

Original Research Article**Comparative study of preloading with ringer lactate v/s 6% hexa starch solutions to prevent hypotension following spinal anaesthesia in elective surgery**Singh B¹, Singh AP², Bhardwaj A³, Singh I⁴¹Dr Balwinderjit Singh
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Dr Balwinderjit Singh
drbalwinder2000@yahoo.co.in**ABSTRACT**

Background: Hemodynamic variations are commonly encountered following subarachnoid block and can attribute to significant mortality and morbidity. To counteract the hypotension, fluid administration before spinal anaesthesia is recommended (preloading). Crystalloids and colloids are recommended as preloading fluids but both have their own merits and demerits.

Objective: This comparative study was done to compare the effectiveness of ringer lactate versus 6% hydroxyl ethyl starch for preventing spinal anaesthesia induced hypotension.

Material and Methods: In this prospective study, we compare the effectiveness of ringer lactate versus 6% hydroxy ethyl starch at 10ml/kg over a period of 20 minutes before spinal anaesthesia in preventing hypotension. After administration of spinal anaesthesia mean arterial pressure were recorded at 1, 5, 10, 15, 30, 45, 60, 90 minutes and 3 hours after spinal anaesthesia. Number of patient, receiving injection Mephentermine sulphate for persistent hypotension was also recorded.

Results: We found that hydroxy ethyl starch is more effective than ringer lactate solution as a preloading fluid in prevention of hypotension following spinal anaesthesia.

Conclusion: Hydroxy ethyl starch is superior to ringer lactate in preventing hypotension in patients undergoing elective lower abdominal surgeries under spinal anaesthesia but the incidence of hypotension is not completely eliminated.

Key Words: Hypotension, pre-loading, ringer lactate, hydroxy ethyl starch, spinal anaesthesia

Introduction

Hypotension is the commonest serious problem following spinal anaesthesia. It is defined as a decrease in the mean arterial pressure by more than 15- 20% from the initial baseline level. Hypotension occurs usually due to autonomic blockade which is two segments higher than the sensory block after administration of spinal anaesthesia. Hence volume preloading has been recommended for prevention of spinal – induced hypotension in this situation. ^[1,2] Pre loading is infusion of 10-20 ml/kg of intravenous fluids prior to procedures like spinal anaesthesia, epidural anaesthesia and induction of general anaesthesia with drugs which are likely to cause hypotension. ^[3] The

aim of preloading is to load the intravascular compartment which is likely to increase venous return and thereby prevent hypotension. Crystalloids and colloids are commonly used intravenous fluids for preloading before spinal anaesthesia but both have their own advantage and disadvantages. Crystalloids (Ringer Lactate (RL) or Normal saline (NS) have their advantages such as easily availability, less reactions and cost effective ^[4,5,6,7] but too much crystalloids cause overloading of pulmonary circulation resulting in signs of overhydration ^[8] and moreover only 1/3 of administered dose of RL or NS will remain in the intravascular compartment which may explain why hypotension associated with

spinal anaesthesia cannot be completely eliminated by crystalloid preloading. On the other side colloids having high molecular weight, when infused intravenously results in more intravascular expansion, less volume required and long duration of action in spite of high cost and fear of allergic reactions. [9,10,11,12] So the aim of our study is to compare the effectiveness of preloading with ringer Lactate versus 6% Hexa Starch solutions to prevent hypotension following spinal anaesthesia in elective surgery and incidence of allergic reactions with either of these fluids.

Material and Methods

After obtaining approval from institutional ethics committee for this prospective study, all the patients were fully explained about the study procedure. A written informed consent was obtained from all patients participating in the study. Patients belonging to American Society of Anaesthesiologist (ASA) Grade- I & II, Weight 40 to 60 Kg, in the age group of 20 to 60 years of both sexes and undergoing various elective operations under spinal anaesthesia where minimal blood loss anticipated were included in the study. Any patient below 12 years, pregnant, patients with cardiovascular, respiratory, central nervous system disorders, requiring supplementation of general anesthesia having renal disease were excluded. Routine investigations, complete hemogram, urine analysis, blood grouping and Rh typing, electrocardiogram (for patients over 40 years of age), chest X-ray, Random blood sugar were done. Preanesthetic evaluation was done on the previous day of surgery.

