

ORIGINAL ARTICLE

EFFICACY OF PHENYLEPHRINE INFUSION VERSES COLLOID PRELOADING IN RESOLVING HYPOTENSION DUE TO SPINAL ANAESTHESIA DURING CAESAREAN SECTION

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Background: Spinal anaesthesia causes hypotension that is countered through various methods. Phenylephrine is a vasoconstrictor and haemocoel increases the intravascular vascular volume; both have an effect in preventing this hypotension; but their comparison has not been done in local setting. **Methods:** Randomized control trial was conducted in month of June, 2017 at Ayub Teaching Hospital, Abbottabad. Block randomization with sealed envelopes was employed. Sample size was set at 90. Two equal groups were formed; Group A received 500 ml of haemocoel before spinal anaesthesia administration and Group B received 300µg of phenylephrine in 100ml infusion over 3 minutes. **Results:** An average drop of 8.2 mmHg, 9.7 mmHg and 3.1 mmHg in MAP was observed in Group A participants at 5 minutes, 10 minutes and 15 minutes respectively after spinal anaesthesia. In Group B, an average drop of 1.2mmHg was observed in first 5 minutes. MAP did not change significantly from this value throughout the monitoring period. There was a drop of 1.2 mmHg at 5 minutes in group B. After this, no further drop in blood pressure was observed. **Conclusion:** Phenylephrine infusion is better than haemocoel preload in preventing hypotension due to spinal anaesthesia.

Keywords: Phenylephrine infusion; Spinal anaesthesia; Hypotension

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INTRODUCTION

Maternal and child health constitutes principal significance in any health care system. The physiological changes during pregnancy and child birth bring forth unique challenges for the health care system.¹ During child birth through caesarean section, neuraxial blockage is considered the most appropriate technique for anaesthesia considering the physiology of labour and child birth; thus saving the mother and the foetus from complications that could occur in other modes of anaesthesia.² However, in neuraxial blockage, the spinal anaesthesia is associated with hypotension (commonly considered as 20% decrease in systolic blood pressure from baseline). This hypotension is due to blockage of sympathetic system (pharmacological sympathectomy) in lumbar region, causing decrease in peripheral resistance.³

The hypotension associated with spinal anaesthesia is its major pharmacological dilemma and is of grave concern particularly in gravid patients where two lives (mother and foetus) are at risk.⁴ The significance of this risk can be well appreciated by considering the hemodynamic changes in a pregnant female which include increase in blood volume and decrease in blood pressure.⁵ Pharmacological

sympathectomy associated with spinal anaesthesia causes a further decrease in blood pressure and thus warrants a lot of care to be taken during this mode of anaesthesia.⁶ In addition to life threatening dilemma, hypotension can also cause nausea, vomiting, dizziness, aspiration, syncope and cardiac arrhythmias.⁷

Various methods have been studied to counteract this hypotensive effect of spinal anaesthesia. These include leg wrapping, elastic stockings, posturing to prevent hypotension, vasopressors, for example adrenaline, from time to time and intravenous fluids (crystalloids and colloids) before and during the administration of spinal anaesthesia.^{8,9}

Out of these, the most feasible and commonly used method is administration of intravenous fluids.¹⁰ However, varying evidences make the timing and type of fluid, with or without vasopressors, debatable and till date it has not been established that which fluid or technique is superior than other.^{11,12} Vasopressors are now becoming famous as an alternative to the fluid therapy that is very commonly associated with fluid overload. Vasopressors and the fluid therapy particularly colloid preload are administered with aim of preventing hypotension caused by pharmacological sympathectomy by maintaining the intravenous blood volume.¹³ This study was conducted to compare the

efficacy of phenylephrine infusion (300 µg in 100 ml over 3 mins) with coloadung with 500 ml colloid solution in prevention of hypotension caused by pharmacological sympathectomy in spinal anaesthesia during caesarean section.

MATERIAL AND METHODS

Randomized control trial was conducted in Ayub Teaching Hospital, Abbottabad with the permission of Review and Ethical committee of the institution. This trial took place in month of June, 2017. Study included pregnant women that were on elective list of caesarean section in Ayub Teaching Hospital, Abbottabad. Patients who declined to give consent or patient who required emergency caesarean section for any of the reason or ended up in any obstetrical emergency. Sample size was set at 90. Since no prior study was there in local setting, statistical calculation could not be done.

