

## Original Research Article

# Comparison of preload versus coload by crystalloid in parturients undergoing caesarean section under spinal anaesthesia: an analytical study

Pawan Kumar Bairwa<sup>1</sup>, Rajeev Sharma<sup>1</sup>, Dharmpal Atal<sup>1</sup>, Mahendra Kumar Verma<sup>2\*</sup>

<sup>1</sup>Department of Anesthesiology SMS Medical College and Hospitals, Jaipur, Rajasthan, India

<sup>2</sup>Department of Community Medicine RVRS Government Medical College Bhilwara, Rajasthan, India

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### \*Correspondence:

Dr. Mahendra Kumar Verma,

E-mail: [drmahendraverma89@gmail.com](mailto:drmahendraverma89@gmail.com)

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## ABSTRACT

**Background:** Spinal anesthesia is popular, simple and well accepted reliable technique for below umbilicus surgery. It is frequently used for lower segment section because of its rapid onset, a dense neural block, avoidance of risk of airway, little risk of local anesthetic toxicity and minimal transfer of drug to the fetus, as well as little risk of failure of block. Objectives of this study was to compare incidence and severity of hypotension, dose requirement of mephenetermine and maternal bradycardia, shivering, nausea, vomiting.

**Methods:** ASA grade I, II parturients posted for elective cesarean section were randomly allocated in two study groups of 55 each to receive either preload or co-load with Ringers lactate solution, blood pressure, heart rate, mephenetermine requirement and other outcomes recorded at regular interval.

**Results:** Hypotension was observed significantly less in co-loading group (37.18%) than preloading group (61.81%). Mean vasopressor requirement was also significantly more in preload group. Heart rate change, nausea, vomiting and fetal outcome remained same across both the groups.

**Conclusions:** Co-loading with crystalloids is more effective strategy than preloading in prevention of spinal induced hypotension. We can save valuable time given for preloading in case of emergency caesarean sections.

**Keywords:** Caesarean section, Crystalloid, Preload and co-load, Spinal hypotension

## INTRODUCTION

Spinal anesthesia always remained preferred technique of anesthesia for cesarean delivery over general anesthesia due to lower maternal mortality and morbidity.<sup>1</sup>

Higher incidence of hypotension is one of disadvantage of this technique that poses increased risk threat to mother and fetus, leading to maternal nausea, vomiting, dizziness, aspiration, syncope, cardiac arrhythmias and fetal hypoxia<sup>2</sup>. Hypotension following spinal is mainly occur due to sympathetic blockade leading to peripheral

vasodilation and venous pooling of blood. As a result, there is decrease venous return and cardiac output leading hypotension.<sup>3</sup> The risk of hypotension is increased in parturient due to the higher level of block (T4) required for caesarian section, unique physiological and anatomic changes of pregnancy and increased susceptibility to the effect of sympathectomy due to reduced sensitivity to the endogenous vasoconstrictors coupled with increased synthesis of endothelium derived vasodilators.<sup>4</sup>

Different methods have been tried to prevent and treat hypotension. Traditionally, pre-hydration with crystalloid

solutions is preferred for the prevention of hypotension.<sup>5</sup> Preloading with various volume of crystalloid and colloid was attempted but could not prevent the maternal hypotension reliably.<sup>6-8</sup> Recent studies demonstrated that preloading failed to prevent hypotension due to rapid redistribution among the body fluid compartments. So, trials were conducted to assess the effectiveness of co-loading i.e. rapid fluid administration at the time of giving spinal anaesthesia.<sup>9-11</sup>

The present study undertaken to compare the efficacy of crystalloid (Ringer lactate) preload versus coload for prevention of spinal induced maternal hypotension and associated outcomes in patients scheduled for LSCS under spinal anaesthesia.

**METHODS**

The observational study was carried out in the department of anesthesiology, SMS hospital and attached groups of hospital from December 2021 to January 2023. Approval of Institutional ethical committee taken. Informed written consent was obtained in patient’s language. Study included 110 parturients of ASA grade I and II, between 18-40 years scheduled for elective cesarean

Patients having hypersensitivity to local anaesthetic drugs and antepartum hemorrhage, pre-eclampsia, eclampsia, gestational hypertension, severe anaemia Excluded from the study.

