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Original Research Article

Comparative evaluation of crystalloid coloading and colloid coloading for prevention of spinal anaesthesia induced hypotension in patients undergoing elective caesarian section

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ABSTRACT

Introduction: The most prevalent consequence after a caesarean surgery is post-spinal hypotension. To avoid this, crystalloid or colloid cohydration might be utilized. We aimed to see how crystalloid and colloid coloading affected hemodynamics and neonatal outcome in patients undergoing elective caesarean section, following spinal anesthesia.

Materials and Methods: A total of 100 pregnant women were enrolled in this study, which were split into two groups of 50 each. Group A was given 10ml/kg Ringer Lactate (RL) And Group B patients received 10ml/kg 6% hetastarch coloading. Patients were monitored for Mean SBP, DBP, MAP, HR, SPO2, mean APGAR score of newborn at 1 and 5 minutes post delivery, the prevalence of nausea and vomiting as well as Vasopressor requirement.

Results: The incidence of hypotension was higher in the crystalloid group, as was the need for Vasopressor, compared to the colloid group. The crystalloid group had a higher rate of nausea and vomiting**.** In the colloid group, hemodynamics such as SBP, DBP, MAP, and HR were more stable. However, as demonstrated by the APGAR score of 1 in both groups, there was no difference in neonatal outcome.

Conclusion: Colloid coloading is more effective method of preventing post spinal hypotension in patients undergoing caesarean section however combined use of Vasopressor and fluids seems to be more effective way of managing post spinal hypotension.

1. Introduction

Hypotension is commonest complication following spinal anaesthesia with incidence of up to 75% in general population and up to 80% in parturient having a caesarean section (CS).[1–3] Sympathetic blockage is to blame causing venous dilation, decrease return and decrease cardiac output and if sustained can result in placental hypoperfusion and fetal hypoxia and acidosis[4] fluid coloading appears to be physiological way of preventing this and which can be done either with crystalloids or colloids.[5,6]

Although clinically colloids appear to be more efficient for preventing postspinal hypotension but it also comes with disadvantages like high cost, effects on coagulation and more sensitivity reactions.[7] Although crystalloids appear to be cheaper alternative, but it may need to administer in large quantity, may cause edema and electrolyte disturbances.[8] Considering importance of hemodynamic stability and its effect on mother and fetus, we aimed to compare effect of coloading with crystalloid and colloids on maternal hemodynamics who are undergoing elective CS

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2. Materials and Methods

This was prospective randomized double blind trial conducted after approval from Institutional Ethics Committee and taking valid informed consent from patients. 100 patients were equally randomized into two groups using a predetermined computer generated random number allocation plan as Group A (Crystalloid group) receiving 10ml/kg Ringer Lactate (RL) And Group B (Colloid group) with 50 patients receiving 10ml/kg 6% hetastarch coloading.

All pregnant women of age group 18 to 35 years of age willing to participate in study of ASA grade I and II with singleton pregnancy were included in study.

Once the patients were enrolled for the study, a thorough history and physical examination was done and patient was investigated according to institutional protocol. Non-invasive blood pressure (BP), electrocardiography (ECG), and a pulse oximeter were attached to the patient when they arrived in the operating room, as were baseline values of heart rate (HR), systolic blood pressure (SBP), and pulse oximeter were taken. SBP and baseline HR were taken as the mean of 3 readings within 10% of each other with the BP recorded from the dependent arm. MBP (mean arterial blood pressure), SBP (systolic blood pressure), DBP (diastolic blood pressure), HR were then recorded throughout the surgery in 5 minutes interval. An 18G iv cannula was taken on nondominant arm of patient. After that patients were placed in sitting position and a 25 gauge spinal needle was placed in the L3-4 vertebral interspace after antiseptic dressing and draping, and hyperbaric bupivacaine 0.5 percent, 2.2 ml was given intrathecally. Thereafter patients were placed supine with left lateral uterine displacement.

Group A received 10ml/kg Ringer Lactate (RL) and Group B receive 10ml/kg 6% hetastarch. Each infusion commenced at the time of the spinal injection, and the procedure was completed in less than 10 minutes. Motor block and the upper sensory level of anesthesia to light touch was assessed. Surgery was allowed to commence if a sensory block to touch at the T6 dermatome is achieved. At delivery all patients received 20 IU of injection Oxytocin. Time of delivery of baby was recorded.

