

## ORIGINAL ARTICLE

### COMPARISON OF CRYSTALLOID PRELOADING AND CRYSTALLOID COLOADING IN EMERGENCY CAESAREAN SECTION FOR FETAL DISTRESS: A PROSPECTIVE STUDY

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**ABSTRACT:** Spinal anesthesia is widely used for emergency and elective C/S delivery. However its main drawback is hypotension which may cause nausea, vomiting and cardiovascular collapse and loss of consciousness in mother as well as fetal hypoxia and acidosis due to placental hypo perfusion.

**AIMS AND OBJECTIVE:** To compare the incidence of hypotension in intraoperative period and to compare the fetal outcome in two groups (Preloading and co loading group). **STUDY DESIGN:** Prospective randomized double blind study. **MATERIALS AND METHOD:** This study was conducted in the obstetric emergency OT of Malda Medical College. 100 primi gravid mothers aged between 18-29 years with ASA-1 physical status posted for emergency C/S for fetal distress was randomly allocated for either preloading (Group P) or co loading (Group C). **RESULT AND ANALYSIS:** Fluid requirement is significantly less in group C. There was no significant difference in the incidence of hypotension and ephedrine use. Fetal outcome in 1 min Apgar score in group C is significantly better as the baby could be delivered quickly in group C. **CONCLUSION:** Our study revealed that preloading can be safely avoided for spinal anesthesia in C/S for fetal distress. By using co loading method we can save valuable time required to deliver the baby and avoid circulatory overload without increasing the incidence of hypotension.

**KEYWORDS:** Caesarean section, co loading, fetal distress, hypotension, preloading, spinal anesthesia.

**INTRODUCTION:** Spinal anesthesia is widely used for emergency and elective C/S and has become the method of choice of anesthesia for C/S because of higher maternal morbidity and mortality associated with general anaesthesia.<sup>1</sup> Beside being economical the advantages include rapid onset of action, better quality of sensory and motor block, ease of administration compared to epidural anesthesia and avoiding complications and risks associated with general anesthesia like failed intubation, risk of aspiration of gastric contents, depressant effects of general anesthesia on neonates.

It has been shown to block the stress response to surgery, decrease the intraoperative blood loss, decrease incidence of postoperative thromboembolism and reduce the risk of mortality and morbidity associated with high risk patients.<sup>2</sup> However spinal anesthesia is not without disadvantages. It is associated with hypotension which is more common and profound in pregnant population. Preloading with crystalloids before spinal anesthesia has been widely practiced to prevent intraoperative hypotension by anaesthesiologist.<sup>3</sup> This practice often hinders immediate administration of spinal anesthesia even in emergency C/S posted for non-reassuring fetal status commonly known as fetal distress.

The wastage of time for preloading may further jeopardize the fetus or it may compel the anesthesiologist to go for general anesthesia which is known to have higher incidence of morbidity

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and mortality for mother and fetus.<sup>4-6</sup> On the other hand hypotension associated with spinal anesthesia may impair the uteroplacental circulation which may also jeopardize fetal oxygenation.<sup>7</sup> For the last two decades the concept of co loading (Infusion of fluid at the time of administering spinal anesthesia) has come to vogue and several studies both in pregnant and non-pregnant population were done.<sup>8,9</sup> In our study we have compared crystalloid preloading and crystalloid co loading in emergency C/S for fetal distress. The study was conducted to compare the incidence of hypotension intra operatively and fetal outcome in two groups.

**MATERIALS AND METHODS:** After taking ethical committee clearance and informed patient consent the study was conducted in the emergency obstetric OT of Malda medical college. 100 primi gravid patients of age group 18-29 belonging to ASA-1 physical status posted for emergency C/S for fetal distress were randomly allocated in two groups- Group P (Preloading group) and Group C (co loading group).

### **Inclusion Criteria:**

1. Term pregnant patients (gestational age between 37 completed weeks to 42 weeks with cephalic presentation).
2. Clinical evidence of fetal distress<sup>10</sup>
  - a) FHR > 160/min or < 110/min.
  - b) FHR takes long time to come back to baseline after contraction phase passes off.
  - c) Irregular heartbeat.
  - d) Meconium stained liquor.

### **Exclusion criteria:**

- a) IUGR baby.
- b) Medical or surgical complications of mother.
- c) Absolute or relative contraindication of spinal anesthesia.
- d) If the patient develops PPH.

