hours of surgery.

DISCUSSION

Various studies done comparing hemodynamic parameters variation and vasopressor required in hypotension in patients with pregnancy induced hypertension have shown varying results. Antoine et al (11) in 2003 compared hemodynamic response in severe preeclamptic and healthy parturients following spinal anaesthesia. They found that decrease in SBP was similar in both groups. However, fall in DBP and MAP was significantly less in severe preeclampsia. They concluded that less decrease in SBP in severe preeclampsia was mainly due to significantly large difference in gestational age and birth weight in study groups. H Ishrat et al (12) did prospective study in preeclamptic and healthy parturients to study incidence and severity of spinal anaesthesia. Their result was consistent to study done by Antoine et al (11). Florentino F Mendes et al (13) included healthy and preeclamptic patients in their study. As per the results decrease in SBP and DBP was almost similar in both groups. Dose of ephedrine to treat clinically significant hypotension was less in severe eclamptic group. In our study, age in healthy group was 25.94± 4.09 years and in preeclampsia group was 26.07 ± 3.95 years. Gestational age in normal healthy group was 37.03 ± 1.27 weeks and in preeclampsia group was 37.37 ± 1.27 weeks. These parameters were comparable. We found that the baseline value of systolic blood pressure was significantly higher in preeclamptic group. Percentage fall in SBP after spinal anaesthesia was more in preeclamptic group(21.99 ± 8.54) as compared to healthy group(20.03 ± 11.58), but the difference between two groups was not statistically significant. Similar findings were noted by H Ishrat et al (12). The SBP and the decrease in SBP was more in preeclamptic group as compared to healthy group, which was statistically significant. Similar results were observed by Florentio F Mendes et al (13) and Robert et al (14). They found that the decrease in SBP of severe preeclamptic group (27.6 ± 10.3) was more than healthy group (24.2 ± 12.4). Antoine G M Aya et al (13), observed the results inconsistent with our study. They concluded that decrease in SBP after spinal anaesthesia was similar in both study groups and the decrease in SBP was more in healthy group (24.3 ± 12.1) as compared to preeclamptic group (19.7 ± 11.0) which was clinically insignificant.

The baseline diastolic blood pressure was significantly higher in preeclamptic group in our study. Percentage fall in DBP after spinal anaesthesia was less in preeclamptic group (23.71 ± 10.49) as compared to healthy group (28.88 ± 10.29), and the difference between two groups was statistically significant. Similar observations were found in studies done by H Ishrat et al(12) and Antoine G M Aya et al(11) Florentino F Mendes et al(13) found that value of lower in healthy than in preeclamptic parturients, this difference was statistically significant. The MAP was significantly higher in preeclamptic group in our study. The percentage fall in MAP after spinal anaesthesia was less in preeclamptic group (21.95 ± 8.79) as compared to healthy group (24.49 ± 9.14), similar results observed by H Ishrat, (12) and Antoine G M Aya et al (11). The study conducted by Antoine G M Aya in 2005(15) was also consistent with our study but the difference in two groups was not statistically significant. H Ishrat et al (12) found that the percentage increase in heart rate was greater in healthy parturients and this difference was statistically significant. In studies done in 2003 and 2005 by Antoine G M Aya et al (11, 16) also found similar results. Our study showed that the baseline value of heart rate was significantly higher in preeclamptic group. We concluded that clinically significant hypotension requiring ephedrine treatment was more in healthy group as compared to preeclampsia group. However, it was not statistically significant. The amount of drug required to treat hypotension was more in healthy group (13.67 ± 5.44) as compared to preeclamptic group (11.65 ± 4.89). Florentino F Mendes et al (13) found similar results. Antoine G M Aya et al(11), Antoine G M Aya et al(16), H Ishrat et al(13) found that the ephedrine required to treat hypotension was more in preeclamptic patients.N. Sikov et al (15) concluded that decrease in systolic, diastolic, and mean arterial blood pressure was similar in both groups, and the mean ephedrine requirement of the normotensive group was significantly high than that of the preeclamptic group.

Our study shows that hypotension encountered was more in healthy

group. The reason for this could be due to aortocaval compression because of gravid uterus and the pathophysiology associated with preeclampsia. The percentage increase in heart rate was significant in healthy group as compared to preeclamptic group, which could be due to normal response to more hypotension. In our study, maternal complications like nausea and vomiting was experienced by 16 healthy parturient and 8 preeclamptic women. These symptoms were easily treated giving ephedrine boluses. Incidences of these complications were higher in healthy group as compared to preeclamptic however, not statistically significant.

There was no significant effect on neonatal outcome due to spinal anaesthesia induced hypotension. The mean birth weight was less in preeclamptic group as compared to healthy and the difference was found to be statistically significant, which could be due to pathophysiology associated with preeclampsia.

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