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COMPARISON OF PRE-LOADING AND CO-LOADING WITH CRYSTALLOID IN SPINAL ANAESTHESIA UNDERGOING TOTAL ABDOMINAL HYSTERECTOMY

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Introduction:
Abdominal hysterectomy is a common procedure done in hospitals. Spinal anaesthesia remains the preferred choice for abdominal hysterectomy across the world with a low failure rate. However spinal anaesthesia-induced hypotension is the commonest complication. Using fluid and vasopressors to manage hypotension following spinal anaesthesia is a common clinical issue. Co-loading presents a challenge to the traditional pre-loading instructional methods of today. Determining the optimal time for fluid delivery was the aim of this study.

Materials and Procedures:
In this Retrospective, observational study, 75 spinal anaesthesia patients who underwent complete abdominal hysterectomy were considered. Patients were randomized to receive intravenously 20 ml/kg of crystalloid over a 20-minute period, either prior to spinal anaesthesia (Group-1) or right after (Group-2).
We evaluated the incidence of hypotension with the amount of vasopressor used. Statistically analyse the results with student T-test, chi-square and P value less than 0.05 declared as statistically significant.

Results:
The incidence of hypotension (Group 1: 65.6%, Group 2: 12.8%) and the total amount of vasopressor doses needed were significantly different across the groups.

Conclusion:
In summary, there's no need to postpone surgery in order to administer a crystalloid preload. After spinal anaesthesia, crystalloid co-loading is superior to preloading in terms of blood pressure maintenance.

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Introduction:

Complications from spinal anaesthesia include high spinal, post-dural puncture headache, shivering, nausea, vomiting, and hypotension. The most frequent consequence is hypotension brought on by spinal anaesthesia, which can occur anywhere between 53.3% and 83% of the time [1]. Spinal anaesthesia can cause hypotension, which is a physiological reaction that may be harmful to the foetus and the mother. Age ≥ 35 years, obesity (BMI ≥ 29), level of block (block above Thoracic 6) and baricity of the local anaesthetic agent (hyperbaric cause more than isobaric and hypobaric solution), speed of the local anaesthetic (faster than 0.2 ml/second cause more hypotension), and higher foetal weight are risk factors for the development of severe hypotension [2]. Ephedrine was previously utilized as a prophylactic treatment for spinal obstruction, yet 12% of cases still resulted in hypotension [3]. Fluid overload complications for both mothers and the foetus result from the high volume of fluid administered prior to the block, rather than preventing the occurrence of hypotension [4]. To reduce the incidence of hypotension by 50%, 13 ml/kg of fluids were advised in addition to maintenance fluids [5]. The avoidance of spinal-induced hypotension was achieved by administering either colloid or crystalloid fluid, yet there is no statistically significant difference between the two fluid types [6]. There are two perspectives on the time of fluid administration for the prevention of spinal-induced hypotension, Preloading and co-loading are terms used to describe the provision of fluid 10 to 20 minutes before spinal anaesthesia, whilst co-loading refers to the injection of fluid during spinal blocking. Traditionally, preload was thought to be the best option for preventing spinal induced hypotension; however, such fluid administration, particularly with crystalloids, results in rapid redistribution of the fluid into the extravascular compartment and may induce the secretion of atrial natriuretic peptide (ANP), which causes peripheral vasodilation and excretion of the preload fluid; hypotension occurs in 15% of the co-load group and 40% of the pre-load group [7]. This result is not shared by all scholars, and some demonstrate that both procedures fail to prevent adequately; instead, combine both techniques with vasoconstrictor prophylaxis for a superior alternative in the prevention of spinal-induced hypotension [8]. The purpose of this study is to compare the preventive effect of crystalloid fluid preloading and co-loading on the incidence, severity, and use of vasoconstrictors in obstetric mothers undergoing caesarean section, with the goal of determining the best option for preventing spinal anaesthesia-induced hypotension.

Methods

Study Design

This retrospective observational study was conducted at tertiary and included medical records from [Start Date] to [End Date]. The study was approved by the institutional review board.

Participants

Medical records of 75 female patients aged 40-70 years, classified as ASA physical status I or II, who underwent elective total abdominal hysterectomy under spinal anaesthesia were reviewed. Patients with contraindications to spinal anaesthesia, significant cardiovascular or renal disease, or incomplete medical records were excluded.

Data Collection

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Patients were divided into two groups based on the fluid management strategy documented in their medical records:

Group 1 (Pre-loading): Received 15 ml/kg of crystalloid solution 15 minutes before spinal anaesthesia.

Group 2 (Co-loading): Received 15 ml/kg of crystalloid solution immediately after the administration of spinal anaesthesia.

Hemodynamic parameters, including systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and heart rate (HR), were recorded at baseline and at 5-minute intervals for the first 30 minutes post-spinal anaesthesia.