Baseline heart rate, blood pressure (NIBP) and SPO<sub>2</sub> were measured after transferring the patient to Operation Theater in a modified supine position with at least 15° left lateral tilt. One 18G cannula was inserted to all the patients and infusion of Ringers Lactate (RL) was started. Patients belonging to Group P received RL at a rate of 15 ml/kg over 20 minutes prior to administering spinal anesthesia (Preloading). Patients in Group C received same infusion at a rate of 20 drops/min prior to spinal anesthesia just to make the cannula patent. Group C patients received 15ml/kg over 20 minutes after administering spinal anesthesia (co loading) and 20ml/min after 20 minutes.

Group P patients received RL at the rate of 20ml/min after spinal anesthesia was administered. Infusion RL was continued at the rate of 20 ml/min up to 1 hour after starting the operation in both the groups and then reduced to 10ml/min if operation is continued beyond 1 hour. Administration of preoperative and intraoperative fluid was managed and monitored by a dedicated anesthesiologist. A second anesthetist who was unaware of patient preloading status administered spinal anesthesia and recorded the intraoperative vital status, the incidence of hypotension, bradycardia, hypoxia and fetal outcome etc.

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Hyperbaric 0.5% Bupivacaine was injected intrathecally between L<sub>3-4</sub> or L<sub>4-5</sub> interspace with patient in sitting position at the dose of 0.25mg/kg body weight up to maximum total dose of 15 mg with 25G Quinke needle. The patient was then turned rapidly to modified supine position. The extension of spinal anesthesia was assessed by cold temperature discrimination using wet cotton balls<sup>11</sup>. Oxygen at the rate of 2l/min was given to all patients via nasal prong till the delivery of the baby. Continuous monitoring of heart rate and SPO<sub>2</sub> was done. SBP and DBP at 2min, 4 min, 6 min, 8 min, 10 min, 15 min, 20 min, 25 min and 30 minutes were recorded and used for data analysis.

All blocks extended to above T<sub>6</sub> level before surgery was allowed to start. Spinal induced hypotension (SIH), cardiovascular side effects (CVSE) and the condition of the baby were the main study outcome. SIH was defined as a decrease of > 30% in systolic blood pressure (SBP) or SBP < 90 mm of Hg.<sup>9, 11, 12</sup> CVSE were defined as SIH plus clinical symptoms of nausea, vomiting or faintness.<sup>13</sup> At the beginning of the procedure patients were instructed to report any episode of nausea, vomiting or faintness occurring during the procedure. Patients were unaware of what treatment they had received.

All patients develop SIH and CVSE were treated with 200 ml of bolus Ringer Lactate followed by 6 mg of bolus Ephedrine. After 3 minutes if the SBP does not increase further dose of ephedrine (3 mg) was repeated after 5 minutes if deemed necessary.<sup>14</sup> Bradycardia was defined as heart rate < 60/min and treated with 0.6mg of atropine. Additional dose of 0.3 mg was repeated after 2 minutes if necessary. Maximum height of block was identified during the procedure. Time of intrathecal injection and surgery, uterine incision and delivery, block and delivery, incidence of SIH and CVSE were noted. Total dose of vasopressor received and Apgar score of baby at 1 and 5 minutes were recorded. All patients received 10 units of injection oxytocin after delivery of the baby.

All values were expressed as mean±SD. Results were analyzed by unpaired t test for parametric data and Mann Whitney U test were used for non-parametric data. Fisher's exact test and Chi square test were used for categorical data as appropriate. P value < 0.05 was considered statistically significant.<sup>15</sup>

### RESULT AND OBSERVATION:

	Group P (n=50)	Group C (n= 50)	P value
Age in Years	21.6±3.1	21.1±3.2	>0.05
Weight in kgs	53.7±5.3	56.6±6.7	>0.05
Height in cms	63.4±7.4	65±8.4	>0.05
Block delivery interval (Minute)	12.6±3.5	13.1±4.2	>0.05
Uterine incision delivery interval (Minute)	38.5±9.5	36.8±8.9	>0.05
Duration of surgery (Minute)	48.6±8.5	46.9±7.9	>0.05
Level of block	T <sub>5</sub>	T <sub>5</sub>	>0.05

**TABLE 1: Maternal characteristic and operative details**

The two groups were compared in age, weight, height, duration of surgery and level of block. There is also no significant difference in uterine incision and delivery interval and block delivery interval among the groups.

