

## Crystalloid Preload Versus Crystalloid Co-load During Elective Caesarean Section Under Spinal Anesthesia

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### Abstract

**Background and Aim:** Spinal anesthesia is a preferred technique of anesthesia for pregnant women undergoing caesarean section. The major disadvantage with this technique is maternal hypotension which carries the greatest risk to mother and foetus. This study was designed to analyse various advantages and disadvantages associated with crystalloid preloading and co-loading during spinal anesthesia. **Methods:** Hundred parturients aged 20 to 40 years of physical status ASA I and II undergoing elective caesarean section under SAB were divided into two groups with 50 patients in each group. In Crystalloid Preload group, 15 ml/kg of Ringer lactate (RL) was preloaded 20 minutes before spinal anesthesia. In Co-load group, 15 ml/kg of RL was co-loaded 20 minutes just after lumbar puncture. Vital parameters were noted before and after giving spinal anesthesia. **Results:** The occurrence of hypotension (SBP < 100 mmHg) in Group P is 30% and 20% in Group C which is statistically insignificant ( $p = 0.35$ ). The incidence of nausea is 8% & 6% in group P & group C respectively ( $p = 0.69$ ). The incidence of vomiting is 2% in group P & 4% in group C ( $p = 0.55$ ). Mephentermine was used in 19 patients in Group P & 13 patients in Group C which is statistically insignificant. **Conclusion:** Both preloading and co-loading with RL have similar effect on occurrence of hypotension in pregnant women receiving spinal anesthesia. Precious time need not be wasted in preloading. Periodic measurement of BP in parturients for early detection of hypotension and administration of vasopressors for maintaining BP close to baseline can ensure better outcome.

**Keywords:** Subarachnoid block; Hypotension; Crystalloid preloading; Crystalloid co-loading.

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### Introduction

Spinal anesthesia has been extensively used for caesarean section because of greater maternal safety and fetal benefits.<sup>1</sup> But the major disadvantage

with this technique is hypotension which is more common and profound in pregnant women due to various causes. This hypotension can cause nausea, vomiting, cardiovascular collapse in the mother, along with fetal hypoxia and acidosis due

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to placental hypoperfusion<sup>2</sup>. Therefore, Prevention of hypotension is necessary for better outcome of both mother and the foetus.

Fluid loading before spinal anesthesia which is referred to as preload is followed for prevention of hypotension. It is a common conventional practice in anesthesia. But, preloading of crystalloid is rapidly redistributed, and may induce atrial natriuretic peptide secretion, resulting in peripheral vasodilatation followed by an increased rate of excretion of the preloaded fluid.<sup>2</sup>

Routinely used methods to prevent or treat maternal hypotension include preloading with fluids (colloid or crystalloid), wedge placement to prevent aortocaval compression and administration of vasopressor drugs.

A more logical approach might be to administer fluid at the time that the local anaesthetic block starts to act. This might increase intravascular volume expansion during vasodilatation from the sympathetic blockade and decrease fluid redistribution and excretion.<sup>2</sup>

Fluid administered before induction of spinal anesthesia is referred to as "preloading" and fluid infused at the time of induction is referred to as "co-loading". Various studies suggest fluid infusion to be more effective if delayed until induction of spinal anesthesia and rapidly administered subsequently. Three possible fluid combinations have been compared in various studies: crystalloid versus colloid preloading, crystalloid preloading versus crystalloid co-loading, and colloid preloading versus colloid co-loading.

The present study was planned to analyse various advantages and disadvantages associated with crystalloid preloading and co-loading during spinal anesthesia and the possible relative benefits of each of these methods.

### Objective of the study

1. To assess and compare the safety and efficacy of crystalloid preload and crystalloid co-load for prevention of maternal hypotension in parturients undergoing elective caesarean section under spinal anesthesia.
2. To assess various haemodynamic parameters like heart rate, systolic BP, diastolic BP & mean arterial pressure.
3. To assess side-effects like nausea and vomiting in patients with crystalloid preload and co-load.

## Materials and Methods

### Study Participants and Recruitment

We conducted a prospective double blinded randomized controlled study over a 2 year period between December 2014 to December 2016. Hundred patients aged 20-40 years belonging to ASA I and II undergoing elective caesarean section were randomly distributed for the study into two groups.