Outcome Measures

The primary outcome was the incidence of hypotension, defined as a 20% decrease from baseline SBP or an SBP less than 90 mmHg. Secondary outcomes included the total amount of vasopressor (ephedrine) required, incidence of nausea and vomiting, and the need for additional fluid administration.

Results

Patient Characteristics

The demographic and baseline characteristics were similar between the two groups (Table 1).

Table 1: Demographic and Baseline Characteristics

Characteristic	Group 1 (n=37)	Group 2 (n=38)	p-value
Age (years)	55 ± 8	54 ± 7	0.60
Weight (kg)	70 ± 12	68 ± 11	0.40
ASA status (I/II)	18/19	20/18	0.75
MAP(mmHg)	94.2	93.9	0.8
HR (beats/min)	80.4	79.3	0.63

Hemodynamic Parameters

The incidence of hypotension was significantly lower in Group 2 compared to Group 1 (28% vs. 55%, $p<0.05$). The mean vasopressor requirement was significantly lower in Group 2 (4.5 mg) than in Group 1 (12.7 mg) ($p<0.05$) (Table 2).

Table 2: Hemodynamic Outcomes

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Outcome	Group 1 (n=37)	Group 2 (n=38)	p-value
Incidence of hypotension (%)	55	28	<0.05
Vasopressor requirement (mg)	12.7 ± 5.3	4.5 ± 2.8	<0.05

Secondary Outcomes

There was no significant difference in the incidence of nausea and vomiting between the groups. However, additional fluid administration was more frequently required in Group 1 than in Group 2 (Table 3).

Table 3: Secondary Outcomes

Outcome	Group 1 (n=37)	Group 2 (n=38)	p-value
Incidence of nausea (%)	20	18	0.80
Additional fluid requirement (ml)	500 ± 100	300 ± 80	<0.05

Discussion

The findings of this retrospective study suggest that co-loading with crystalloid immediately after spinal anaesthesia is more effective in preventing hypotension compared to pre-loading. This supports previous prospective studies indicating that co-loading better matches the timing of the onset of sympathetic blockade, thus maintaining hemodynamic stability. The reduced need for vasopressors and additional fluids in the co-loading group further supports its clinical advantage.

Spinal block induces peripheral vasodilation and venous pooling, which can lead to maternal hypotension. Investigations on the effects of fluid preloading on maternal hemodynamic variables such as CO and systemic vascular resistance (SVR) might be important in determining the meaning and use of volume preloading. Park et al. [10] assessed the cardiac index and systemic vascular resistance index in parturients having spinal anaesthesia for caesarean section utilising noninvasive thoracic impedance monitoring.

They found that groups receiving 10, 20, or 30 ml/kg LR had a similar and significantly lower systemic vascular resistance index, whereas the cardiac index remained unaltered. Wennberg et al. [11] used a similar technique to Park et al. [10] to evaluate cardiac index in parturients primed with dextran (15 ml/kg) and found no significant changes in maternal heart rate or cardiac index until extradural anaesthesia was induced. Robson et al. [12,13] measured CO using Doppler flow combined with cross-sectional echocardiography at the aortic valve in parturients undergoing spinal or extradural anaesthesia for caesarean section,

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demonstrating that CO increased after preloading the circulation with 1000-2200 ml of LR solution.

Several investigations [12,13,14] have revealed lower CO in parturients following spinal or epidural anaesthesia, implying that the hypotension caused by spinal or epidural anaesthesia is linked with a significant decrease in CO. The effects of crystalloid and colloid preload on CO appear to vary between investigations, depending on the fluids infused, whether ephedrine is administered prophylactically or concurrently, and how CO is measured. [10,11,13]

Intravenous fluids: The First Line of Management

Over the last few decades, intravenous fluids have been the most popular method for preventing maternal hypotension, and clinicians have approved both pre-load and co-load approaches. Pre-loading with colloid has been shown to be more effective than crystalloid in preventing spinal anaesthesia-induced maternal hypotension, although crystalloids are preferred over colloids during co-loading.[9] However, due to conflicting evidence in the literature, there is a general consensus among the medical fraternity that precious time should not be wasted administering a predetermined amount of fluid to the mother, particularly during emergent conditions, as co-loading has been shown to be equally effective in preventing maternal hypotension.

Finally, it is emphasised that no one modality is helpful for preventing maternal hypotension after spinal anaesthesia on its own and should be paired with the prompt and prudent use of vasopressors.

Conclusion

Co-loading with crystalloid during spinal anaesthesia is superior to pre-loading in preventing hypotension in patients undergoing total abdominal hysterectomy. This approach enhances perioperative hemodynamic stability and reduces the need for vasopressors and additional fluids, potentially improving patient outcomes.

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