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A Comparative Study of Two Methods of Phenylephrine Administration to Manage Hypotension in Caesarian Section During Spinal Anaesthesia

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ABSTRACT

In this prospective study, injection phenylephrine was used as a vasopressor agent to prevent or treat spinal anaesthesia-induced hypotension undergoing an elective cesarean section. Phenylephrine, when used as an infusion at a dose of 100mcg/min for preventing hypotension, was effective when compared to a bolus dose of the same drug. Even though phenylephrine infusion was effective as a vasopressor, there was a fall in heart rate occasionally as a reflex action, but it was not statistically significant. There was no incidence of bradycardia or change in rhythm. In elective cesarean sections was effective in maintaining the blood pressure and reverting the hypotension episodes. But when compared phenylephrine infusion group provided more stable blood pressures. In Group I, only 6.7% incidence of hypotension episodes, whereas in Group II, 96.7% incidence of hypotension episodes were seen, indicating phenylephrine infusion was more effective in preventing hypotension episodes. In both, the groups had similar pre-induction systolic blood pressure, but the mean systolic blood pressure was higher in the infusion group and was statistically significant. In both groups had similar pre-induction diastolic blood pressure., however, after the subarachanoid block, the mean DBP was higher in the infusion group and was statistically significant. Mean arterial pressure pre-induction was similar in both the groups, but mean arterial pressure was higher in the infusion group and was statistically significant. Phenylephrine does much higher in Group I (infusion group) when compared to Group II (bolus group), which was statistically significant (P<0.001). No significant side effects were observed in the study (nausea, vomiting). There was no significant difference between the two groups in APGAR scores.

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Key Words
Phenylephrine, bradycardia, hypotension, diastolic blood pressure, APGAR scores

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INTRODUCTION

The delivery of a baby by Caesarean section has become increasingly common. Several factors account for the increased section rate. It has been commonly accepted that severe trauma to the baby can be eliminated by avoiding potentially delicate mid-forceps or vaginal breech delivery and performing a Caesarean section instead. The widespread use of electronic and biochemical fetal monitoring before and during labour has made it easier to identify a fetus in jeopardy and promptly deliver the baby by the abdominal route. The clinical impression that Caesarean section is less traumatic for the tiny fetus and concerns over potential lawsuits in cases of poor neonatal outcome has also encouraged obstetricians to perform Caesarean sections with less positive indication than in the past. Conduction anaesthesia is the most commonly used anaesthetic for the Caesarean section. Spinal anaesthesia appears to be the preferred technique[1-3]. Although the spinal block offers several advantages like sensory block, muscle relaxation, minimal risk of aspiration and a well awake patient to assess the clinical condition, it is often associated with significant adverse effects like hypotension. Hypotension is one of the commonest problems following spinal anaesthesia for Caesarean section, potentially endangering both mother and child. Measures to decrease incidence and severity of maternal hypotension include left uterine displacement, fluid preload, prophylactic vasoconstrictors, Trendelenburg position and leg compression, etc[2,4,5-7]. Traditionally, ephedrine has been the vasopressor of choice in pregnant women. The use of a-agonists has generally been avoided since the 1970s because of the concerns. About their potential adverse effects on uterine blood flow. However, in a quantitative, systematic review of randomized controlled trials of ephedrine versus phenylephrine for the management of hypotension during spinal anaesthesia for cesarean delivery, Lee and colleagues showed that there was no difference between ephedrine and phenylephrine in efficacy. They did find, however, that women given phenylephrine had neonates with higher umbilical cord blood pH values than women gave ephedrine, although the risk of true fetal acidosis (umbilical pH value of 7.20) was similar in both groups. Because acidotic changes in the umbilical arterial pH are sensitive indicators of reduced uteroplacental perfusion, the authors concluded that their finding was indirect evidence that uterine blood flow may, in fact, be better with phenylephrine compared with ephedrine[3,8-14]. So this randomized study is performed to determine the efficacy of prophylactic phenylephrine infusion in preventing spinal hypotension following subarachnoid block for cesarean section in our patient group.