### Allocation of groups

Based on the study done by Manu Bose *et al.*<sup>5</sup> considering significant Hypotension in Group 1 and Group 2 with odds ratio of 3.25, alpha error 5% and power of 80% the sample size was calculated using OpenEpi software version 2.3.1 which came to be 49 in each group which is rounded to 50 per group.

*Group P* (preload group) - 15 ml/kg of Ringer lactate was preloaded 20 minutes before commencement of spinal anesthesia.

*Group C* (co-load group) - 15 ml/kg of Ringer lactate was co-loaded in 20 minutes just after lumbar puncture.

The following patients were excluded from the study

1. Emergency surgeries.
2. ASA grade III and IV.
3. Severe anaemia, coagulation abnormalities and bleeding disorders.
4. Morbid obese patients.
5. Patients with multiple pregnancies.
6. Patients with other co-morbid conditions.
7. Patients with raised ICP.
8. Patients with previous history of surgeries on the spine.
9. Patients with spinal deformities and with history of backache.
10. Patients with active skin lesions over lumbosacral region.

After a detailed pre-anaesthetic examination and obtaining informed consent, all the patients were cannulated with 18G IV cannula and premedicated with Inj Ranitidine 50 mg & Inj. Metoclopramide 10 mg IV one hour before surgery. In operation theatre, Patient was made to lie on operating table with left lateral tilt. Monitors like pulse oximetry, non-invasive blood pressure & electrocardiography were connected. Base line heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure values were recorded.

Under strict aseptic precautions, lumbar puncture was performed in left lateral position by midline approach by using disposable Quincke spinal needle (25 G) at L3-L4 intervertebral space. Patients were monitored continuously using pulse oximeter, non invasive blood pressure, and electrocardiogram. After spinal anesthesia, Oxygen was delivered by facemask.

#### Parameters observed and recorded

Heart Rate, Systolic BP, Diastolic BP, Mean Arterial Pressure, Respiratory Rate and SpO<sub>2</sub> levels were recorded at 0, 2, 4, 6, 8, 10, 15, 20, 25, 30, 35, 40, 45 minutes till the end of surgery.

Bradycardia was considered when heart rate was less than 50/min (treated with Inj. Atropine).

Hypotension was defined as systolic BP less than 100 mmHg or a 20% fall in BP from the baseline (treated with Inj. Mephentermine).

#### Ethical Considerations

The study was initiated only after obtaining Institutional Ethical Committee (IEC) approval. Informed written consent was taken from the patient or the patient's next of kin prior to the study.

#### Statistical analysis

All recorded data were entered using MS Excel software and analysed using SPSS 20 version software for determining the statistical significance.

Results were expressed as mean  $\pm$  standard deviation. Proportions were compared using Chi-square test.

The student 't' test was used to determine whether there was a statistically significant difference between the study groups.

"p" value of  $>0.05$  was considered not to be statistically significant,  $<0.05$  was considered to be statistically significant, a value of  $<0.01$  was considered highly statistically significant & a "p" value of  $<0.001$  was considered as extremely statistically significant.

#### Results

The patient characteristics like age, weight, height, ASA status, and average total fluid administered were comparable among the two groups as shown in Figure 1. There was no statistically significant difference in heart rate & SBP among the groups. The incidence of hypotension (SBP $<100$ ) in Group P is 30%, whereas in Group C it is 20% as shown in Figure 2. This difference is statistically insignificant ( $p = 0.35$ ). DBP & MAP are slightly lower in Group P, but without any statistically significant difference. The incidence of nausea is 8% & 6% in preload group & Co-load group respectively ( $p = 0.69$ ) (Table 1). The incidence of vomiting is 2% in preload group & 4% in co-load group ( $p = 0.55$ ) (Table 1). Mephentermine was used in 19 patients in Group P & 13 patients in Group C which is statistically insignificant (Fig. 3).

