



## COMPARATIVE STUDY OF RINGER'S LACTATE AND 6% HYDROXYETHYL STARCH AS PRELOADING FLUID FOR PREVENTION OF HYPOTENSION FOLLOWING SUBARACHNOID BLOCK

**Dr. Shebeer Kottayil\***

Consultant Cardiac Anaesthesiologist, Aster Malabar Institute of Medical Science, Kozhikode, Kerala. \*Corresponding Author

**Dr. Sukanya Prince Mary.A.J**

Associate Professor, Department of Anaesthesiology, Malabar medical college hospital and research centre, Modakkallur, Kozhikode, Kerala.

**Dr. Mangesh Shenoy**

Professor and Head, Department of Anaesthesiology, MES Medical College, Perinthalmanna, Kerala.

### ABSTRACT

**Background and Objective:** To compare the efficacy of Ringer's lactate and 6% hydroxyethyl starch in reducing the incidence and severity of hypotension after subarachnoid block. Design: Prospective and randomized comparative study. **Materials and methods:** 100 patients in the age group of 20 to 60 years of ASA Grade I scheduled for elective lower abdominal and lower limb surgeries were randomly allocated into two groups. CRL-Group: received 20ml/kg of Ringer's lactate. COL-Group: received 10 ml/kg of HES 6% 20 minutes prior to spinal anaesthesia. Pulse rate, systolic, diastolic and mean arterial blood pressure was recorded at an interval of every minute up to 5 minutes, every 5 minutes up to 60 minutes duration. **Results:** The incidence of hypotension was 86% in CRL-Group, and 6% in COL-Group, which was statistically significant. The Mephenetermine bolus requirements were less in COL-Group (3 of 50 patients) when compared to CRL-Group (43 of 50 patients). None of them have allergic reactions in COL-Group. **Interpretation and Conclusion:** It was observed from our study that 6% HES group reduces incidence of hypotension after subarachnoid block, thus requiring lesser mean dose requirements of Mephenetermine when compared to Ringer's lactate group. 6% HES is effective and safer when compared with Ringer's lactate in preventing hypotension in patients undergoing surgeries under SAB. In conclusion we found that colloids when compared with crystalloids reduce the incidence of spinal anaesthesia induced hypotension.

**KEYWORDS :** Hypotension, Preloading, Colloids, 6% HES, Ringer's lactate, subarachnoid block

### INTRODUCTION

Hypotension has an incidence of 15% to 33% and is one of the most common side effects of spinal anaesthesia(1). The administration of large volumes of intravenous fluids before spinal anaesthesia to prevent hypotension has become routine practice( 2). However, the efficacy of fluid administration before spinal block has been tested mostly in obstetric patients(3), only a few studies have evaluated the value of fluid administration before spinal anaesthesia in general surgical patients. Giving crystalloids intravenously before spinal anaesthesia has been traditionally practiced to reduce the incidence of hypotension(4). Crystalloid solutions have a short intravascular half-life and are poor plasma volume expanders, so hypotension associated with spinal anaesthesia may not be completely eliminated by crystalloid preloading. Colloid solutions which remain in the circulation for a longer period seem to be an effective alternative. Some authors have observed improved haemodynamic effects during spinal anaesthesia after the administration of colloid solutions. However, the ideal fluid regimens scheduled for spinal anaesthesia is controversial. Moreover, with increasingly available various colloid solutions, attention need to be given to the different properties of these colloids. This study is made to compare the efficacy of Hetastarch (6%) and Ringer's lactate in preventing the incidence and severity of hypotension and maintaining haemodynamic status in patients undergoing surgeries under spinal anaesthesia.

### AIMS AND OBJECTIVES

1. To compare the preloading efficacy of Ringer's lactate solution at 20 ml/Kg body weight and Hydroxyethyl (6% solution) starch at 10 ml/ kg bodyweight for prevention of hypotension following subarachnoid block.
2. To study the allergic reactions of hydroxyethyl starch.