MATERIALS AND METHODS

A prospective study was conducted in 60 primigravidas undergoing an elective cesarean section. The primis included in the study were divided into 2 groups:

- **Group I:** primi who received intravenous prophylactic phenylephrine infusion at 100 micrograms /min for 3 minutes immediately after subarachnoid block.
- **Group II:** Primis who received phenylephrine as boluses of 100microgram for the treatment of hypotension following subarachnoid block.

Inclusion Criteria:

- Full-term primi posted for elective cesarean section.
- Age 18-30 yrs.
- ASA Grade-II.

Exclusion Criteria:

- Primi above 30 yrs and below 18 yrs.
- Primi with preeclampsia, eclampsia, hyperthyroidism.
- Primi having co-existing neurological, cardiovascular, renal, cerebrovascular, metabolic, psychiatric disorders.
- Primi with glaucoma, occlusive vascular disorder.
- Known hypersensitive to local anaesthetics and any contraindications to spinal anesthesia or having known fetal abnormalities.
- Fetal distress.

Monitoring:

- After shifting the patient inside the operation theatre, the following hemodynamic variables were monitored and documented as baseline parameters (blood pressure by NIBP (SBP, DBP, MAP) HR, SPo2 on room air, two lead ECG lead II, v5 was monitored throughout the procedure.
- After baseline parameter was recorded, then after giving subarachanoid block at 1st min, 2ndmin, 3rdmin, 5thmin, 15thmin, 30thmin, 45thmin, 60thmin, 90th min. (SBP, DBP, MAP, HR) were recorded.
- Incidence of adverse hemodynamic effects.
- Incidence of nausea and vomiting.
- APGAR SCORE at 1st min and 5th min after baby delivery.
- The time of skin incision to baby delivery was recorded.

Procedure: All the primigravida were reloaded with ringer's lactate solution at the rate of 15 ml/kg over 15mins after securing intravenous line with 18g cannula and continued at 15ml/min. As a protocol, all the necessary equipment for the conduct of general anaesthesia, suction apparatus, defibrillator and rescue

vasopressors were kept ready as a part of preparation. Under strict aseptic precautions with 2%, chlorhexidine scrub was used to prepare the part and the subarachnoid block was performed in lateral position after skin infiltration with 2% lidocaine. A 25G quincke needle was inserted at l2-l3 intervertebral space and hyperbaric 0.5% bupivacaine 2.0ml was injected intrathecally after confirming the needle position by CSF visualization. After subarachnoid block with 0.5% Bupivacaine upper sensory level of the sympathetic block was assessed by using the alcohol swab and motor block was assessed by Modified Bromage scale. Immediately after completion of subarachnoid block phenylephrine infusion was started in Group I with a syringe pump that was connected to iv line via a three-way stop cock and was continued for a minimum of 3 minutes at a rate of 1ml/min(100mcg/min). After which the infusion was either stopped or continued according to the protocol based on hemodynamic parameters (systolic blood pressure).All the hemodynamic parameters were recorded at 1st min, 2nd min, 3rd min, 5th min, 15th min, 30th min, 45th min, 60th min, 90th min. The infusion was stopped if systolic blood pressure was $\geq$20% of baseline SBP and it was continued or restarted if systolic blood pressure was < 20% of baseline SBP. In Group II, phenylephrine bolus at 100mcg/each bolus dose was given following a drop in systolic blood pressure of <20% of baseline after giving subarachnoid block. After delivery, oxytocin 20 IU in 1000ml NS (normal saline) was given by slow intravenous infusion as per protocol. APGAR score was assessed at 1st min and 5th min after the delivery of the baby by a separate anesthesiologist. Oxygen was routinely given at 4 liters/min by clear face mask. Any incidence of nausea (reported by parturients) or vomiting (observed by the investigator) was recorded.