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	Group P(n=50)	Group C(n=50)	P value
Preload volume(ml)	805.45±79.7	10.3±7.5	<0.05
Intraoperative fluid(ml)	1053.56±57.80	1456.39±78.90	<0.05
Dose of ephedrine(mg)	7.6±2.5	8.1±2.7	>0.05
Total fluid requirement till the end of surgery(ml)	1859.01±60.67	1466.89±68.71	>0.05

**TABLE 2: Fluid and Ephedrine Administration**

This table shows that though intraoperative fluid requirement is more in Group C, total amount of fluid received by Group C is significantly less compared to Group P. But there is no significant difference in the total dose of ephedrine administration in the two groups.

	Group P(n=50)	Group C(n=50)	P value
No. of patients became hypotensive	17	16	>0.05
Total episode of hypotension	24	22	>0.05
CVSE	13	11	>0.05
No of episode of hypotension requiring ephedrine bolus	21	20	>0.05
No of hypotension requiring second dose of ephedrine	6	7	>0.05
No of patients having bradycardia	8	7	>0.05

**TABLE 3: Intraoperative hypotension and bradycardia**

Table 3 shows that there is no significant difference in the number of patients become hypotensive, episodes of hypotension, bradycardia and ephedrine requirement. 4 patient of Group P and 5 patients of Group C received injection ondansetron 4mg i.v. for nausea and vomiting. Other patients developing CVSE responded well with correction of blood pressure.

	Group P(n=50)	Group C(n=50)	P value
Apgar score at 1minutes	7.6±0.76	8.8±0.28	<0.05
Apgar score < 7 at 1 minutes	14	5	<0.05
Apgar score at 5 minutes	9.21±0.19	9.32±0.18	>0.05
Apgar score < 7 at 5 minutes	3	2	>0.05

**TABLE 4: Neonatal outcome**

Fetal outcome in 1 minute Apgar is significantly better in group C and significantly less no of babies of Group C had 1 min Apgar score less than 7 but no significant difference in both the groups at 5 minutes Apgar score.

	Pre operative	0 min.	2 min.	4 min.	6 min.	8 min.	10 min.	15 min.	20 min.	25 min.	30 min.
Group P (n=50)	131.43 ±6.34	134.67 ±5.69	130.46 ±6.59	126.70 ±7.44	120.56 ±9.81	116.45 ±10.37	114.12 ±9.72	107.48 ±8.95	108.65 ±11.67	109.76 ±9.45	113.68 ±7.89
Group C (n=50)	130.47 ±8.69	130.56 ±8.97	126.78 ±8.36	122.78 ±9.45	118.67 ±8.34	115.67 ±11.45	112.76 ±10.67	116.65 ±8.78	116.65 ±10.67	118.75 ±8.67	117.65 ±9.76
P value	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

**TABLE 5: Intraoperative Systolic Blood Pressure (SBP)**

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Intraoperative SBP change: There is no significant difference in SBP among the two groups except at 15 minutes, 20 minutes and 25 minutes when SBP in Group c is significantly higher than Group P.

	Pre-operative	0 min.	2 min.	4 min.	6 min.	8 min.	10 min.	15 min.	20 min.	25 min.	30 min.
Group P (n=50)	83.87 ±5.78	84.94 ±6.23	81.46 ±6.79	78.34 ±6.29	76.87 ±6.21	72.63 ±5.15	70.12 ±7.34	69.53 ±6.45	68.37 ±6.78	69.09 ±6.81	70.41 ±6.59
Group C (n=50)	82.56 ±6.73	82.75 ±6.14	78.72 ±5.06	76.82 ±5.19	73.67 ±5.97	70.61 ±6.51	68.34 ±6.59	66.54 ±6.32	66.31 ±7.34	68.16 ±5.97	70.43 ±6.10
P value	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

**TABLE 6: Intraoperative diastolic blood pressure (DBP)**

Intraoperative diastolic blood pressure change: There is no significant difference in two groups

	Pre-operative	0 min.	2 min.	4 min.	6 min.	8 min.	10 min.	15 min.	20 min.	25 min.	30 min.
Group P (n=50)	77.11 ±5.67	78.89 ±6.41	78.17 ±7.29	77.42 ±6.91	75.28 ±7.35	76.54 ±5.82	76.61 ±6.78	76.43 ±5.95	76.61 ±7.06	77.54 ±7.32	77.87 ±6.34
Group C (n=50)	75.61 ±6.43	77.83 ±8.03	76.85 ±7.98	77.11 ±7.14	77.89 ±7.82	76.11 ±6.27	75.36 ±6.21	75.71 ±6.52	77.46 ±8.38	76.68 ±7.96	75.03 ±5.97
P value	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

**TABLE 7: Intraoperative heart rate**

Intraoperative heart rate change: No significant difference was observed among two groups regarding heart rate.