Hypotensive episodes, defined as 20% decrease in Mean arterial pressure (MAP) or MAP 60mmHg or systolic blood pressure decline less than a pressure of 80 mmHg was recorded. Inj. Ephedrine was used to treat hypotension at one minute interval till blood pressure returns to normal value. Time of hypotension and number of doses was recorded. If hypotension is not controlled by 3 bolus doses of Inj. Ephedrine, additional bolus of 100 ml IV fluid was given and the additional amount of fluid and noted. Bradycardia, defined as pulse rate < 60 per minute was noted and Inj. Atropine 0.6mg administered. Neonatal outcome was assessed by recording baby's APGAR score recorded at birth, 1 minute, and 5 minutes. Urine output, total fluid requirement and blood loss was recorded at the end of surgery. Patients were observed in recovery room for 2 hours postoperatively and Pulse rate, NIBP, SpO2 were recorded. Patient was observed for nausea, vomiting, rigors, shivering, and allergic reaction. Patients requiring blood transfusion, obstetric hysterectomy, conversion to general anesthesia were excluded from study.

Data was presented in tables and statistical analysis was performed using SPSS Software version 15.0. For categorical variables such as age, parity, ASA grade, and weight, the Chi square test was performed. For HR, blood pressure, APGAR score, and other variables, a Student's t-test was employed to compare within-group values to baseline values. Student's t-test was used to evaluate intergroup differences in the data gathered at each measured time point, and a paired t-test was used to determine intragroup differences from baseline within each group. P 0.05 was taken into account .P >0.05 was considered insignificant, <0.05 as significant and highly significant if <0.001.

3. Results

Total 100 patients were enrolled study with 50 patients in each group.

Demographic characters were comparable in both groups including age, parity, BMI, ASA status and duration of surgery.

Hypotension was more common in group A than in group B, and the need for vasopressor was similarly higher in group A, as evidenced by the data from Tables 2 and 3. The heart rates of both groups were comparable intraoperatively throughout the research. There was no discernible difference between the groups (Figure 1). SBP, DBP, and MAP were all lower intraoperatively in comparison to Group B, statistically significant differences exist in Group A (Figures 2, 3 and 4).

The groups' APGAR scores at 1 minute (8.021.55 vs. 8.121.21) and 5 minutes (8.221.33 vs. 8.661.15) were compareble (p >0.05).

Table 1: Demographic parameters in both groups

Parameters	Group A	Group B	P value
Age		25.16 ± 3.96	>0.05
Parity		24.58 ± 3.96	
Primigravida	33	30	>0.05
Multigravida	17	20	
BMI (kg/m2)	26.35 ± 4.85	25.84 ± 4.20	>0.05
ASA I	34	32	>0.05
ASA II	16	18	
Duration of surgery in minutes	52.22±3.58	51.42 ±4.33	>0.05

Table 2: Comparison of incidence of hypotension between groups

Hypotension	Group A n (%)	Group B n (%)	P value
Yes	28(56%)	13(26%)	<0.05
No	22(44%)	37(74%)	<0.05
Total	50(100%)	50(100%)	<0.05

Table 3: Comparison of vasopressor doses needed among study groups

Vasopressor doses needed	Group A	Group B	P value
Yes	30(60%)	19(38%)	< 0.05
No	20(40%)	31(62%)	<0.05

Table 4: Comparison of APGAR scores of neonates

APGAR score	Group A Mean±SD	Group B Mean±SD	P Value
At 1 minute	8.02±1.55	8.12±1.21	>0.05
At 5 minutes	8.22±1.33	8.66±1.15	>0.05

Table 5: Comparison of incidence of nausea and vomiting between groups

Incidence of nausea and vomiting	Group AN (%)	Group BN (%)	P value
Yes	13(26%)	2(4%)	< 0.05%
No	37(74%)	48(96%)	
Total	50(100%)	50(100%)	