Postoperative Observation: Heart Rate and Blood pressure were recorded immediately after surgery. Parturients were transferred to the recovery room and observed until the time of the total regression of analgesia and recovery from motor paralysis. Once the patient is recovered, vital functions are stable and parturients were transferred to the post-operative ward. In the post-operative ward, vital parameters were monitored parturients were followed up till discharge.

RESULTS AND DISCUSSION

Spinal anesthesia has become the preferred technique for cesarean section. Hypotension remains a major drawback with this technique, despite maternal positioning to avoid aortocaval compression and various other preventive measures, including crystalloid and colloid infusions. It has shown that the percentage decrease in placental perfusion is related to the percentage reduction in maternal arterial pressure and not an absolute reduction in pressure.

Clinical studies in women undergoing scheduled cesarean delivery have confirmed that small (40–100µg) bolus doses of phenylephrine used to counteract hypotension during spinal anaesthesia were effective and as safe as ephedrine bolus doses for the mother and the neonate. The usual approach to use vasopressors is reactive rather than proactive. Spinal anaesthesia-induced maternal hypotension is allowed to develop and then treated accordingly. We have, instead, studied prophylactic phenylephrine infusion and compared it with the control group, which is not receiving prophylactic infusion for, but when hypotension occurred, were treated with phenylephrine. In our study, phenylephrine was administered for prevention and treatment of hypotension in the cesarean section during spinal anaesthesia Group I 30 pts was given intravenous phenylephrine prophylactically 100mcg/min for 3 minutes immediately after spinal anaesthesia and Group II 30 patients received 100mcg of bolus phenylephrine for treatment of hypotension episodes. All the patients were primigravida and between the age group of 18-30 yrs. And a major number of patients were included between 21-25 yrs of age, which is 20 patients (66.7%) in Group I and 23 patients (76.7%) in Group II, as seen in (Table 1). The mean age of both the groups was 24.5yrs and 24 yrs. Mean patients weight In the Group I was 64.2 and in Group II was 64.9. The mean patient's height in Group I was 157.3, and in Group II was 155.6. In our study Group, I had fallen in HR than Group II, which was at 1min, 2min, 30min, 45min, 90min periods. This was significant, as seen in (Table 5) study conducted by Bilal Mohammad *et al.,* who have also used prophylactic phenylephrine infusion for hypotension showed significant fall in HR in their study Group than their control group with ephedrine46. This fall in HR was not <50/min. Hence, atropine was not used in any of the cases. The number of episodes of hypotension higher in Group I out of 30 patients, only two patients (6.7%) had hypotension episodes when compared with 29 patients (96.7%) in Group II, which was statistically significant with a P-value <0.001. The mean dose of phenylephrine used in Group I was 470mcg, and the mean dose of phenylephrine used in Group II was 203.3mcg. The dosage used in Group I, i.e., infusion Group, was significantly higher than Group II with a P-value of <0.001. APGAR score was taken for all the babies delivered. Current evidence supports APGAR scores as a better predictor of neonatal outcome than measurement of umbilical artery pH. In our study, none required tracheal intubation and ventilation or admission to the special care baby unit in the

Table 1: Mean Baseline Hemodynamic Variables in Both the Groups

Baseline Parameters	Group I Mean ± SD	Group II Mean ± SD	p value
HR	90.7 ± 7.1	92.4 ± 3.5	0.254
SBP	124.0 ± 8.8	124.4 ± 6.3	0.840
DBP	74.3 ± 4.5	72.4 ± 5.1	0.125
MBP	90.7 ± 5.1	89.5 ± 4.7	0.366

