

**COMPARISON OF CRYSTALLOID VS COLLOID AS PRELOADING SOLUTION IN PREVENTION OF SPINAL INDUCED HYPOTENSION DURING LSCS**Shridhar N. Ekbote<sup>1</sup>, Nandan Padashetty<sup>2</sup>, A. Srinivasa Murthy<sup>3</sup>**HOW TO CITE THIS ARTICLE:**

Shridhar N. Ekbote, Nandan Padashetty, A. Srinivasa Murthy. "Comparison of Crystalloid vs. Colloid as Preloading Solution in Prevention of Spinal induced hypotension during LSCS". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 13, March 31; Page: 3299-3305, DOI: 10.14260/jemds/2014/2284

**ABSTRACT: BACKGROUND:** Preferred technique of anesthesia for caesarean section is spinal anesthesia and the commonest complication of this technique is hypotension. Because hypotension is associated with increased morbidity and mortality in the fetus as well as in the mother, several modalities have been recommended to bring down its incidence. Volume preloading 15-20min before spinal anesthesia is commonly practiced one. Among the different fluids available, commonly used for preloading are crystalloids and colloids. Many studies have been done to evaluate the efficacy of different fluids for preloading. Many investigators have found that colloids are superior to crystalloids for preloading. In this context, this study was designed to test the hypothesis that colloid preloading is associated with less hypotension than crystalloid preloading. **AIM:** To compare the efficacy of RL with Pentastarch 6% as preloading fluid in prevention of spinal induced hypotension in caesarean section patients. **METHODOLOGY:** Two groups, group I and group II comprising of 30 parturients each, belonging to ASA I and ASA II coming for elective caesarean section under spinal anesthesia were selected. Parturients in group I were preloaded with 1L of Ringer's lactate solution whereas those in group II were preloaded with 500 ml of Pentastarch 6% solution. After institution of spinal anesthesia with 2 ml-2.2ml of hyperbaric Bupivacaine using 25G Quincke's needle, patient's blood pressure and other vital parameters were monitored intraoperatively every 2 min for first 20 min and then every 5 min till the end of surgery and results were subjected to statistical analysis. **RESULTS AND CONCLUSION:** Parturients who were preloaded with Pentastarch 6% had less hypotension than those preloaded with RL. We concluded that colloids are better preloading agents than crystalloids for control of spinal induced hypotension in caesarean section patients. **KEYWORDS:** Caesarean section, spinal anesthesia, hypotension, fluid preloading, crystalloids, colloids.

**INTRODUCTION:** Nowadays, delivery by caesarean section has become increasingly common for various reasons. Spinal anesthesia appears to be the preferred technique of choice.<sup>1</sup> It is preferred over general anesthesia due to its simplicity and reliability but can cause severe hypotension due to higher level of sympathetic blockade. As hypotension is associated with increased morbidity and mortality, its prevention is of utmost importance especially in pregnant population as the life of mother as well as fetus is at risk.<sup>2</sup>

Several techniques and methodologies like trendelenburg position, left uterine displacement, prophylactic vasoconstrictor, fluid preloading etc. have been recommended for the prevention and treatment of hypotension caused by spinal anaesthesia.<sup>3-6</sup>

Volume preloading, the acute administration of fluid bolus to optimize the blood volume before institution of spinal anesthesia, has been widely practiced one. Both crystalloids as well as colloids have been used for volume preloading. Several studies have revealed that colloids are

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superior to crystalloids in prevention of spinal induced hypotension.<sup>7-14</sup> Our present study has been designed to test this hypothesis.

**MATERIALS AND METHODS:** After obtaining approval from ethics committee and informed written consent from the patients, two groups, group I and group II, each comprising of 30 parturients coming for elective caesarean section were formed. Pregnant patients between the age group of 18years to 40years, similar in demographic characteristics, with no co-morbid conditions belonging to ASA I and ASA II, having singleton pregnancy, posted for elective caesarean section were included in the study. Patients with history of hypertension, CCF, diabetes mellitus, asthma, psychiatric illness, those on medications, those having contraindications for spinal anesthesia and those not giving consent were excluded from our study.

After overnight fasting, all the parturients were premedicated with inj. Rantac 50mg i.v. 1 hour before surgery. On O.T. table, Patients basal vital parameters were recorded preoperatively using multiparameter monitor. Patients in group I were preloaded with 1L of ringer's lactate solution where as those in Group II were preloaded with 500ml of Pentastarch six percent solution over a period of 15-20 min before spinal anesthesia. Spinal block was instituted with 25G Quincke's spinal needle at the level of L3-L4 or L4-L5 using 2 to 2.2ml of Bupivacaine 0.5% heavy. Patients were positioned supine with lateral tilt. After obtaining adequate level of block, surgery was performed. All the parturients were given O<sub>2</sub> by facemask at 5L/min throughout the surgery.