All patients were premedicated with tablet diazepam 10 mg 60 minutes before shifting to the operation theater. A peripheral intravenous line with 18 gauge cannula was secured in one of the upper limb. Volume of infusion will be determined according to body weight of patients. Patient

was randomly divided into two groups. Group R had received Ringer's lactate at 10 ml/Kg and patients in Group-HES had received 6% Hydroxy Ethyl starch at 10 ml/Kg. Both these solutions were infused over a period of 20 minutes before performance of subarachnoid block. After preloading, all patients received Ringer's Lactate solution for fluid maintenance.

Baseline parameters (Heart Rate, mean arterial blood pressure and oxygen saturation) were recorded using electronic multipara monitoring device. Under aseptic precautions lumbar puncture was performed with 26 gauge spinal needle (Quincke's needle) through midline approach with patient in right lateral or left lateral decubitus position at third or fourth, fourth – fifth lumbar intervertebral space. After free flow of CSF, 3.0 ml of 0.5% injection bupivacaine (heavy) was injected. Immediately after the injection, the spinal needle was withdrawn and patient turned to supine position. Following spinal anaesthesia mean arterial pressure were recorded at following intervals - 1, 5, 10, 15, 30, 45, 60, 90 minutes and 3 hours after spinal anaesthesia. Rescue medications were recorded if used. Sensory level of blockade was checked after 5 minutes using pin prick method.

Hypotension was managed initially with increase in fluid infusion rate and administering 100% oxygen by mask. If hypotension still persists, despite the above measures, injection mephenteramine sulphate was administered intravenously 6 mg bolus and repeated until the blood pressure increased to acceptable levels. Analysis of variance (ANOVA) has been applied for blood pressure variation between two groups and chisquare test has been applied to compare number of doses of injection mephenteramine sulphate used intraoperatively.

Results

Table: 1 Patient's characteristics

Variables	Ringer lactate group(R)	Hexa Ethyl Starch Group(HES)	P Value
Age(Years)	44.2±4.1	46.1±5.2	>0.05
Weight(Kg)	54.23±3.23	52.35±4.13	>0.05
Sex Distribution (M/F)	14/16	12/18	>0.05

Table: 2 Mean arterial blood pressure variation in both the groups

MA BP (m m of Hg)	HES	98.12±2.32	94.13±4.02	90.12±3.14	86.31±4.25	80.24±4.13	84.18±2.31	88.35±2.31	90.17±2.25	94.19±2.20	96.22±3.32
	RL	95.12±3.32	89.16±2.19	82.20±4.34	76.18±3.36	72.28±3.31	77.25±3.35	80.22±2.21	86.12±2.29	90.30±3.28	92.18±4.27
Timing after SA	Basal value	1 Min	5 Min	10 Min	15 Min	30 Min	45 Min	60 Min	90 Min	3 Hours	

The two groups were comparable in patient's characteristics age, weight and sex distribution (Table 1).

Variation in Mean Arterial Blood Pressure

Table 2 shows mean arterial blood pressure variation with passage of time after administration of subarachnoid block. There is progressive fall in mean arterial blood pressure from the basal value in both the groups after administration of spinal anaesthesia. In ringer lactate group mean basal arterial blood pressure was 95 mm of Hg. It falls to 89 mm of Hg after one minute, 82 mm of Hg after 5 minutes, 76 mm of Hg after 10 minutes and maximum fall after 15 minutes was 72 mm of Hg(25%). Mean arterial blood pressure started rising after 30

minutes and became 92 mm of Hg after 3 hours of subarachnoid block.

