



A STUDY TO COMPARE INTRAVENOUS BOLUS PHENYLEPHRINE AND EPHEDRINE IN CONTROLLING HYPOTENSION UNDER SPINAL ANAESTHESIA FOR CAESAREAN SECTIONS

Anaesthesiology

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ABSTRACT

Introduction : Spinal anaesthesia is more acceptable method of anaesthesia in elective cesarean section, but hypotension is the major limitation of this technique which might trigger to serious complications for both mother and fetus. The use of vasopressors is necessary to control hypotension caused by spinal anaesthesia. The present study was designed to compare the vasopressor effects of ephedrine and phenylephrine in ameliorating hypotension in elective caesarean delivery

Methods: This was a Retrospective study . Data of 100 Cases of Caesarean Section surgeries were selected which used Ephedrine and phenylephrine as Vasopressors during Spinal Anaesthesia in last 2 years. Randomization was done using computer tables in selecting data. Patients were randomly allocated into two groups of 50 each. Randomization was done using computer tables in selecting data. The intergroup comparisons were made by Student's t-test and chi-square test for categorical variable.

Results: There was no significant difference between different Age , height & BMI in two groups. The number of rescue doses required in group 1 and group 2 was statistically insignificant. The differences observed in baseline HR, SBP, DBP, and mean blood pressure between the two groups were statistically insignificant. There was a higher incidence of bradycardia in patients receiving phenylephrine. The difference in birth weight of neonates between the two groups was statistically not significant. No neonate had Apgar score <7 at 1 min and 5 min.

Conclusion: In the present study, there was no statistically significant difference in the incidence of hypotension with rapid administration of crystalloid at the time of induction of spinal anaesthesia in both the groups ($P > 0.05$). We conclude from the present study that ephedrine and phenylephrine in appropriate equivalent doses are equally efficient in managing hypotension during spinal anaesthesia for caesarean delivery.

KEYWORDS

Spinal Anaesthesia , Retrospective Study , Ephedrine , Phenylephrine Hypotension.

INTRODUCTION

Spinal anaesthesia, recently, has been known as an acceptable anaesthesia technique, especially for caesarean section, due to advantageous on epidural anaesthesia, such as rapid onset, intensity, symmetric sensory and motor block & Spinal (subarachnoid) anaesthesia is considered to be the "gold standard" technique for caesarean delivery.^[1] However, hypotension is the most common side effect of neuroaxial blocks in the obstetric patient. Spinal anaesthesia for caesarean delivery is associated with 80% of hypotension cases without prophylactic measures^[2] that might endanger the lives of both mother and fetus.

Many interventions such as pelvic tilt,^[3] leg elevation and wrapping,^[4] and the prophylactic administration of fluids^[5] or vasopressors^[6] have been proposed and used to reduce the incidence of maternal hypotension. Despite all these measures, approximately 25% of patients still experience hypotension episodes.^[6]

Crystalloid prehydration has poor efficacy for preventing hypotension, probably because it undergoes rapid distribution.^[7] As an alternative, rapidly administering crystalloid at the time of initiation of anesthesia (called coload) may be more physiologically appropriate as the maximum effect can be achieved during the time of block and consequent vasodilation evolution.^[8]

Ephedrine and phenylephrine are of common vasoconstrictor drugs which their effect on hypotension during anaesthesia have been compared in many studies.

Ephedrine has been the vasopressor of choice since it has been shown to have a more protective effect on uterine blood flow and perfusion pressure than α -adrenergic agonists.^[9] However, ephedrine is no longer the gold standard for prophylaxis and treatment of hypotension after spinal anaesthesia for caesarean delivery. Moreover, higher dose of ephedrine causes significant maternal tachycardia and fetal acidosis.^[10] More recent evidence has supported the use of alpha agonists such as phenylephrine demonstrating better acid base status and similar efficacy in blood pressure control.^[11]

Hence, the present study was designed to compare the vasopressor effects of ephedrine and phenylephrine in ameliorating hypotension in elective caesarean delivery receiving crystalloid coload during intrathecal bupivacaine injection.

METHODOLOGY

This Retrospective study involved Prior Consent from Hospital Authorities / Medical Superintendent of the tertiary care hospitals to see the records of the patients & were found within ethical standards. Patients who were admitted in the various Obstetrical units of tertiary care hospitals in Randomly selected Hospitals including Our Teaching Hospital of our city . Data of Caesarean Section surgeries were selected which used Ephedrine and phenylephrine as Vasopressors during Spinal Anaesthesia in last 2 years Randomization was done using computer tables in selecting data.