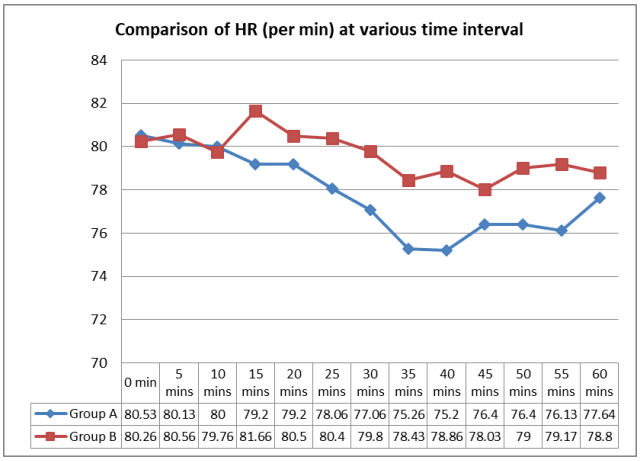

Fig. 1: Comparison of Heart Rate (per min) at various time intervals

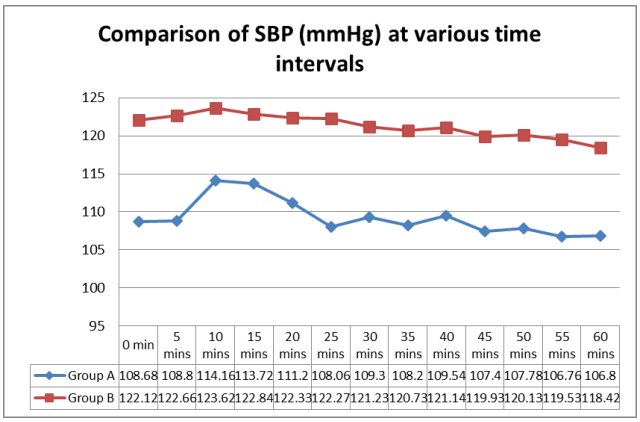

Fig. 2: Comparison of systolic blood pressure [SBP (mmHg)] at various time intervals

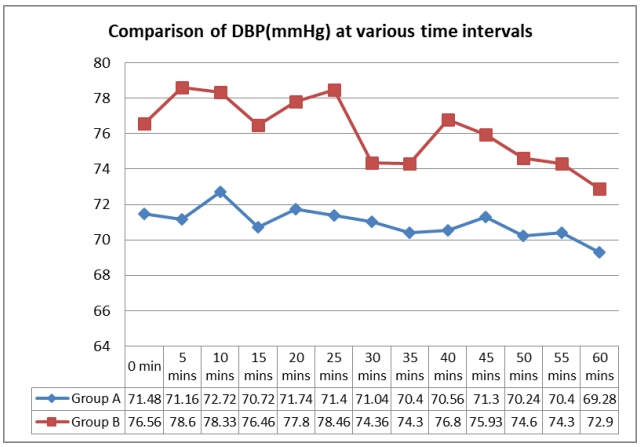

Fig. 3: Comparison of diastolic blood pressure [SBP (mmHg)] at various time intervals

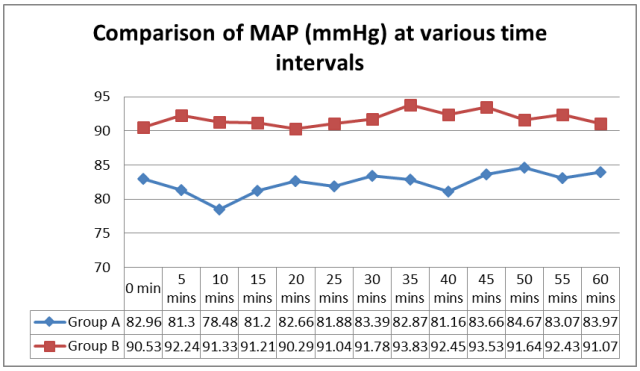

Fig. 4: Comparison of mean arterial pressure MAP (mmHg) at various time interval

4. Discussion

Spinal anesthesia is commonly employed technique for cesarean section due to its simplicity, faster onset, reliability and low cost.[9] Sympathectomy caused by spinal anesthesia can cause hypotension in significant number of cases even after giving left uterine displacement resulting in maternal morbidity in the form of nausea and vomiting, altered consciousness, cardiovascular collapse.[3,10]

Also maternal hypotension can compromise placental perfusion leading to adverse effects on fetus which may be in the form of acidosis in term infants[11] but may cause more deleterious effects in premature fetuses.[12]

So being an anesthesiologist our aim is to either prevent it or to treat it fast and effectively so as to avoid all deleterious effects.[13]

So we conducted study of crystalloid and colloid coloading so as to prevent maternal hypotension and subsequent deleterious effects.