Heart rate and blood pressure were recorded every 2 min for the first 20 min then every 5 min till the end of surgery. ECG and SpO<sub>2</sub> were monitored continuously. In addition to vital parameters, height of the block, amount of i v fluids used, amount of Ephedrine needed, episodes of nausea or vomiting and any allergic reactions to I.V fluids were recorded. APGAR scores at birth, at 1min, and at 5min were recorded to assess fetal outcome. We have considered fall in systolic blood pressure to less than 20 % of the basal value as hypotension. Any hypotensive episodes were treated using 5mg Ephedrine I.V and additional infusion of I.V fluids. Data collected were subjected to statistical analysis using statistical softwares namely SPSS, MedCalc etc. Any p-value less than 0.05 (p<0.05) was taken as significant.

**RESULTS:** Demographic characteristics: Age, height, and weight of parturients in both the groups were comparable as seen from Table 1.

BASIC CHARECTERISTICS	GROUP I	GROUP II
AGE in years	24.10 ± 4.35	24.13 ± 3.51
WEIGHT in kgs	64.47 ± 3.71	64.43 ± 2.74
HEIGHT in cms	157.95 ± 3.67	157.17 ± 2.90

**Table 1: Comparison of demographic characteristics between the 2 groups**

The age of parturients ranged between 18 and 40 years. The mean age in group I was 24.10 years with SD 4.35 and that in Group II was 24.13 years with SD 3.51. The mean weights in group I and Group II were 64.47 kgs (SD 3.71) and 64.43 (SD 2.74) kgs respectively. The height of the parturients ranged between 152 cms-165 cms. The mean height in Group I and Group II were respectively 157.95 cms (SD 3.67) and 157.17 cms (SD 2.90). Hence, age, height and weight were comparable in both the groups and were found to be statistically insignificant.

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**INCIDENCE OF HYPOTENSION:** The incidence of hypotension in parturients in Group I and Group II were 60% and 33% respectively and were found to be statistically significant with  $p=0.0346$ .

INCIDENCE OF HYPOTENSION	GROUP I	GROUP II	TOTAL
ABSENT	12(40%)	20(66.67%)	32
PRESENT	18(60%)	10(33.33%)	28
<b>Total</b>	<b>30</b>	<b>30</b>	<b>60</b>

**Table 2: Comparison of Incidence of hypotension between two groups**

(The one tailed p-value equals 0.0346. The association between groups and outcomes is considered to be statistically significant.)

**EPHEDRINE REQUIREMENT:** The requirement of Ephedrine was more in Group I than in Group II as seen from the following Table no. 3 with  $p=0.6$ .

REQUIREMENT OF EPHEDRINE	GROUP I	GROUP II
Not Required	12(40%)	20(66.7%)
Required	18 (60%)	10(33.3%)
5mg	09(50%)	6(60%)
10mg	09 (50%)	3(30%)
20mg		1(10%)
Total	135mg	80mg
Mean $\pm$ SD	7.5 $\pm$ 2.57	8.0 $\pm$ 4.83

**Table 3**

**DISCUSSION:** Spinal anesthesia is widely used anesthesia technique for caesarean sections as it is simple to perform, safe, and highly reliably.<sup>1</sup> But it can produce severe hypotension secondary to the sympathetic blockade leading to vasodilatation and peripheral pooling of blood causing decreased venous to heart and decreased cardiac output. The resultant hypotension ultimately affects the maternal and fetal wellbeing.<sup>2</sup> To have better maternal and fetal outcome, hypotension has to be prevented. Several investigators have recommended different methods to minimize the hypotensive effects of spinal anesthesia with varying degree of success. One of the most commonly used method is administration of intravenous fluids prior to spinal anesthesia, a technique called preloading with the hope that this will offset the vasodilatory effects of spinal induced sympathectomy.

In 1968, Wollman and Marx<sup>6</sup> done a study to assess the efficacy of pretreatment of parturients with 1L of 5% Dextrose in Ringer's lactate solution administered 30min before spinal block on incidence of spinal hypotension. Study has revealed that preloading has beneficial effect on the incidence of spinal hypotension. Similarly, Lewis et al<sup>15</sup> in 1983 conducted a study to test the efficacy of 2L of Hartman's solution as preload and found that fluid preloading is safe and effective method of reducing spinal induced hypotension in caesarean patients.

After viewing hypotension as persistent problem, Clark et al<sup>4</sup> in 1976 studied the effect of combination of preloading and left uterine tilt on spinal induced hypotension and learnt that spinal hypotension can be greatly reduced by either preloading alone or in combination with left uterine tilt. Mathru et al<sup>16</sup> found no hypotension when patients were treated with 15 ml/kg of 5% albumin in

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ringer's lactate solution before spinal anesthesia. Contrary to the above findings, few investigators have discovered no benefit by volume preloading in caesarean patients. Rout et al<sup>17</sup> in 1992 demonstrated that rapid crystalloid preloading has no beneficial effect on spinal induced hypotension in parturients. Similarly, Husaini and Russell<sup>18</sup> in 1998 found that crystalloid preloading has failed to decrease the incidence of spinal induced hypotension in caesarean section patients.