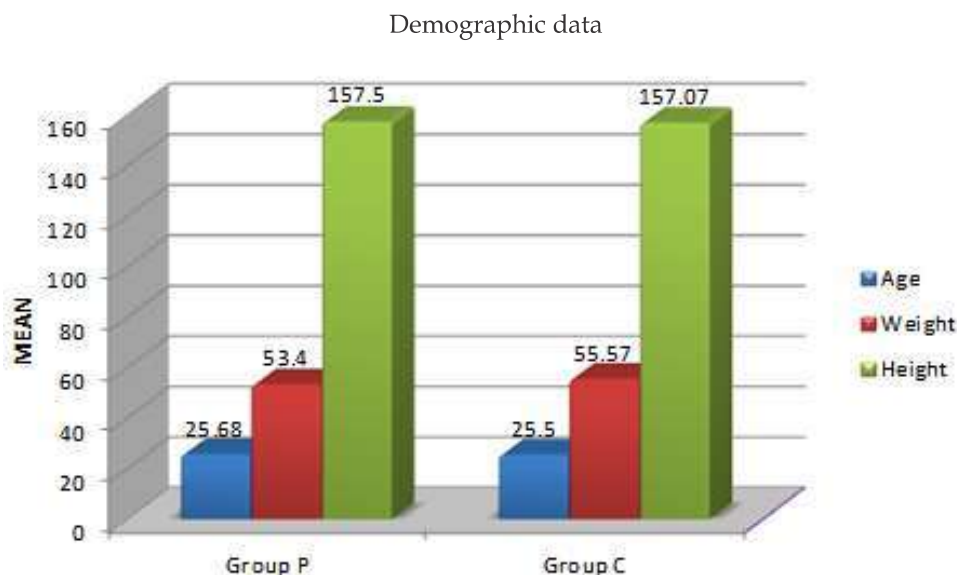


Fig. 1: Comparison of demographic data between the groups.

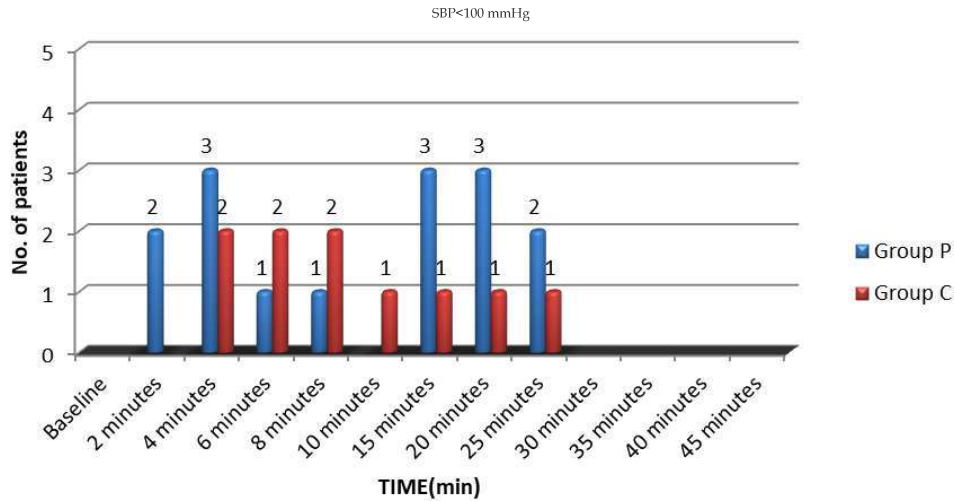


Fig. 2: Number of patients with SBP < 100 mmHg in the groups.

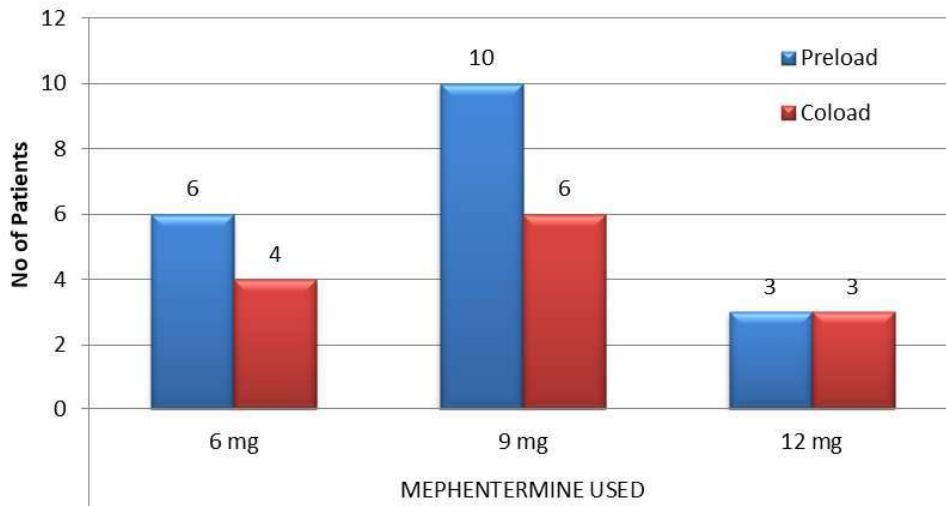


Fig. 3: Comparison of usage of Mephentermine in both the groups.