After assessing the eligibility of the patients an informed written consent was taken from the patient. She was explained the scientific value of this study in local language and was given free will to join the study. Women who signed the written consent then were randomized. Eligible women were randomized by sealed envelope method into two groups to receive either 500ml of haemocoel (group A) before spinal anaesthesia or 300 µg of phenylephrine in 100ml infusion over 3 minutes (group B) respectively. The women were followed throughout the surgical procedure. As soon a patient reported in the hospital, her biodata was taken. She was assessed for being appropriate for study. If she was not in any emergency situation, she was declared fit for study. After taking the consent from the patient, she was randomly allocated into group A or group B and subjected to corresponding interventions (as mentioned above). Hypotension was defined as systolic blood pressure (SBP) <90 mmHg or 20% decrease from baseline or mean arterial pressure MAP <60 mmHg. Outcome measure were taken as mean arterial pressure at baseline then after 5 minutes, 10 minutes and 15 minutes of spinal anaesthesia administration. Neonate was assessed through APGAR score at 5 minutes after delivery. Statistical analysis was done using SPSS 10.

RESULT

In group A, there were total 45 patients. The mean age of patients in this group was 26.3±1 years with an average BMI being 22.7 Kg/m². All of the patients were on elective list for caesarean section and had no co-morbidity affecting blood pressure. The baseline mean arterial blood pressure (MAP) of this group was 100.3 mmHg (with systolic BP being 131mmHg and diastolic BP being 85). All the patients were administrated the spinal anaesthesia at level of L4/ L5. In this group, 95.56% (n=43) experienced a drop of more than 10 mmHg in mean arterial pressure during the entire study. The remaining two participating patients had a drop of 8.1 and 8.9 mmHg in MAP respectively. The variation of mean arterial blood pressure at five, ten and fifteen minutes after administration of spinal anaesthesia are shown in figure-1 respectively.

In group B, there were total 45 patients; out of these 1 declined to continue participation thus leaving us with 44 patients in this group. The mean age of these participating patients was 27±2 years. Their average BMI came out to be 21.1 Kg/m². None of the participants had any co-morbidity that would affect blood pressure. All of the participants were on elective list of caesarean section. Thirteen patients were administered at L4/L5 and one at L3/ L4. The baseline mean arterial blood pressure of this group came out to be 101 mmHg (with systolic blood pressure of 125 mmHg and diastolic blood pressure of 90). In this group, 6.81% (n=3) participating patients experienced a drop of more than 10mmHg during the entire study. Remaining 93.19% (n=41) did not cross this threshold hold. Five patients did not experience hypotension at all. The fluctuation of mean arterial blood pressure in this group at five, ten and fifteen minutes respectively is shown in figure-1.

None of the patient (n=0) went into hypotension considering to operational definition in either of the groups. The average drop in MAP in group A was 8.2 mmHg in first 5 minutes of spinal anaesthesia administration compared to 1.2 mmHg in group B (p-value < 0.0001). In group B, 11.12% (n=5) of the patient did not experience any drop-in blood pressure at five minutes of spinal anaesthesia administration (figure-1).

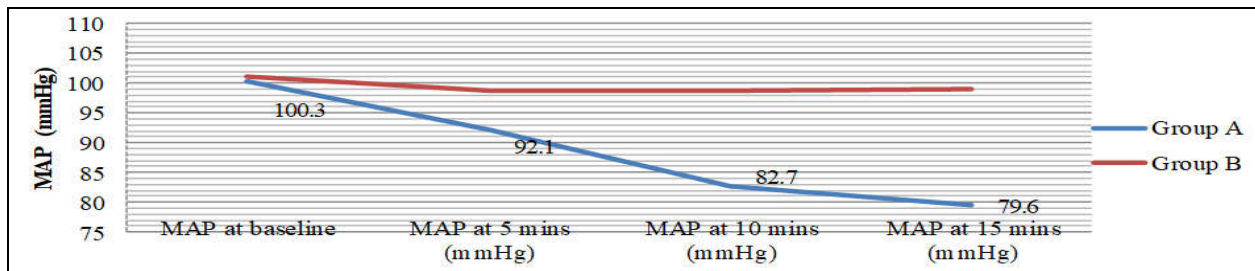


Figure-1: Comparison of MAP fluctuation in group A vs group B

At 10 minutes, on average there was further drop of 9.7 mmHg in MAP in participating patients of group A compared to no recordable drop in MAP in patients of group B (p -value <0.0001).

At 15 minutes, a slight drop of 3.1 mmHg in MAP was seen in group A. From this point further, no significant fluctuation in MAP were recorded in this group till end of surgery. The participating patients in group B did not experience any significant static change in MAP from this point further.

None of the patient in either of the groups went into shock or required any medications to up-regulate the blood pressure. Anxiolysis was required for one patient in group B.

