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**Original research article**

# A Comparison of Crystalloid Preloading and Co-Loading for Hypotension Prevention During Elective Caesarean Section Under Spinal Anaesthesia

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## ABSTRACT

**Introduction:** Patients undergoing cesarean sections frequently have hypotension following spinal anesthesia; maternal hypotension occurs 60%–70% of the time. By giving intravenous fluid boluses, hypotension brought on by spinal anesthesia can be treated or avoided. The purpose of this study was to assess the efficacy of crystalloid fluid preloading and co-loading in reducing the occurrence of hypotension following spinal anesthesia in cesarean delivery.

**Method:** There were 54 participants total who took part in this investigation. Subjects chosen through successive sampling who met the inclusion criteria for elective cesarean sections under spinal anesthesia were gravida individuals between the ages of 15 and 41 with an ASA 1 or ASA 2 physical condition. Three groups- the preloading group, the co-loading group, and the control group- were formed from the participants. Mean arterial pressure (MAP), pulse rates, and systolic and diastolic blood pressure are assessed in resting conditions and 2, 3, 5, 7, 9, 11, 13, 15, and 25 minutes following spinal anesthesia. The Repeated Measured Multivariate Analysis of Variance (MANOVA) test was used in the statistical analysis to see how the three groups of patients differed in terms of several hemodynamic parameters. The variations in hemodynamic parameters between each group were compared using the Bonferonni post hoc test.

**Results:** Results of the Bonferroni post hoc test revealed significant differences in the decline in systolic, diastolic, and MAP blood pressure between the co-loading group with the preloading group and the control group ($P < 0.002$); the co-loading group experienced the lowest decline.

**Conclusion:** Compared to the preloading and control groups, crystalloid fluid co-loading dramatically reduced the incidence of hypotension following spinal anesthesia in cesarean delivery**.**

**Keywords: Preloading, crystalloid fluid, co-loading, and a cesarean section**

## INTRODUCTION

In the general population, 25% to 75% of people have hypotension after spinal anaesthesia; however, 60% to 70% of cases of maternal hypotension occur in patients undergoing caesarean section [1,2]. Postspinal hypotension is primarily brought on by sympathetic inhibition, which

results in venous pooling and peripheral vasodilation. As a result, there is a reduction in cardiac output and venous return, which leads to hypotension [1]. Pregnant women undergoing caesarean section surgery with block levels as high as the 4th thoracic segment dermatome are at an increased risk of hypotension. Additionally, pregnant women with artocaval compression and higher vulnerability to sympathectomy's effects due to reduced sensitivity to endogenous vasoconstrictors combined with enhanced synthesis of endothelium-derived vasodilators have an increased risk of hypotension [1,3].

Acute hypotension can have harmful repercussions on the mother and foetus. Symptoms including lightheadedness, nausea, vomiting, aspiration, syncope, and cardiac rhythms can all have an impact on the mother. Long-lasting maternal hypotension may result in uteroplacental hypoperfusion, which is harmful to the developing foetus [1,4,5]. Investigations have been made into age (35 years), body mass index (BMI) greater than 25 kg/m2, high block, high dosages of local anaesthetics, and large newborns as risk factors for hypotension brought on by spinal anaesthesia [3]. Both nonpharmacological and pharmacological approaches can be used to stop hypotension from spinal anaesthesia.

Nonpharmacological treatments include leg wrapping, inflatable splints or boots, or thromboembolic deterrent stockings, albeit these treatments are also less successful [6]. Pharmacological techniques using supplementary oxygen, intravenous fluid bolus delivery, and intravenous vasopressor medication injections of phenylephrine 25–50 mcg or ephedrine bolus 5–15 mg [3, 6, 7].

The use of intravenous fluid boluses to prevent hypotension following spinal anaesthesia during caesarean section surgery has been studied in several ways. According to evidence from the literature, giving intravenous fluids 10-15ml/kg 15-20min before spinal anaesthesia has been found to be an effective way to lower the likelihood of hypotension following spinal anaesthesia. Preloading fluids are given before spinal anaesthesia, which has been demonstrated in several studies to lower the risk of hypotension after spinal anaesthesia [1].
This study compared the efficacy of crystalloid fluid preloading and coloading to lower the incidence of hypotension in patients undergoing spinal anaesthesia for caesarean section surgery.

**METHOD:**
This investigation is a single-blind clinical experiment. 54 participants in total took part in this study. Participants were chosen using a sequential selection process with the inclusion criteria being that they had to be pregnant patients between the ages of 15 and 41 with an ASA physical status of 1 or 2 who were having an elective caesarean delivery under spinal anaesthesia. Those who experienced a failure of spinal anaesthesia were not included in the study.

Three groups will be formed from the participants: 18 members of treatment group 1 (P1) were given 100 ml of Ringer lactate fluid to be consumed within 10 minutes prior to spinal anaesthesia (preloading); 18 members of treatment group 2 (P2) were given the same amount to be consumed within 10 minutes of spinal anaesthesia (co-loading); and 18 members of the control group (K) were not given any preloading or co-loading fluids.
Levobupivacaine 0.4% plain 15 mg was administered at the L3-L4 location to provide spinal anesthesia. The Sri Krishna Medical College and Hospital Research Ethics Committee gave its clearance for this study, which was carried out at Sri Krishna Medical College and Hospital in Bihar.