This may be due to the fact that the crystalloid solutions used for preloading may remain in the circulation for short period due to rapid redistribution into extra vascular spaces. They do not thus expand the volume in the real sense. This has prompted many investigators to think of other fluids like colloids and albumin for preloading. Several studies have been done and are being done to evaluate the efficacy of colloids in bringing down the incidence of spinal induced hypotension in parturients.

Many investigators have found that colloid preloading offsets hypotension and hypervolemia more effectively than the crystalloid solutions. This is because colloid solutions contain larger molecules that stay in vascular compartment for longer duration and help maintain stable hemodynamics. The plasma oncotic pressure remains stable with colloid preloading whereas crystalloid preloading decreases it significantly. This is evident from a scientific study by Wennberg et al<sup>19</sup> which reports that plasma oncotic pressure decreased by only 1.7mm Hg after preloading with 3% Dextran 70 before epidural anesthesia for caesarean section, compared with a 5.6 mmHg decrease following preloading with RL.

In our current study, the incidence of hypotension was found to be low in patients who received six percent Pentastarch solution as preload compared to patients who received ringer's lactate solution as preload.

In Pentastarch group, 67% had no hypotension where as in crystalloid group 40% had no hypotension. This difference was found to be statistically significant.

The results in our study are similar to those obtained by other various authors. Hallworth et al<sup>7</sup> in 1982 showed that the incidence of spinal induced hypotension was only 5% following preloading with of 500ml of polygelatin in 500ml of Hartmann's solution compared to preloading of 1L of Hartmann's solution. We also had similar incidence of hypotension in crystalloid group but in colloid group the incidence is comparatively more in our study. This may be due to difference in the amount and composition of the preload.

Karinen et al<sup>8</sup> in 1995, in his study, compared the effect of 1L of crystalloid preloading with that of 500ml of colloid preloading on maternal hemodynamics during spinal anesthesia for caesarean section. They found that the incidence of hypotension in crystalloid group is 62% whereas that in the colloid group is 38% which is very much similar to the results obtained in our study.

French et al<sup>10</sup> in 1999 similarly compared the effect of preloading of 15ml/kg of 10% pentastarch with that of Hartmann's solution and found that significantly more number of patients in Hartmann's group (47.5%) developed the hypotension than in the pentastarch group (12.5%). They concluded that starches may be suitable for preloading in parturients and provide an alternative to the aggressive use of vasoconstrictors.

It was revealed from a study by Lin et al<sup>11</sup> in 1999 that the incidence of hypotension and requirement of Ephedrine were significantly more in RL group than in Dextran group.

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Bhagwanjee et al<sup>20</sup> in 1990 and Van Bogaert<sup>21</sup> in 1998, separately found that leg wrapping can be used to reduce spinal induced hypotension significantly. But leg wrapping has its own disadvantages.

Kang et al<sup>5</sup> proved that infusion of ephedrine is superior to bolus doses in maintaining blood pressure in parturients after spinal anesthesia but the use of vasopressors can jeopardize fetal wellbeing as evident from a study by Alahuhta et al.<sup>22</sup>

During the study, we have treated hypotension initially with head low tilt and then if not corrected 5mg Ephedrine boluses. Even though amount of vasopressor used to treat hypotension was found to be more in Group I (135mg) compared to Group II (80mg), it was not found to be statistically significant with  $p=0.6$  and this can be further improved probably by increasing volume of colloid infused. Other factors which can influence the incidence of hypotension, like amount of intraoperative blood loss and intraoperative fluids used also studied and were found to be comparable in both the groups.

The parameters like age of the patients, weight and height, dosage of local anesthetic used and level of spinal block obtained were intentionally kept comparable in both the groups to avoid these factors influencing our study. Neonatal outcome was found to be good and comparable in both the groups. Three patients in group I and 4 patients in Group II had vomiting and were treated with Ondansetron 4 mg i.v. Shivering was present in 3 patients in group I and 5 patients in Group II and were treated with conventional methods.

**CONCLUSION:** It can be concluded that prevention of spinal induced hypotension in parturients to avoid its deleterious effects on both the mother and fetus can be attempted using simpler and safer methods like volume preloading. Among preloading agents, colloids are superior to crystalloids in reducing the incidence of spinal induced hypotension. Pentastarch appears to be the ideal preloading agent because its duration of plasma volume expansion matches with the duration of spinal anesthesia and also because of its safety profile.

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Date of Submission: 01/03/2014.  
Date of Peer Review: 03/03/2014.  
Date of Acceptance: 14/03/2014.  
Date of Publishing: 25/03/2014.