Table 2: Mean HR Between Both the Groups

HR	Group I Mean ± SD	Group II Mean ± SD	p value
BASELINE	90.7 ± 7.1	92.4 ± 3.5	0.254
1min	88.9 ± 7.6	94.4 ± 5.8	0.003*
2min	89.1 ± 7.6	94.3 ± 6.4	0.006*
3min	89.6 ± 6.8	91.8 ± 5.0	0.175
5min	88.6 ± 6.8	91.5 ± 3.9	0.053
15min	88.3 ± 5.4	90.9 ± 7.0	0.112
30min	87.0 ± 6.9	90.3 ± 4.7	0.033*
45min	87.9 ± 6.5	90.7 ± 3.6	0.041*
60min	87.7 ± 7.0	90.9 ± 6.3	0.064
90min	85.7 ± 10.2	90.8 ± 7.4	0.029*

Table 3: Mean Systolic Blood Pressure (SBP) Between Both The GROUPS

SBP	Group I Mean ± SD	Group II Mean ± SD	p value
BASELINE	124.0 ± 8.8	124.4 ± 6.3	0.840
1min	125.8 ± 8.1	127.5 ± 9.7	0.446
2min	124.4 ± 9.4	117.9 ± 13.1	0.032*
3min	125.8 ± 7.7	104.4 ± 13.8	<0.001*
5min	124.4 ± 7.8	100.1 ± 12.6	<0.001*
15min	124.5 ± 9.4	102.8 ± 12.6	<0.001*
30min	123.6 ± 10.1	104.8 ± 8.8	<0.001*
45min	126.3 ± 9.8	108.9 ± 8.8	<0.001*
60min	125.5 ± 9.7	108.9 ± 8.5	<0.001*
90min	123.8 ± 11.8	108.6 ± 7.6	<0.001*

Table 4: Mean Dosages of Phenylephrine (in mcg) Used in Both the Groups

Parameter	Group I Mean ± SD	Group II Mean ± SD	p value
Phenylephrine(mcg)	470.0 ± 262.8	203.3 ± 92.8	<0.001*

Table 5: Distribution of Apgar Score at 1Min Between Both the Groups

Apgar Scores (1min)	Group I N (%)	Group II N (%)	p value
8	14(46.7%)	5(16.7%)	0.360
9	10(33.3%)	18(60.0%)	
10	6(20.0%)	7(23.3%)	
Total	30(100.0%)	30(100.0%)	

immediate post-delivery period. The APGAR score was recorded at 1min and 5 min. The mean APGAR at 1min for Group I was 8.7 and for Group II was 9.1 The mean APGAR at 5 min for Group I was 9.7 and Group II was 9.8. The mean APGAR score at 1 min and 5 min were not statistically significant. Of both, the Groups APGAR score at 1 min was categorized into 8,9,10. Of which maximum babies came in APGAR score 8 in Group I 14, i.e. (46.7) and in Group II APGAR score of 9, i.e., 18(60%). At the end of 5 minutes, the APGAR score of 10 was seen in maximum babies in both groups. That is 21(70%) in Group I and 22(73.3%) in Group II. In our study incidence of nausea and vomiting, only one patient out of 30 in Group II and none of 30 patients in Group, I have nausea and vomiting. This correlation with the study done by cooper and colleagues in which nausea and vomiting were less frequent with phenylephrine. As per our study, which was done with infusion of phenylephrine in Group I and bolus dose of 100mcg of phenylephrine in Group II there was statistically significant difference in hemodynamic parameters of the Group I that in those given infusion of phenylephrine there was statistically significant difference in SBP and MAP and less incidence of hypotensive episodes in Group I than Group II. The other parameters, like APGAR, score at 1 and 5 minutes and nausea and vomiting showed no significance.

CONCLUSION

- Administration of prophylactic phenylephrine infusion is more effective as vasopressor compared to therapeutic Boluses in elective cesarean section done under subarachanoid block.
- Prophylactic phenylephrine infusion was associated with lower heart rates occasionally when compared to bolus doses.

- There is no significant reduction in APGAR scores at 1st and 5th min in both groups.
- There were no significant maternal side effects seen in both groups.

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