Systolic and diastolic blood pressure (DBP), mean arterial blood pressure, and pulse rate is examples of hemodynamic parameters that are examined in resting settings as well as 2, 3, 5, 7, 9, 11, 13, 15, and 25 min after spinal anesthesia. The Repeated Measured Multivariate Analysis of Variance (MANOVA) test was used in the statistical analysis to see how the three groups of patients differed in terms of several hemodynamic parameters. The variations in hemodynamic parameters between each group were compared using the Bonferonni post hoc test. When the P value was less than 0.04 the difference was deemed significant.

**RESULTS:**

54 people in total who complied with the inclusion and exclusion criteria were included in this study. No participants had dropped out as of the study's start date, making all 54 individuals eligible, whose data would then be evaluated.

As shown by the features of the variables above, which include participant characteristics based on age, ASA physical state, and baseline hemodynamic parameters, it can be said that the three therapy groups are comparable **[TABLE 1].**

**Table 1: Participant characteristics (n = 18)**

| **Parameter** | **Group** | | | **P-value** |
|---|---|---|---|---|
| | **Group 1** | **Group 2** | **Control** | |
| **Age (years) mean ± SD** | 31.6 ± 4.8 | 31.2±5.3 | 30.2±6.0 | 0.404 |
| **Physical Status ASA** | | | | |
| ASA 1 (%) | - | - | - | - |
| ASA 2 (%) | 100 | 100 | 100 | |
| Basal SBP (mmHg), Mean ± SD | 121.3±11.3 | 125.8±8.7 | 118.7±10.0 | 0.127 |
| Basal DBP (mmHg), Mean ± SD | 76.3±6.6 | 79.6±8.7 | 77.2±6.5 | 0.294 |
| Basal MAP (mmHg), Mean ± SD | 91.7±6.8 | 95.2±6.1 | 90.3±7.5 | 0.115 |
| Basal Pulse rate (x/min), Mean ± SD | 87.6±6.2 | 85.4±6.1 | 90.4±4.2 | 0.047 |

Systolic blood pressure (SBP), diastolic blood pressure (DBP), pulse pressure, and pulse rate at 2, 3, 5, 7, 9, 11, 13, 15, and 25 minutes are compared based on the characteristics of hemodynamic changes in each group. Between the three participant groups, there were significant differences in the mean SBP, DBP, mean arterial pressure (MAP), and pulse rate at the sequence time posttreatment ($P < 0.002$).

The need for ephedrine varied substantially among the three samples ($P < 0.002$), with the control group having the highest need (8.7 4.1 mg on average). Similar to the incidence of nausea and vomiting, there were substantial differences between the three sample groups, with the control group experiencing the highest rates (up to 90%) [**Table 2**].

**Table 2: Specifications for ephedrine dosage and the frequency of nausea and vomiting among the participants (n=18)**

| **Parameter** | **Group** | | | **P-value** |
|---|---|---|---|---|
| | **Group 1** | **Group 2** | **Control** | |
| **Ephedrine requirement Mean±SD** | 2.3±2.5 | 1.2±0.1 | 8.7±4.1 | <0.002 |

| | | | | |
|---|---|---|---|---|
| **The incidence of Nausea and vomiting** | 20 | 10 | 70 | <0.002 |

The Bonferroni post hoc test was used to compare the reductions in SBP, DBP, MAP, and pulse rate between the therapy groups. The results of this test revealed that there were significant differences in the reductions of SBP, DBP, and MAP between the preloading group and the coloading group (P 0.002), as well as between the coloading group and the control group (P 0.002). Comparing the coloading group to the preloadingco-loadingrol groups, the coloading group considerably lessens the decline in SBP, DBP, and MAP. There was no discernible difference between the preloading group and the control group in the decreases in SBP, DBP, and MAP ($P > 0.04$).

There were no discernible differences between the preloading and coloading groups ($P = 0.428$) or the preloading and control groups ($P = 0.011$) in the comparison of the pulse rate parameters. However, there was a significant difference ($P < 0.002$) between the coloading group and the control group when they were compared.

**Discussion:**

The findings indicate that the incidence of hypotension varies between the three groups in a statistically meaningful way. When compared to the preloading and control groups, the coloading group saw a considerably lower incidence of hypotension as evidenced by a decline in SBP, DBP, and MAP. The outcomes of a study by Rao et al. in 2015 comparing the efficiency of preloading with coloading with crystalloid fluid in caesarean sections with spinal anaesthesia are identical to those of this study. In the Rao trial, the incidence of hypotension was 40% in the coloading group ($P = 0.023$), which was significantly lower than the incidence in the preloading group [8]. This was in line with the findings of the Oh et al. study from 2014, which showed that coloading significantly reduced the incidence of hypotension compared to preloading ($P = 0.026$) [9,10].