### Methodology

This study was a prospective comparative study done in the Department of Anaesthesiology in a tertiary care centre over a period of one year. All the patients between 20 to 60 years of

age, weighing 40 to 80 kgs, who meet American Society of Anaesthesiologists Physical Status grade-I scheduled for various elective operations in supine position under spinal anaesthesia were included in the study after taking Institute ethical committee clearance and written informed consent from patients. Patient with contraindication for spinal anaesthesia and patients with severe cardiovascular, respiratory and central nervous system disorders were excluded from the study. The patients were randomly allocated into two groups. CRL-Group: received Ringer's lactate. COL-Group: received HES 6% 20 minutes prior to spinal anaesthesia. The sample size of the study was 50 patients in each group. Preanaesthetic check-up was done and patient was reviewed one day prior to the surgery. On the day of surgery, Anaesthesia machine was checked. Appropriate size endotracheal tubes, working laryngoscope with 3 and 4 size blades, stylet and working suction apparatus were kept ready. Emergency drug tray was kept ready. Patient was seen in premedication area and peripheral intravenous line with 18 gauge cannula was secured in one of the upper limb as per surgical site. Then patient was shifted to operating theatre (OT). In the OT standard monitors were attached(5 lead ECG, Non Invasive blood pressure and Pulse Oximetry). Baseline heart rate, O<sub>2</sub> saturation and blood pressure were recorded. All patients were pre-medicated with injection Midazolam 1mg. The patients were allocated in one of the groups by lot method. CRL-Group received crystalloid Ringer's lactate and COL-Group received colloid 6% Hydroxyethyl starch. Volume infusion was determined according to body weight. Patients in CRL-group received Ringer's lactate at 20 ml/ Kg and patients in COL-group received 6% Hydroxy Ethyl starch at 10 ml/ Kg. Both these solutions will be infused over a period of 20 minutes before performance of subarachnoid block. After pre-loading, all patients received Ringer's Lactate as maintenance fluid at the rate of 2ml/kg/hr. Under aseptic precautions lumbar puncture at L3-L4 interspace was performed with 23 G Quincke Babcock needle through midline approach with patient in right lateral or left lateral decubitus position. After free flow of

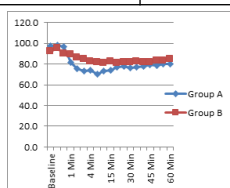
CSF, 2.5-3.5 ml of 0.5% Injection Bupivacaine heavy was injected and patient was turned to supine position. Blood pressure and heart rate were recorded at an interval of every minute for 5 minutes, every 5 minutes for next 60 minutes. Sensory level of blockade was checked after 5 minutes. Hypotension was considered as a decrease in the systolic blood pressure by more than 25% from the baseline level. Hypotension occurring within 15 minutes of subarachnoid block was managed with IV fluids or Mephentermine sulphate. Bradycardia (Heart rate less than 60/min) was managed with intravenous injection Atropine 0.6 mg. Data was recorded on a pre-designed proforma and analysed using SPSS software. p value<0.001 was considered statistically significant.

**OBSERVATION AND RESULTS**

It was observed that both groups were comparable with respect to age ,gender and weight. The baseline heart rate and systolic blood pressure was compared between both groups and was found not statistically significant. It was found that there was slight increase in the pulse rate in both the groups after preloading. However, heart rate change after 5, 10, 15 minutes was not statistically significant. There was no significant difference between the baseline systolic blood pressure of the two groups. After giving spinal anaesthesia, between 1st to 15<sup>th</sup> minutes, the fall in systolic blood pressure in CRL-Group was greater than that in COL-Group and it was statistically significant. There was no significant difference between the baseline Diastolic blood pressures of the two groups . After giving spinal anaesthesia, the fall in diastolic blood pressure in CRL-Group was greater than that in COL-Group and which was statistically significant. There was significant change in mean arterial pressure in the two groups from one minute after subarachnoid block. In the CRL-Group ,out of 50 patients 43 patients required mephentermine and 29 out of 43(86%) patients required repeat doses. In the COL-Group 3 out of 50(6%) patients required mephentermine and none of them required repeat dose.

**Table: Comparison of Diastolic Blood Pressure(DBP) between group at different interval of time**

TIME	MEAN DBP (CRL group)	MEAN DBP (COL group)	p value
Baseline	80.2	77.8	0.085
Before SAB	79.4	77.3	0.144
0min	76.5	72.6	0.063
1min	65.9	71.5	0.013
2min	58.6	68.8	0.000
3min	55.5	64.7	0.000
4min	55.6	64.7	0.000
5min	53.1	63.8	0.000
10min	56.5	62.5	0.025
15min	56.7	65.0	0.000
20min	58.7	64.2	0.010
25min	58.9	65.4	0.000
30min	59.0	63.9	0.005
35min	59.2	65.6	0.000
40min	59.4	66.2	0.000
45min	60.8	66.2	0.001
50min	59.7	66.1	0.000
55min	60.7	66.4	0.001