All patients received pantoprazole 40 mg orally on the night before and in the morning of the day of surgery. The patients were given metoclopramide 10 mg intravenously 30 min prior to surgery. For the study, all patients were two intra venous cannulae, one for administration of fluid and the other used to give the drugs. On arrival to the operation room, non-invasive monitoring was instituted, including ECG, NIBP, SPO2 and baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) were recorded using the pulse-oximeter monitor. All patients received 10 mg (2ml) of 0.5% hyperbaric bupivacaine over 15 sec intrathecally, in the left lateral position in the L3-4 inter vertebral space with 25-gauge Quincke’s spinal needle. In Group A, the patients received 15 ml/kg of RL solution within 20min prior to subarchnoid block. The patients in Group B received 15 ml/kg of RL solution within 20min just after subarachnoid block. After the spinal injection, the patients were put in the supine position with a 15 degrees wedge under the right hip.

The sensory level was assessed using pin prick to 25G needle every 5 min till the level stabilized for at least three consecutive readings. After achieving a block height of T 5, the surgery was allowed to commence. The following parameters were recorded every 2 min after the spinal injection till the first 10 min, every 5 min till next 20 min and every 10 min thereafter till the end of the surgery: HR, SBP, DBP, MBP and SpO2.

Maternal hypotension was defined as a decrease in SBP to more than 20% of the baseline of SBP value. Hypotension was treated with crystalloid boluses and 6 mg mephentermine was given intravenously every 3 min, until the SBP recovered to the baseline value. Bradycardia was defined as a HR less than 50 beats/minute and was treated with intravenous atropine 0.6mg. The dose of mephentermine required to treat hypotension was recorded.

The study was approved by the Institutional Ethics Committee of the SMS Medical College Jaipur (SMS/IEC/1141/2021dated 01/12/21).

**Statistical analysis**

Continuous variables were summarized as mean and standard deviation, while nominal/categorical variables as percentages. Parametric tests like unpaired t test were used for analysis of continuous variables, whereas chi-square test and other non-parametric test will be used for nominal/categorical variables as per data yield. And Multivariate analysis was applied to determine the association Data analysis was conducted using SPSS-23 A p-value <0.05 was considered significant.

**RESULTS**

Both study groups were comparable with respect to age, sex, height and weight. Majority cases were of previous cesarean section suggestive of rising trend of LSCS.

**Table 1: Patients characteristics.**

Parameter	Group A	Group B	P value
Age (year)	25.7±4.4	26.5±3.69	0.331
Weight(kg)	58.7±6.12	58.14±6.24	0.610
Height (cm)	154.6±10.4	155.1±9.8	0.981

**Table 2: Baseline parameter.**

Parameter	Group A	Group B	P value
Heart rate (bpm)	89.3±5.5	88.9±4.9	>0.05
Systolic BP	122.4±7.2	120.6±6.4	>0.05
Diastolic BP	79.6±6.4	78.6±6.2	>0.05
Mean BP	92.2±3.5	93.1±2.5	>0.05

**Table 3: Perioperative adverse events.**

Parameter	Group A (%)	Group B (%)	P value
Hypotension	61.81	37.18	0.028
Nausea	27.27	16.36	0.248
Vomiting	5.45	7.27	1.000
Bradycardia	9.09	10.90	1.000
Shivering	1.81	0	1.000

Baseline heart rate, systolic bp, diastolic bp and mean bp were comparable in both groups. Duration of surgery was comparable across the group and statistically not significant. Requirement of iv fluid is higher (p-value<0.05) in group A (1634.73±104.61) as compare to group B (1595.45±94.52) and dose of mephentermine (p-value<0.05) in group A (8.45±4.86) as compare to group B (6.14±4.51) is significantly higher in group A than group B respectively.