Additionally, this research discovered that the coloading group's requirement for ephedrine was much lower than that of the preloading and control groups ($P < 0.002$). The incidence of nausea and vomiting was much lower in the coloading group than in the preloading group, and this is comparable to Rao's trial where the total amount of ephedrine required. [9,10] This also had something to do with the findings of the study on hemodynamic parameters, which showed that the incidence of hypotension was more considerably greater in the control group. This is consistent with the theoretical underpinning that hypotension and nausea are two complications that can arise from spinal anaesthesia. According to this theoretical underpinning, a significant drop in blood pressure or MAP will have an impact on cerebral blood flow, which can result in symptoms like nausea and vomiting [6,7,11].

The incidence of hypotension as measured by hemodynamic measures (SBP, DBP, and MAP) was also found to be lower in the preloading group than in the control group, but this difference was not statistically significant ($P > 0.04$). This is in line with the findings of the Faydaci and Gunaydin study, which found that preloading with crystalloid fluid during caesarean section surgery under spinal anaesthesia had no discernible impact on the incidence of hypotension or nausea and vomiting when compared to the control group [11]. Following spinal anaesthesia, hypotension typically develops within the first 10 to 20 minutes. During this time, local anaesthetic medications must have time to cause a specific level of nerve block, after which it will continue to do so. Fixation time is the term for this [9]. Crystalloid fluid injection during vasodilation is more effective than prophylaxis in preventing hypotension during spinal

anaesthesia in caesarean section surgery because crystalloids are not restricted to the intravascular space and spread quickly into the extracellular space. Since crystalloid fluid still remains intravascularly during vasodilation brought on by sympathetic blockade, it is seen more logical to administer fluid at the same time as local anaesthetic into the intrathecal region to have the greatest benefit throughout the time of blockade [9,10].

**Conclusion:**

Based on the findings of this study, it can be said that 100 ml of crystalloid fluids administered as a co-loading is more effective than 100 ml of crystalloid fluids administered as a preloading in lowering the incidence of hypotension in cesarean patients following spinal anesthesia. When compared to the administration of 1000 ml of preloading crystalloid fluid, the administration of 100 ml of co-loading liquid crystalloid is more effective at lowering the need for ephedrine vasopressor and the occurrence of nausea and vomiting after spinal anesthesia in patients undergoing cesarean sections.

**References:**

1. Bajwa SJ, Kulshrestha A, Jindal R. Co-loading or pre-loading for prevention of hypotension after spinal anaesthesia! a therapeutic dilemma. Anesthesia, essays and researches. 2013 May;7(2):155.
2. Mercier FJ, Augè M, Hoffmann C, Fischer C, Le Gouez A. Maternal hypotension during spinal anesthesia for caesarean delivery. Minerva Anestesiol. 2013 Jan 1;79(1):62-73.
3. Tawfik MM, Hayes SM, Jacoub FY, Badran BA, Gohar FM, Shabana AM, Abdelkhalek M, Emara MM. Comparison between colloid preload and crystalloid co-load in cesarean section under spinal anesthesia: a randomized controlled trial. International journal of obstetric anesthesia. 2014 Nov 1;23(4):317-23.
4. Loubert C. Fluid and vasopressor management for Cesarean delivery under spinal anesthesia: continuing professional development. Obstetric Anesthesia Digest. 2013 Jun 1;33(2):75.
5. Mackey DC, Wasnick JD, editors. Morgan & Mikhail's clinical anesthesiology. McGraw-Hill Education LLC.; 2013.
6. Kee WD. Chapter 3 Uteroplacental Blood Flow in: Chesnut's Obstetric Anesthesia.
7. Rao AR, Vijaya G, Mahendra BV. Comparison of Effects of Preloading and Colloading with Ringer Lactate in Elective Cesarean Cases Under Spinal Anesthesia. IOSR-JDMS. 2015;14(10):57-64.
8. Fikran Z, Tavianto D, Maskoen TT. Comparison of the Effect of Crystalloids Fluid Provision Before Spinal Anesthesia (Preload) and Shortly after Spinal Anesthesia (Co-load) on Maternal Hypotension Incidence in Caesarean Delivery. JAP. 2016;4(2):124-30.
9. Oh AY, Hwang JW, Song IA, Kim MH, Ryu JH, Park HP, Jeon YT, Do SH. Influence of the timing of administration of crystalloid on maternal hypotension during spinal anesthesia for cesarean delivery: preload versus coload. BMC anesthesiology. 2014 Dec;14:1-5.
10. Mercier FJ. Cesarean delivery fluid management. Current Opinion in Anesthesiology. 2012 Jun 1;25(3):286-91.
11. Ni HF, Liu HY, Zhang J, Peng K, Ji FH. Crystalloid coload reduced the incidence of hypotension in spinal anesthesia for cesarean delivery, when compared to crystalloid preload: a meta-analysis. BioMed research international. 2017 Dec 17;2017.