In our study we found that colloid had reduced incidence of hypotension than those receiving crystalloid (Figures 2, 3 and 4 and Table 2). This finding was consistent with findings of Macdonald et al[14] where they also had fewer episodes of hypotension in colloid group than in crystalloid group necessitating lower doses of vasopressor in colloid group. The colloid group's hemodynamics were more stable than the crystalloid group's and this may be attributed to fact Crystalloids remain in intravascular space for a shorter time and distribute rapidly into the extracellular fluid compared to colloids.

However, regardless of the type of iv fluid used, the incidence of hypotension in both groups was high (56 percent and 26 percent, respectively) and significant, necessitating vasopressor treatment; thus, regardless of the type of iv fluid used, combined use of vasopressor and iv fluids is recommended in the management of spinal induced hypotension.[13,15,16]

Although there was significant difference in incidence of hypotension as well as requirement of vasopressor in both groups i.e. crystalloid group had more significant hypotension, neonatal outcome was comparable in both groups as studied shown by APGAR scores at 1 and 5 minutes.(Table 4) indicating that transient hypotension treated using vasopressor do not usually affect fetal outcome.[17,18] However using vasopressor for correction of hypotension in the background of inadequate knowledge of its effect on fetoplacental perfusion should be restricted and prevention of hypotension should be preferred approach rather than its correction.

We had greater incidence of nausea and vomiting in crystalloid group than in colloid group and findings were consistent with findings of Mercier[19] Fatema[20] and Shahriyari.[21]

Although colloids are considered safe and does not transfer cross fetoplacental barrier[22] it has potential to cause allergic reactions and is expensive too. And this could be a reason why many institutions as well as anesthesiologist still prefer to use crystalloid over colloids despite knowing its advantages.[23]

5. Conclusion

Colloid coloading was found to be a more effective strategy of reducing post-spinal hypotension in patients after caesarean section in our study. Regardless of the fluid therapy chosen, some degree of hypotension is likely to develop, which must be treated with Vasopressor therapy.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare no conflict of interest.