**DISCUSSION:** More than 30% of the patients receiving spinal anesthesia develop SIH according to Carpenter RL, Caplan RA, Brown DL et al<sup>16</sup>. There are several methods to reduce and prevent the incidence of hypotension i.e. left uterine displacement, use of vasopressor, leg elevation, massaging of calf muscle and preloading<sup>14</sup>. Preloading with crystalloid is one of the most common techniques among the anesthesiologist to reduce the incidence of hypotension. Previous studies have used 15-20 ml/kg RL for preloading in C/S.<sup>9,17,18</sup> In our study we have preloaded our patient of Group P with 15 ml/kg of RL.

In CS of the patient with fetal distress where imminent delivery of the baby is warranted preloading may waste valuable time. As spinal anesthesia is not contraindicated and is less costly than GA, it is preferable to go for spinal anesthesia even in case of fetal distress.<sup>18</sup> Most of the studies also have shown that Apgar score of these babies delivered under spinal anesthesia is better than those delivered under general anaesthesia.<sup>5,18</sup> In rural India where most of the patients coming to Govt. hospital are below poverty line, the cost of GA is an additional financial burden on the patients.

In addition to being time consuming preloading may cause circulatory overload in pregnant mother particularly after delivery which normally manifested by raised CVP.<sup>19</sup> The extra load is not so harmful in patients with normal cardiovascular functions but may be potentially fatal in patients with myocardial insufficiency and pre eclampsia leading to pulmonary oedema.<sup>13</sup> Pregnant patients are more susceptible to pulmonary edema due to increased pulmonary capillary permeability.<sup>20</sup>

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In our study we have found no significant difference in the incidence of hypotension and CVSE among the two groups. Our observation is similar to previous studies.<sup>8, 9, 13, 19</sup> In our study though there is no statistically significant difference, the incidence of hypotension is slightly more in patients who were preloaded compared to those who were co loaded. The crystalloid fluid which was used for preloading 15-20 min before spinal anesthesia has relatively short intravascular life. Since 75% of any crystalloid diffuses into interstitial space, its efficacy in expanding plasma volume is only transient<sup>21</sup>. On the other hand when fluid was administered along with administration of spinal anesthesia (Co loading), expanded intravascular compartment is filled up as there is sympathetic block induced vasodilatation and less chance of circulatory overload. In our study we have found that in the patients who received preloading has a slight higher initial SBP than those who did not. But fall of SBP is more in patients who were preloaded. The patients who received bolus fluid after spinal anesthesia (co loading) have significantly less fall in SBP than the other group (Table-5). Our observation is similar to the observations made by Jose L et al<sup>9</sup>.

Some of the studies have shown that preloading and co loading with colloid may be of more help to reduce the incidence of SIH and CVSE but the cost of colloid and risk of anaphylactic reaction with colloid do not make it a suitable and widely acceptable alternative of crystalloids<sup>22</sup>.

Regarding the neonatal outcome, we have not found any significant difference in Apgar score of neonates at 5 minutes but there is significant difference in neonatal outcome at 1 minute Apgar score between these two groups (Table -4). Significantly more no of the babies had 1 minute Apgar score less than 7 in preloaded groups compared to co loaded group. Previous studies<sup>13, 19</sup> have found no significant difference both in 1 minute and 5 minutes Apgar score but those studies were conducted in elective C/S without fetal distress where there was no urgency to deliver the baby. In our set up it was not possible to do umbilical blood PH and blood gas analysis so we relied totally on Apgar score.

**CONCLUSION:** From our study it can be concluded preloading can be safely avoided for spinal anesthesia in C/S posted for fetal distress. By using co loading method we can save valuable time required to deliver the baby and avoid circulatory overload without increasing the incidence of hypotension. Regarding neonatal outcome 1 minute Apgar is better in co loading group.

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