100 Patients (candidates) categorized in American Society of Anaesthesiologists (ASA) classes of 1 and 2, age of 18-40, BMI range of 18.5-25, systolic blood pressure of 120 to 140 mmHg were included into the study. Those candidates with any history of migraine, psychiatric diseases, drug using (except authorized pregnancy additives), multiple pregnancy, headache before surgery, contraindications for spinal anaesthesia, pregnancy disorders like pre-eclampsia and Umbilical cord anomalies, and those with uncontrolled clinical condition, such as high blood pressure, diabetes, and cardiovascular diseases, were excluded from study. Also, patients who received Atropine, following bradycardia, and those with more than one attempt of spinal anaesthesia were excluded.

All Patients underwent standard clinical examinations, routine biochemical and haematological investigations, Ultrasonography of whole abdomen and received treatment as decided by their treating physician and surgeon. Medical record numbers were used to generate the data for analysis.

Patients were randomly allocated into two groups of 50 each. Group 1 received bolus of intravenous (IV) ephedrine 6 mg whenever there was a fall in maternal SBP >20% from the baseline. Group 2 received bolus of phenylephrine 100 μ g IV whenever there was a fall in maternal SBP >20% from the baseline.

On arrival in the operation theater, the heart rate (HR), electrocardiogram (ECG), noninvasive blood pressure (NIBP), respiratory rate, and arterial O_2 saturation (SpO_2) were monitored. An infusion of normal saline was started in all the patients to maintain the patency of the IV cannula. Patients were placed in the left lateral position and lumbar puncture was performed with 25-gauge Quincke needle in $L_3 - L_4$ intervertebral space. Once free flow of the

cerebrospinal fluid was obtained, 1.5 mL (7.5 mg) of 0.5% bupivacaine (heavy) with 0.5 mL (25 µg) of fentanyl was administered over 0.2 mL/s. Coload with rapid administration of 20 mL/kg Ringer's lactate solution was started simultaneously after identification of the cerebrospinal fluid. The time of injection of the drug was noted and the patient was placed in a supine position. Immediately after induction of spinal anesthesia, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and HR were recorded. Neonatal outcome was assessed using Apgar score at 1 min and 5 min and neonatal umbilical cord blood pH values. At delivery, the umbilical cord was clamped and 1 mL of blood sample was collected in heparinized syringe for acid base analysis.

Continuous data were expressed as mean $\pm$ standard deviation (SD). The intergroup comparisons were made by Student's *t*-test and chi-square test for categorical variable. The data were analyzed by IBM SPSS Statistics 23. Overall, $p < 0.05$ was proposed to represent statistical significance after correction.

RESULTS

The two groups, i.e., group 1 and group 2 matched with regard to their age, body weight and height. The mean value of the age was 30.71 years, and no significant difference was observed in the age value of three different groups. Also, the mean value for weight in Kgs, height in metres and BMI was 60.2, 1.56, and 27.56, respectively, and there was no significant difference between different three groups, as mentioned for age value.

The number of rescue doses required in group 1 and group 2 was statistically insignificant

The differences observed in baseline HR, SBP, DBP, and mean blood pressure between the two groups were statistically insignificant. There was a higher incidence of bradycardia in patients receiving phenylephrine than those receiving ephedrine. In both the groups, HR was maintained around the baseline value till the induction of block after which the HR increased considerably for few min corresponding to the interval of fall in the MAP. After this period, the HR settled to the baseline values. The difference in mean HR and MAP till delivery between the two groups was insignificant. However, at the 30th min and 60th min observations, the mean HR was in the range of 81-85 bpm in group 1 and 77-81 bpm in group 2 that were statistically significant ($P < 0.05$) though clinically not significant. However, 64 out of 50 patients in group 2 and none in group 1 had HR < 50 bpm, requiring intervention.

A rapid fall from the baseline value of the mean SBP, mean DBP, and mean arterial blood pressure of both the groups till delivery was observed; then, mean SBP was maintained in both the groups. The difference in the incidence of hypotension between the groups was not statistically significant ($P > 0.05$). The range of SBP in the two groups in our study was 108-114 mmHg ($P = 0.03$); mean DBP was 58-66 mmHg ($P = 0.03$), and MAP was 76-80 mmHg ($P = 0.02$), that were statistically significant but clinically not significant.

The difference in birth weight of neonates between the two groups was statistically not significant. No neonate had Apgar score < 7 at 1 min and 5 min. The mean neonatal umbilical cord pH in group 1 versus group 2 was 7.30 ± 0.05 versus 7.36 ± 0.03 , respectively. Parturients who were administered phenylephrine delivered neonates with higher umbilical cord pH than those given ephedrine, and the difference was statistically significant ($P < 0.005$).