Proportions of hypotension cases in group A are significantly higher (p<0.05) than the group B. No significant difference was found in context to side effect like Nausea, vomiting, bradycardia and shivering in between group A and Group B. This is also evident from the chi square test performed, the p-value (>0.05) showed no significant difference in proportion of side effect.

## DISCUSSION

Despite of popularity of spinal anaesthesia for cesarean sections, hypotension is most common causative factors considered are raised venous capacitance, fall in systemic vascular resistance and aortocaval compression.<sup>12,13</sup> In view of raised venous capacitance, various volumes of crystalloid and colloid solutions were infused before spinal anaesthesia to prevent subsequent hypotension.<sup>14</sup> Various strategies like left uterine displacement, preloading with crystalloids and colloids with various volumes, pneumatic tourniquet and vasopressors tried for prevention and treatment of spinal hypotension. Unfortunately, all these regimens alone were not enough for the prevention of spinal hypotension. According to Starling's law, the exchange of fluid is determined by the capillary and interstitial fluid hydraulic pressure and oncotic pressure.<sup>15</sup> The capillary hydraulic pressure increases over time during crystalloid infusion, which may lead to increased hydraulic pressure difference and fluid filtration from plasma into interstitium. Timing of crystalloid infusion plays the crucial role as it gets distributed across extracellular space into interstitial space leading to suboptimal intravascular expansion.<sup>9-11</sup> Pouta et al. described role of increased atrial natriuretic peptide.<sup>16</sup> Since natriuretic peptide type C is a potent vasodilator produced in the endothelium of great vessels.<sup>17</sup> rapid fluid administration before induction of anesthesia may exacerbate peripheral vasodilatation and facilitate fluid excretion.<sup>18</sup> There is increased risk of development of pulmonary oedema in parturients because of physiological changes in cardiovascular system during pregnancy. Although preloading group did not show sign of pulmonary oedema in our study, it might be instrumental in high-risk case such as preeclampsia and preexisting heart disease.

Aradhanadevi et al and Oh AY, et al also found incidence of hypotension was reduced significantly in the co-loading group compared with the preloading group were significantly lower in comparison to the preloading

groups which is similar to our study and requirement of no of doses and total doses of mephentermine and nausea and vomiting was low in the co-loading group compared to the preloading group.<sup>19,20</sup> Borse YM, Khan M, Rao A and Oh stating that crystalloid Co-loading is more effective than preloading for prevention of spinal induced hypotension.<sup>20-23</sup>

Verma S et al also found that co-loading i.e. hydration at the time of actual block during LSCS was more efficient in preventing hypotension following spinal anaesthesia.<sup>24</sup> It was seen that hypotensive episodes were significantly higher with preloading technique as compared to co-loading technique. However, bradycardia episodes were higher with group P as compared to group C. The side-effects of nausea and vomiting were also found to be significantly higher with preloading technique as compared to co-loading technique the use of mephentermine was significantly more in Group P (72.5%) as compared to Group C (30%). In study of I Made Artawanetal and, Bhardwaj N et al incidence of hypotension seen from a reduction in SBP, DBP and MAP decreased significantly in the co-loading group compared with the preloading and control groups need for ephedrine in the co-loading group decreased significantly compared to the preloading and control groups (p<0.001).<sup>20,24</sup>

Shingal A et al, also revealed that despite 40-70% incidence of hypotension and incidence of nausea was also less in co-load group of patients making patients more comfortable.<sup>25</sup>

## Limitation

We had used non-invasive blood pressure measurement and could not get beat to beat or every minute measurement of mother's blood pressure and others limitation also we couldn't appreciate the duration of hypertension in between episodes of hypertension.

## CONCLUSION

In conclusion, co-loading with 15 ml/kg of RL solution is more effective strategy then preloading in the prevention of hypotension in the obstetric population receiving spinal anesthesia. Valuable time need not be wasted in preloading the parturient as preloading alone is ineffective for the prevention of maternal hypotension, during cesarean section under spinal anesthesia. Frequent measurement of the blood pressure in the subjects (at 2 min intervals) for prompt recognition of hypotension and administration of vasopressors for maintaining the maternal blood pressure close to the baseline can ensure better neonatal outcome.

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