Average APGAR score of neonates born to participating patients in group A at five minutes was 8.7 compared to APGAR score of 8.5 in group B at same time; however, this was not statistically significant.

DISCUSSION

In Pakistan, colloids and crystalloids are mainly used for prevention of hypotension in spinal anaesthesia.¹⁴ In our study, none of the patients had mean arterial blood pressure (MAP) less than 60 mmHg during the entire monitoring time. We, thus, had to base our calculations on average drop of blood pressure in either of the groups. While considering this drop in MAP, our study has shown the supremacy of phenylephrine infusion over the colloid preloading. This is consistent with Kee WD *et al* where role of phenylephrine infusion along with different fluids is compared in prevention of negative outcomes of spinal anaesthesia.⁷ Also, because the pathophysiology of the hypotension and mechanism of action of phenylephrine reciprocate each other, the supremacy of phenylephrine is justified. Pharmacological sympathectomy of spinal anaesthesia causes the hypotension through vasodilation.³ Sympathetic system of our body is concentrated at cervical and lumbar region. When spinal anaesthesia is administered at lumbar region, the anaesthetic agent attenuates the sympathetic outflow from this region causing vasodilation and thus hypotension.³ This is countered through administration of fluids that increase the intravascular volume and prevent the blood pressure from dropping down.¹⁴ Vasoconstrictors (for example phenylephrine) directly cause peripheral vasoconstriction and directly antagonize the effect of sympathectomy.

Our study has shown that preloading with colloids did not prevent the hypotension as effectively as phenylephrine. Phenylephrine, being a selective α_1 receptor agonist, is frequently used (Internationally but not in Pakistan where fluid therapy is widely practiced¹⁴) in obstetric anaesthesia

due to this α_1 agonist action causing marked arterial vasoconstriction. In our study, we used phenylephrine infusion of 300 μ g in 100ml and administered it over 3 minutes just after giving spinal anaesthesia. Although a standard dose has not been defined,¹⁵ infusions have been advocated in the range of 25–100 μ g/min and considering the immediate onset and duration of action of 5–10 min. It justifies out dosage of 300 μ g of phenylephrine and measurement of blood pressure (mean arterial blood pressure) at 5 minutes and 10 minutes after giving the spinal anaesthesia.¹⁶

For foetal outcome, blood gases (arterial or venous), blood pH and APGAR score at 1 minute after birth and at 5 minutes after birth are measures. However due to limitations of manpower, APGAR score could only be documented at 5 minutes after birth. Although this score was not different in either of the groups and none of the babies required any neonatal intensive care unit admission; we cannot affirm supremacy of any of the therapy over the other as far as foetal outcome is concerned due to lack of confirmatory test (in form of foetal blood gases and pH). Despite this limitation, recent evidence has indicated that 5 minutes APGAR score is better predictor of neonatal outcome than the measurement of umbilical artery pH justifying our use of 5 minutes APGAR scoring for foetal outcome (however; still this evidence has predictive values and not confirmatory values therefore we cannot affirm the supremacy of either of the therapies (haemocoel or phenylephrine)).¹⁷

Another limitation we faced was of the fluid optimization of all the patients because of high influx of patients and paucity of resources. Ideally all the patients in the study must have been optimized to limit the confounding factors of hypovolemia or hypervolemia. All the patients were given fluids considering the nil per oral protocol but this fluid was not calculated on the bases of their body weight. Although none of the patients had any clinical signs of hypovolemia or hypervolemia, we cannot claim that confounding factors were addressed appropriately.

White coat hypertension or anxiety could not have addressed other than by counselling. One patient in group B required anti-anxiety medication in form of 1mg midazolam considering her anxiousness and nervousness over the procedure. This did not affect the blood pressure significantly.

CONCLUSION

Phenylephrine infusion in a dose of 300 μ g in 100 ml over 3 minutes just after spinal anaesthesia administration is better than preloading with 500 ml of haemocoel in preventing hypotension associated

with spinal anaesthesia. None of the therapies have any conclusive affects (beneficial or harmful) of the neonates.

AUTHORS' CONTRIBUTION

AAS: supervised the research programme, literature search, write-up AR: executed the research project, addressed the statistical queries & drafted the manuscript. MAA, YN: assisted in completion of research, manuscript drafting, data analysis and proof-read the final article. MR: assisted research & manuscript drafting. AH: provided technical assistance. SJ: solved statistical queries. EAHS: helped in execution of research. AAM: assisted research & manuscript drafting. NA: solved confounding issues. S: assisted research & manuscript drafting.

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