
PREVENTION OF SPINAL ANAESTHESIA INDUCED HYPOTENSION IN ELECTIVE CESAREAN SECTION: A COMPARISON OF RINGER LACTATE, PENTASTARCH 6% AND POLYGELATIN 3.5% AS PRELOADING FLUIDS

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Abstract

Aim and Objective: To find a safe and effective method for diminishing the incidence and severity of spinal anaesthesia induced hypotension (SAIH) by preloading either with ringer lactate (RL) or pentastarch 6% or polygelatin 3.5%. **Method:** A total of 120 parturients of ASA grade II were divided into three equal groups. For preloading, group I parturients received 15ml/kg of RL and group II received 7.5ml/kg of pentastarch 6% and group III received 7.5ml/kg of polygelatin 3.5% over 15 to 20 minutes before initiation of spinal anaesthesia. **Results:** Subarachnoid block was given at L₂- L₃ or L₃-L₄ with 2 to 2.5 ml of 0.5% bupivaccaine (Heavy). The upper sensory level was tried to maintain between T₄ to T₆. After subarachnoid block, SBP and DBP in all three groups decreased but fall in SBP and DBP in RL group being significantly more than that in pentastarch 6% and polygelatin 3.5% groups. The incidence of hypotension (62%) as well as number of episodes of hypotension (total 35) was more in RL group, therefore vasopressor requirement in this group was maximum (108 mg). Mean time of onset of hypotension in RL group was 6.16 minutes and in group II was 13 minutes and in group III it was 13.2 minutes. **Conclusion:** The preloading either with pentastarch 6% or polygelatin 3.5% is highly effective and comparable in prevention of SAIH. But risk of allergic reaction with polygelatin 3.5% makes pentastarch 6% better and safer colloid for preloading.

Keywords: Spinal anaesthesia induced hypotension; Pentastarch; Polygelatin; Subarachnoid block; Bupivaccaine

1. Introduction

Spinal anaesthesia induced hypotension continues to be a troublesome problem associated with spinal anaesthesia. Pregnant patients' especially those who are at term are more prone to develop SAIH due to occurrence of aortocaval compression by gravid uterus which is further aggravated by sympathetic blockade after spinal anaesthesia [1]. Incidence of SAIH varies from 50% to 92% [2,3]. However, severe and prolonged maternal hypotension carries potentially

serious consequences both for the mother and the fetus, which on occasion has resulted in death [4]. SAIH lasting for more than 2 minutes leads to decrease in placental blood flow, fetal hypoxia and adverse neurobehavioral performance of the newborn [2].

Various non-pharmacological and pharmacological methods have been studied either to reduce or eliminate SAIH in parturients undergoing cesarean section. Non-pharmacological methods include LUD, inflatable boots, [5], constrictive

bandages [6], and knee stockings [7]. But none of the method was found to be satisfactory and effective. Among the pharmacological methods, crystalloid preloading i.e. intravascular expansion by infusion of I. V. fluids can reduce the incidence of SAIH but fails to eliminate SAIH completely. Besides, it is associated with adverse effects like fluid overloading, risk of maternal and fetal pulmonary edema, hemodilution [3].

Vasopressors given either prophylactically or in response to hypotension have been found to be effective, but decrease uterine blood flow due to vasoconstrictive effects of the drugs. So it cannot be considered optimal and should be reserved for circumstances in which all other measures fail [5]. In recent studies colloids are studied as preloading fluids to prevent SAIH. Colloids cause greater plasma expansion and have longer intravascular stay than crystalloids and colloids are found to prevent SAIH more effectively [8] but there are chances of allergic reaction. Newer starches like pentastarch has 7 times lower incidence of allergic reaction than gelatin [9]. The purpose of this study was to find a safe and effective method for diminishing the incidence and severity of spinal anaesthesia induced hypotension (SAIH) by preloading either with ringer lactate (RL) or pentastarch 6% or polygelatin 3.5%.