DISCUSSION

In the present study, there was no statistically significant difference in the incidence of hypotension with rapid administration of crystalloid at the time of induction of spinal anesthesia (coload) in both the groups ($P > 0.05$). The overall incidence of hypotension in the study population was 43% that was significantly less compared to the incidence (more than 80%) observed in other studies.^[2] Khan *et al.*^[13] observed a statistically significant ($P < 0.008$) difference in the incidence of hypotension in the coload group (44%) compared to the preload group (70%) in a study on 100 parturients.

In this study, there was a higher incidence of bradycardia in patients receiving phenylephrine than those receiving ephedrine. This is expected to be due to increase in blood pressure with an α -agonist that might lead to reactive bradycardia (baroreceptor reflex). This was responsive to glycopyrrolate without adverse consequences. The result

of this study is in accordance with the studies of Nazir *et al.*^[14] (5/50 vs 17/50 in the phenylephrine group) and Lee *et al.*^[15] [relative risk (RR) of 4.79; 95% confidence interval (CI), 1.47-15.60] with $P < 0.05$. The incidence of nausea and vomiting was more in the phenylephrine group than the ephedrine group 32% versus 20% in our study that was not statistically significant ($P = 0.16$).

In this study, HR changes reflected a trend inverse to that of the MAP. The difference in mean HR and MAP till delivery between the two groups was insignificant. However, at the 30th min and 60th min observations, statistically significant ($P < 0.05$) though clinically not significant differences in the mean HR of both the groups were observed. Similar findings were found by Khan *et al.*^[13] who observed HR changes with an increased trend for around 10 min. This change was attributed to causes such as anxiety, aortocaval compression, and hypotension.

Assuming The equivalent doses of ephedrine and phenylephrine were 6 mg and 100 µg, respectively,^[12] The incidence of fall in blood pressure was maximum during the first 10 min following the subarachnoid block and we observed that vasopressor use was maximum during this period. This corresponds to the immediate sympathetic block after intrathecal injection. We also observed that phenylephrine was used more frequently in 10 min compared to ephedrine. It is distinctly apparent by the wider SDs of mean SBP values in the phenylephrine group but no statistical significant difference was observed ($P > 0.05$). On the other hand, Ngan Kee *et al.*^[6] and Dyer *et al.*^[8] opined that vasopressor requirements was reduced till the time of delivery in their studies. The average median dose was 0 mg versus 10 mg of ephedrine ($P < 0.001$) in the study by Ngan Kee *et al.*^[6]

We observed in this study that there was no difference between ephedrine and phenylephrine in their efficacy for managing hypotension following spinal anesthesia in parturients undergoing caesarean delivery in the range of doses that have been studied. The results of this study are in accordance with the study of Nazir *et al.*^[14] and Adigun *et al.*^[16] They observed that both vasopressors effectively restored both the systolic and DBP.

Gunda *et al.*^[17] compared the effectiveness and side effects of vasopressors ephedrine and phenylephrine administered for hypotension during caesarean delivery under spinal anesthesia. However, their study suggested that phenylephrine may be the more appropriate vasopressor when considering maternal well-being. This may have been due to less dose of ephedrine (3 mg) that was used in their study as compared with this study.

In our study, the difference in birth weight of neonates between the two groups was not statistically significant. Parturients who were administered phenylephrine delivered neonates with higher umbilical cord pH than those given ephedrine but the difference was clinically not important as there was no true fetal acidosis ($pH < 7.2$). Our study results regarding umbilical cord pH were in accordance with other investigators.^{[14],[18],[19]} They concluded in their studies that the umbilical artery pH was similar in both the groups irrespective of whether ephedrine or phenylephrine was used to maintain blood pressure during spinal anaesthesia in parturients undergoing caesarean delivery.

However, our study results are not consistent with the studies carried out by Ngan Kee *et al.*^[12] and Lee *et al.*^[20] where the umbilical artery pH was less in neonates in the ephedrine group than the phenylephrine group. Acidotic changes in the umbilical artery are sensitive indicators of uteroplacental insufficiency. The study findings are indirect evidence that uterine blood flow may in fact be better with phenylephrine compared with ephedrine. One of the reasons ephedrine causes acidosis is that it crosses through the placenta and has a direct effect (β_2 action) on the fetus so as to cause acidosis. But there was no difference in Apgar score between the two groups at 1 min and 5 min. The difference in birth weight of neonates between the two groups was also statistically not significant.

CONCLUSION

We conclude from the present study that ephedrine 6 mg and phenylephrine 100 µg are equally efficient in managing hypotension during spinal anesthesia for caesarean delivery.

ACKNOWLEDGEMENTS

We would like to thank All the Hospital Authorities of the participating tertiary care hospitals.

Compliance With Ethical Standards.**Conflict Of Interest** – None.**Funding** – None.**Informed Consent** - Obtained.**REFERENCES**

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