**Figure: Comparison of Mean arterial pressure between groups at different intervals of time**

**DISCUSSION AND CONCLUSION**

Subarachnoid block is the more commonly administered procedure for pelvic, lower abdominal and lower limb procedures. Hypotension during subarachnoid block is because of sympathetic blockade which causes relative hypovolemia and decreased venous return. The prophylactic administration of crystalloid before regional anaesthesia has been shown to be ineffective in eliminating spinal anaesthesia-induced hypotension. A colloid solution remains in the intravascular compartment for a longer period. We have conducted a comparative study of preloading efficacy of 6% hydroxyethyl starch and Ringer's lactate in prevention of hypotension following subarachnoid block. Incidence of hypotension has been found to be in 86% in patients of CRL-Group (Ringer's lactate group) and 6% in patients of COL-Group (Hydroxy ethyl starch group), and there is statistically significant fall in blood pressure in CRL-Group than in COL-Group. Also the dose of mephentermine required was less in the colloid groups compared to the ringer lactate group. In CRL-Group, out of 50 patients 43 patients required treatment with mephentermine and 29 out of 43 patients required a repeat bolus. In COL-Group 3 patients required treatment with mephentermine and none of these patients required a repeat bolus which was statistically significant. These findings are consistent with the findings of others who have compared colloid and crystalloid preloading prior to spinal anaesthesia. Riley et al(1995)(5) conducted a study to determine whether preoperative administration of 6% hydroxyethylstarch decreases the incidence and severity of hypotension after spinal anaesthesia for elective caesarean section. 40 non labouring ASA grade I and II women having non urgent caesarean section were randomized to receive either 500 ml of 6% HES plus one litre of ringer lactate (n=20), or two litre of ringer lactate prior to induction of spinal anaesthesia. Hypotension occurred in 45% of patients who received HES Vs 85% of those who received only ringer lactate (p<0.05) and minimum systolic blood pressure was lower in the ringer lactate group than in the HES group. In addition, the ringer lactate group had a higher maximum heart rate, a shorter mean time to hypotension and required more 5 mg doses of ephedrine for treatment of hypotension than HES group. They concluded that 6% of HES plus ringer lactate is more effective than ringer lactate alone. Sharma et al(6) found that intravenous infusion of 500 ml of 6% hetastarch is more effective than 1000 ml of lactated Ringer's solution in attenuating spinal anaesthesia induced hypotension in women undergoing postpartum tubal ligation. Incidence of hypotension was 52% in the lactated Ringer's solution and 16% in the hetastarch group. Karinen et al(7) study in 1995 aimed to compare the effect of Ringer's lactate and Hydroxyethyl starch preloading on the haemodynamic state during spinal anaesthesia on patients undergoing caesarean section. The study showed high incidence of maternal hypotension in the crystalloid (62%) group as compared to the colloid group (38%). 5 patients developed bradycardia and were treated with Atropine 0.6 mg i.v. We did not come across any allergic reactions to hydroxyethyl starch .We found that hydroxyethyl starch is superior to Ringer's lactate solution in prevention of hypotension following subarachnoid block. Incidence of hypotension in hydroxyethyl starch group is significantly decreased but not completely eliminated.

**Conflict Of Interest:**None

**REFERENCES**

1. Carpenter RL, Caplan RA, Brown DL, Stephenson C, Wu R. Incidence and risk factors for side effects of spinal anaesthesia. *Anesthesiology* 1992; 76: 906-16.
2. Covino BG, Scott DB, Lambert DH. Handbook of spinal anaesthesia and analgesia. Philadelphia: WB Saunders, 1994.
3. Murray AM, Morgan M, Whitwam JG. Crystalloid versus colloid for circulatory preload for epidural caesarean section. *Anaesthesia* 1989; 44:463-6.
4. Rout CC, Rocke DS, Levin J, Gouws E, Reddy DA. A reevaluation of the role of crystalloid administration for the prevention of hypotension associated with spinal anaesthesia for elective cesarean section. *Anesthesiology* 1993; 79:262-9.

5. Riley ET, Cohen SE, Rubenstein AJ, Flanagan B. Prevention of hypotension after spinal anaesthesia for Cesarean section: Six percent hetastarch versus lactated Ringer's solution. *Anesth Analg* 1995; 81: 838-842.
6. Sharma SK, Gajraj NM, Sidwai JE. Comparison of hypotension during spinal anaesthesia: A comparison of Hetastarch versus lactated Ringer's solution. *Anesth Analg* 1997; 84: 111-114.
7. Karinen J, Rasanen J, Alahuhta S, Jouppila R, Jouppila P. The effect of crystalloid and colloid preloading on uteroplacental and haemodynamic state during spinal anaesthesia for caesarean section. *British Journal of Anaesthesia* 1995; 75: 531-535.