Materials and Methods

After obtaining Institutional Ethical Committee approval, the present randomized study was conducted in Department of Anaesthesiology, Mahatma Gandhi Institute of Medical Sciences Sevagram from January 2003 to June 2004 to compare the efficacy of Ringer lactate,

pentastarch 6% and polygelatin 3.5% as preloading fluids for prevention of SAIH in patients posted for cesarean section. A total of 120 parturients of ASA grade II were enrolled and divided into three groups of 40 parturients in each group. For preloading, group I parturients received 15 ml/kg of RL and group II received 7.5 ml/kg of pentastarch 6% and group III received 7.5 ml/kg of polygelatin 3.5% over 15 to 20 minutes before initiation of spinal anaesthesia. Incidence and severity of SAIH were noted. Baseline and after preloading SBP, DBP, heart rate and oxygen saturation were recorded and compared among three groups. Results were analyzed statistically by X^2 test and p value <0.05 was considered statistically significant.

Observations and Results

Table 1 show the comparison of dose requirement of vasopressor in all three groups. Number of patients was 119 due to exclusion of case of anaphylactoid reaction of group III. Dose requirement of vasopressor in group I (108 mg) was significantly higher as compared to group II and group III.

I-D interval and U-D interval were comparable in Group I (13.9 ± 1.2 and 60.6 ± 31.2 respectively), Group II (14 ± 1.21 and 61.12 ± 30.73 respectively) and Group III (13.8 ± 1.58 and 59.84 ± 34.74 respectively), ($P > 0.05$). Mean duration of surgery in group I was 40.75 min, in group II it was 40.62 min and in group III was 42.62 minutes ($p > 0.05$). Thus the duration of surgery was comparable in all three groups and found no significant difference among three groups ($p > 0.05$). Mean apgar score was comparable in all three groups as shown in table 2 ($p > 0.05$).

Discussion

All the three groups were comparable in regards to demographic profile (age, weight and height) and volume of local anesthetic used. Subarachnoid block was given at L₂-L₃ or L₃-L₄ with 2 to 2.5 ml of 0.5% bupivacaine (Heavy). Maximum patients in all three groups attained level of SAB between T₄ to T₆ with median being T₅. Mean I-D interval, U-D interval and duration of surgery were comparable in all three groups. However, in polygelatin 3.5% group, anaphylactoid reaction was observed in 1 patient after SAB. Patient had cardiovascular collapse with angioneurotic edema. Immediate resuscitation was carried out successfully with injection atropine, mephentermine, dopamine infusion adrenaline, hydrocortisone and pheniramine. Therefore this patient was excluded while comparing hemodynamic parameters, incidence and severity of SAIH and vasopressor requirement. Patient was conscious throughout surgery and did not require any ventilatory support.

Baseline SBP, DBP and oxygen saturation were comparable among three groups. However, baseline and after preloading HR recordings were comparable among three groups ($p > 0.05$). After subarachnoid block, SBP and DBP in all three group decreased but fall in SBP and DBP in RL group being significantly more ($p < 0.01$) than that in pentastarch 6% and polygelatin 3.5% groups. However SBP, DBP were comparable in both pentastarch 6% and polygelatin 3.5% groups, throughout the study ($p > 0.05$). These findings are correlated with the previous studies [3, 6]. Lowest SBP recorded was 50 mm Hg in RL group, which was seen in patient who did not

respond to first two doses of vasopressor given at SBP of 90 mmHg and 80 mmHg respectively. However in pentastarch 6% group it was 80 mmHg and in polygelatin 3.5% group it was 82 mmHg (excluding case of anaphylactoid reaction). These finding are similar to the reports by Khetarpal et al [8].

Incidence of hypotension was significantly higher in RL group (62%), ($p < 0.001$), which is similar to the incidence reported by Karinen et al (62%) [10]. The incidence of hypotension was reduced significantly in pentastarch 6% group to 15% which is correlated with the Khetarpal et al (15%) [8] and French et al (12.5%) [11]. In polygelatin 3.5% group observed incidence of hypotension was 15.3% which is correlated with Satproedprai et al [12], Mean time of onset of hypotension in RL group was 6.16 minutes and in pentastarch 6% group was 13 minutes and polygelatin 3.5% group it was 13.2 minutes. Patients preloaded with crystalloid had an earlier onset of hypotension as compared to those receiving colloids. In RL group, of the 25 (62.5%) patients who developed hypotension, 16 (64%) patients had only one episode of hypotension 8 (32%) patients had 2 episodes of hypotension and only 1(4%) patient had 3 episode of hypotension. 6 patients in both group II and III who developed hypotension had only one episode each. Besides total number of episodes of hypotension was significantly more in RL group (35; 74.4%), ($p < 0.001$) as compared to pentastarch 6% (12%) and polygelatin 3.5% (12.7%) groups. Thus, pentastarch 6% (7.5 ml/kg) and polygelatin 3.5% (7.5 ml/kg) were equally effective in controlling severity of SAIH as none of the parturient had recurrent episodes of

hypotension while 9 patients out of 25 hypotensive patients in RL group had repeated episodes of hypotension.