In HES group, mean basal arterial blood pressure was 98 mm of Hg. It subsequently falls to 94 mm of Hg after 1 minute, 90 mm of Hg after 5 minutes, 86 mm of Hg after 10 minutes and maximum fall after 15 minutes was 80 mm of Hg (18%). Mean arterial blood pressure started rising after 30 minutes and became 96 mm of Hg after 3 hours of subarachnoid block. So the fall in mean arterial blood pressure after 15 minutes were more in patients preloaded with ringer lactate than HES group and difference was statistically significant(P<0.05).

Dose of injection Mephenteramine Sulphate requirements

18 patients out of 30 in ringer lactate group and 10 out of 30 patients in HES group require injection Mephenteramine sulphate for persistence hypotension respectively and value is statistically significant ($p < 0.05$) Hence our results reveals that hypotension occurred in both the groups but it is more in case of patients preloaded with ringer lactate before administration of spinal anaesthesia. We did not come across any allergic reaction to hydroxy ethyl starch as well as ringer lactate although it is reported in the literature with either of the fluids.

Discussion

Till date arterial hypotension following spinal anaesthesia is one of the most unsolved problem and needs special attention. Arterial hypotension following spinal anaesthesia results in significant morbidity and mortality in compromised patients due to fall in cardiac output and subsequently decrease in cerebral and renal blood flow. Arterial hypotension has been defined as fall in blood pressure by 15-20% from the basal mean arterial blood pressure. It depends upon the level of sympathetic blockade, site of operation, patient's age, co-existing diseases and circulating blood volume. The usual management is either to increase the peripheral resistance by use of vasoconstrictors or with mechanisms to increase the cardiac output of the heart. The effective method to increase the cardiac output of heart is by increasing the venous return to heart with the help of expansion of circulating blood volume. The prophylactic administration of crystalloids before spinal anaesthesia has been considered a safe and effective method to increase the circulating blood volume and thus reducing the severity of hypotension but it has its own disadvantages. [3,4,5]

Administration of crystalloids results in renal impairment and congestive heart failure if infused in large volume. Excessive administration of crystalloid may produce

peripheral edema in compromised patients. Another disadvantage that approximately 75% of crystalloid diffuses into the interstitial space very fast and thus expansion of circulating blood volume is only transient. So colloids are tried for preloading before spinal anaesthesia because of their physical properties (high molecular weight) they stay in circulation for prolonged period. [8]

In our study after subarachnoid block there was progressive fall in BP upto 15 minutes and maximum hypotension occurred between 5-15 minutes. This incidence of hypotension has been found to be higher in group R (Ringer Lactate Group) as compared to group HES (Hydroxy Ethyl) group. Our observations are close to the study conducted by sharma et al [9] on 90 patients undergoing caesarean section and found that 6% hexastarch solution is superior to the ringer lactate to prevent hypotension following spinal anaesthesia. As Colloid solutions contain large molecules and therefore do not decrease plasma colloid pressure as much as crystalloid solutions and hence intravascular volume is well maintained as compared to crystalloid administration.

Contrary to our study, it is observed in other studies that volume preloading with crystalloid or colloid has no effect on the incidence of spinal induced hypotension and it is also demonstrated that preloading or coloadng with colloid is equally efficacious. [13,14,15] In our study, we did not come across any allergic reactions to hydroxyl ethyl starch and found that hydroxyl ethyl starch is superior to ringer's lactate solution in prevention of hypotension following spinal anaesthesia but incidence is not completely eliminated. Study shows that hydroxy ethyl starch also has several other advantages such as prevention of deep vein thrombosis and decreased allergic potential several times lower than that of gelatin.

We concluded that hydroxy ethyl starch is superior to ringer lactate in

preventing hypotension in patients undergoing elective lower abdominal surgeries under spinal anaesthesia but the incidence of hypotension is not completely eliminated.

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