Table 1: Incidence of Nausea and Vomiting.

Group	NAUSEA		Vomitting		Total
	Yes	No	Yes	No	
Preload	4 (8%)	46 (92%)	01 (2%)	49 (98%)	50
Coload	03 (6%)	47 (93%)	02 (4%)	48 (96%)	50
Total	7	93	03	97	100

**Discussion**

Spinal anesthesia is a standard technique for pregnant women undergoing elective caesarean section but hypotension remains the main complication with this technique. This hypotension has harmful effects on both mother and foetus, leading to maternal nausea, vomiting and fetal hypoxia.

Hence various measures have been utilized to decrease the incidence of hypotension following spinal anesthesia. One such measure is fluid preloading, but it is associated with several drawbacks. An alternate measure is co-loading during spinal anesthesia. Although, experience with this approach is limited.

Studies done by Parmar *et al.* found that Co-loading with 20 ml/kg of ringer lactate is as

effective as preloading with same volume over 20 minutes in lower limb surgeries and believes that it is not required to spend time to deliver preload and delay surgery for the prevention of SA induced hypotension.<sup>1</sup>

Dyer *et al.* conducted a study and concluded that an equivalent volume of crystalloid administered rapidly, immediately after the performance of spinal anesthesia for elective caesarean section, is associated with a lower pre-delivery requirement for the vasopressor ephedrine than a traditional preload<sup>2</sup>.

Khan *et al.* conducted a study and concluded that there is significantly lower incidence of post-spinal hypotension found in co-load group than preload group and parturient in the co-load group required significantly less vasopressor doses than the pre-load group.<sup>3</sup>

Aparna Williams *et al.* conducted a study and concluded that both preloading and co-loading with 15ml/kg of RL solution are ineffective in prevention of spinal induced maternal hypotension.<sup>4</sup>

Bose *et al.* conducted a study concluding that co-loading with 15 ml/kg of Ringer lactate solution is as effective as preloading with same volume over 20 minutes before subarachnoid block to prevent hypotension and bradycardia.<sup>5</sup>

Singh *et al.* conducted a study where he found that fluid preloading had no effect on the incidence of hypotension and bradycardia following spinal anesthesia.<sup>6</sup>

In a study conducted by Tamilselvan *et al.* he found that despite increase in cardiac output following fluid preload, particularly with HES 1.0 L, hypotension still occurred. His data suggested that increase in CO after fluid preload cannot compensate for reductions in arterial blood pressure following spinal anesthesia.<sup>7</sup>

Rout *et al.* conducted a study and found that hypotension associated with spinal anesthesia for caesarean section cannot be eliminated by fluid preloading in the supine wedged patient.<sup>8</sup>

Gunusen *et al.* conducted a study where he found that the frequency of moderate or severe hypotension was lower in the ephedrine group than in the crystalloid or colloid preload group. The incidence of nausea was significantly different between the crystalloid preload and ephedrine group. Umbilical blood gas analysis and Apgar scores were similar in all groups. The combination of an ephedrine infusion at 1.25 mg/min with a crystalloid co-load was more effective than fluid preloading with crystalloid or colloid in the

prevention of moderate and severe hypotension.<sup>9</sup>

NganKee *et al.* conducted a study where he found that the combination of high dose phenylephrine infusion and rapid crystalloid co-loading is effective for preventing hypotension during spinal anesthesia for caesarean delivery.<sup>10</sup>

From our study it can be concluded that preloading & co-loading have similar effects on the incidence of hypotension following spinal anesthesia in caesarean section. Therefore, it is preferable to avoid the time delay which occurs in preloading the parturient. Co-loading or Preloading may not be very effective in preventing hypotension, it is sensible to use vasopressors alongside to prevent hypotension & its adverse effects.

## Conclusion

From our study it can be inferred that:

1. Both preloading and co-loading with 15 ml/kg of RL solution, have similar effect on the occurrence of hypotension in the obstetric population receiving spinal anesthesia.
2. Time delay due to preloading can be avoided as preloading alone is not very effective for the prevention of maternal hypotension.
3. Periodic measurement of the blood pressure in the patients (at 1 min intervals) for early detection of hypotension and administration of vasopressors for maintaining the maternal blood pressure close to the baseline can ensure better outcome.

**Conflict of Interest:** None

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