As the incidence of hypotension as well as number of episodes of hypotension were more in RL group, the vasopressor requirement in this group was maximum 108 mg. Of the 25 hypotensive women 15 (60%) needed single IV bolus dose of 3 mg mephentermine and 9 (36%) women needed double bolus dose of mephentermine and only 1 (4%) needed 3 doses of mephentermine. Whereas both pentastarch 6% and polygelatin 3.5% group total vasopressor requirement was 18 mg: all hypotensive female needed only single dose of mephetermine each. These findings are comparable with findings of earlier studies [4, 12].

Prevention of SAIH by pentastarch 6% and polygelatin 3.5% was highly significant than RL group ($p < 0.001$). Neonatal outcome was similar and good in crystalloid and colloid groups despite significant difference in incidence of SAIH. Nausea, vomiting and shivering were minor problems in all the three groups, occurred in similar frequency and did not require any intervention. However, one patient developed severe anaphylactoid reaction to polygelatin 3.5% and required immediate resuscitation with good outcome.

Conclusion

From present study, we can assume that preloading either with pentastarch 6% or polygelatin 3.5% is highly effective and comparable in prevention of SAIH. But risk of allergic reaction with polygelatin 3.5% makes pentastarch 6% better and safer colloid for preloading.

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Table 1: Dose requirement of vasopressor in all three groups

Dose requirement	Group I	Group II	Group III
3 mg	15	06	06
6 mg	09	00	00
9 mg	01	00	00
Total requirement (mg)	108	18	18
P Value	0.001		

Groups I, II and III were comparable with regards to oxygen saturation measurements throughout the study ($p > 0.05$) as depicted in figure 1.

Figure 1: Comparison of oxygen saturation in the three groups (n=120)

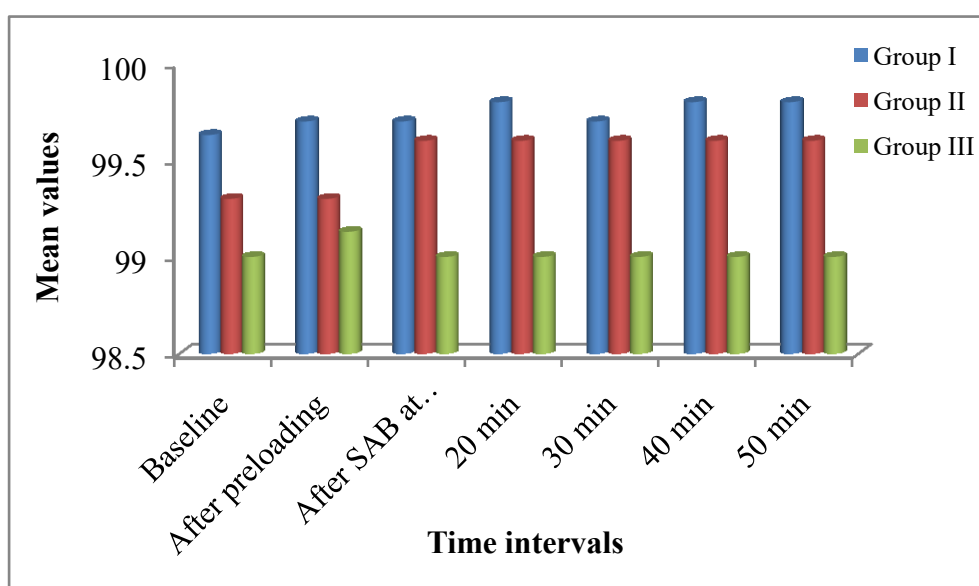


Table 2: Mean apgar score at 1 min, 5 min, 10 min. (n=120)

Mean apgar Score	Group I	Group II	Group III
1 min	8.55±0.78	8.65±0.60	8.4±0.98
5 min	8.95±0.32	9	8.95±0.32
10 min	10	10	10

Incidence of nausea, vomiting, shivering was similar in all groups, ($p > 0.05$) as shown in figure 2.

Figure 2: Side effects in all three groups