References

1. Bajwa SS, Kulshrestha A, Jindal R. Co-loading or pre-loading for prevention of hypotension after spinal anaesthesia! a therapeutic dilemma. *Anesth Essays Res*. 2013;7(2):155–9.
2. Mercier FJ, Auge M, Hoffmann C. Maternal hypotension during spinal anesthesia for cesarean delivery. *Minerva Anestesiol*. 2013;79(1):62–73.
3. Rocke DA, Rout CC. Volume loading, spinal hypotension and Caesarean section. *Br J Anaesth*. 1995;75:257–9.
4. Mueller MD, Bruhwiler H, Schupfer GK, Lüscher KP. Higher rate of fetal acidemia after regional anesthesia for elective cesarean delivery. *Obstet Gynecol*. 1997;90(1):131–4.
5. Carvalho B, Mercier FJ, Riley ET, Brummel C, Cohen SE. Hetastarch co-loading is as effective as Preloading for the prevention of hypotension following spinal anaesthesia for caesarean delivery. *Int J Obstet Anaesth*. 2009;18(2):150–5.
6. Banerjee A, Stocche RM, Angle P, Halpern SH. Preload or coload for spinal anaesthesia for elective Caesarean delivery: a meta-analysis. *Can J Anaesth*. 2010;57(1):24–31.
7. Liu FC, Liao CH, Chang YW, Liou JT, Day YJ. Hydroxyethyl starch interferes with human blood ex vivo coagulation, platelet function and sedimentation. *Acta Anaesthesiol Taiwanica*. 2009;47(2):71–8.
8. Masoumi K, Forouzan A, Darian AA, Navaii AR. Comparison of the effectiveness of Hydroxyethyl Starch (Voluven) solution with normal saline in hemorrhagic shock treatment in Trauma. *J Clin Med Res*. 2016;8(11):815–8.
9. Riley ET, Cohen SE, Macario A, Desai JB, Ratner EF. Spinal versus epidural anesthesia for cesarean section: a comparison of time efficiency, costs, charges, and complications. *Anesth Analg*. 1995;80(4):709–12.
10. Kee WDN, Khaw KS, Ng FF. Comparison of phenylephrine infusion regimens for maintaining maternal blood pressure during spinal anaesthesia for Caesarean section. *Br J Anaesth*. 2004;92(4):469–74.
11. Maayan-Metzger A, Schushan-Eisen I, Todris L, Etchin A, Kuint J. Maternal hypotension during elective cesarean section and short-term neonatal outcome. *Am J Obstet Gynecol*. 2010;202(1):56.
12. Laudenbach V, Mercier FJ, Roze´JC, Larroque B, Ancel PY, Kaminski M, et al. Anaesthesia mode for caesarean section and mortality in very preterm infants: an epidemiologic study in the EPIPAGE cohort. *Int J Obstet Anesth*. 2009;18(2):142–9.
13. Kee WDN. Prevention of maternal hypotension after regional anaesthesia for caesarean section. *Curr Opin Anaesthesiol*. 2010;23(3):304–9.

14. Mcdonald S, Fernando R, Ashpole K, Columb M. Maternal cardiac output changes after crystalloid or colloid coload following spinal anesthesia for elective delivery: a randomized controlled trial. *Anesth Analg*. 2011;113(4):803–10.
15. Mercier F. Fluid loading for cesarean delivery under spinal anesthesia: have we studied all the options? *Anesth Analg*. 2011;113(4):677–80.
16. Riley ET, Cohen SE, Rubenstein AJ, Flanagan B. Prevention of hypotension after spinal anesthesia for cesarean section: six percent hetastarch versus lactated Ringer's solution. *Anesth Analg*. 1995;81(4):838–42.
17. Corke BC, Datta S, Ostheener GW, Weiss JB, Alper MH. Spinal anaesthesia for cesarean section. The influence of hypotension of neonatal outcome. *Anaesthesia*. 1982;37(6):658–62.
18. Caritis SN, Abonleish E, Edelstone DI, Mueller-Heubach E. Fetal acidbase state following spinal or epidural anesthesia for cesarean section. *Obstet Gynecol*. 1980;56(5):610–5.
19. Mercier FJ, Diemunsch P, Ducloy-Bouthors AS, Mignon A, Fischler M, Malinovsky J. 6% Hydroxyethyl starch (130/0.4) vs Ringer's lactate preloading before spinal anaesthesia for Caesarean delivery: the randomized, double-blind, multicentre CAESAR trial. *Br J Anaesth*. 2014;113(3):459–67.
20. Khosravi F, Alishahi M, Khanchemehr Y, Jarineshin H. A Comparison Between the Effects of Preloading with Ringer's Solution and Voluven on Hemodynamic Changes in Patients Undergoing Elective Cesarean Section Under Spinal Anesthesia. *Med Arch*. 2019;73(1):44–8.
21. Shahriari A, Khooshideh M, Heidary M. Prevention of Hypotension during Spinal Anesthesia for Caesarean Section: Preload with Crystalloids or Hydroxyethyl Starch. Medical Hypothesis. *Med Hypothesis Discov Innov Interdisciplinary*. 2014;1(2):1–4.
22. Marcus MA, Vertommen JD, Aken HV. Hydroxyethyl starch versus lactated Ringer's solution in the chronic maternal-fetal sheep preparation: a pharmacodynamic and pharmacokinetic study. *Anesth Analg*. 1995;80(5):949–54.
23. Allen TK, Muir HA, George RB, Habib AS. A survey of the management of spinal-induced hypotension for scheduled cesarean delivery. *Int J Obstet Anesth*. 2009;18(4):356–361.

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