

Original Article

A COMPARATIVE STUDY OF COLOADING AND PRELOADING WITH BALANCED CRYSTALLOIDS FOR PREVENTION OF POST-SPINAL HYPOTENSION IN PATIENTS UNDERGOING ELECTIVE CAESAREAN SECTION

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Abstract

Background

Spinal anesthesia is the most common anaesthetic technique for cesarean delivery due to its rapid onset, a dense neural block, little risk of local anesthetic toxicity and minimal transfer of drug to the fetus, as well as little risk of failure of block. However, incidence of hypotension is one of the disadvantages of this technique because of sympathetic blockade. Conventionally, crystalloid preloading has been used to prevent spinal anaesthesia induced hypotension, but it has shown varying results. Therefore, focus is on crystalloid coload for prevention of spinal induced hypotension.

Method

An observational prospective study was done on 60 parturients undergoing elective cesarean delivery. Patients were randomized into 2 groups who received either crystalloid preloading or coload. Parameters assessed were, heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, incidence of hypotension and use of mephentermine.

Result

In this study, there was a significant difference in the incidence of hypotension in both the groups, which was more in the preload group. Total dose of mephentermine used was also significantly more in the preload group.

Conclusion

We concluded that crystalloid coload is beneficial to prevent post-spinal hypotension in patients undergoing elective cesarean delivery, as compared to patients receiving preloading fluid.

Keywords

Crystalloid preload, coload, hypotension

Introduction

Spinal anesthesia is the most common anaesthetic technique for cesarean delivery because of higher maternal morbidity and mortality associated with general anaesthesia. The advantages of spinal anaesthesia are rapid onset, a dense neural block, little risk of local anesthetic toxicity and minimal transfer of drug to the fetus, as well as little risk of failure of block. Other advantages are excellent surgical analgesia, inhibits stress response, post operative analgesia, good skeletal muscle relaxation, airway instrumentation can be avoided, reduced chances of post operative deep vein thrombosis and pulmonary embolism. However, a higher incidence of hypotension is one of disadvantages of this technique. Hypotension during spinal anaesthesia for caesarean section remains a common scenario in our clinical practice, potentially endangering both mother and child. Prolonged hypotension leads to organ ischemia, uteroplacental hypoperfusion, loss of consciousness, and cardiovascular collapse.

Several measures have been advocated to decrease the severity of hypotension induced by spinal anaesthesia, like use of prophylactic vasoconstrictor, leg compression, trendelenberg position, left sided uterine displacement, but fluid preloading is commonly practiced. Various types of crystalloid and colloid have been used as preloading fluid for prevention of spinal hypotension. Different crystalloids commonly used in preloading are Ringer lactate, normal saline and colloids that are used in preloading are gelatin, dextran, hetastarch, pentastarch, tetrastarch. There are several disadvantages associated with colloids, such as cost, allergic reactions, and their effects on coagulation. As a result, crystalloids are still preferred by many anesthesiologists.

The timing of crystalloid infusion is of great importance because it distributes rapidly into the extracellular space and the volume expanding effect is maximal at the early stage. Several studies have been done to evaluate the efficiency of preloading and co-loading. This study has been undertaken to compare the efficacy of volume preloading and volume coloadng with crystalloids in preventing hypotension associated with spinal anaesthesia in patients undergoing elective LSCS.

Material and Method

After getting approval from hospital ethics committee, and after getting approval from the concerned obstetrician 60 healthy pregnant women with ASA grade I and II undergoing caesarean delivery between 18 to 35 years and weight between 40 and 80 kg were selected for the study. Patients undergoing emergency surgeries and who had contraindications to SA were excluded from the study. Patient with PIH, Diabetes, Obesity and Abruption Placenta were also excluded from the study.

Thorough pre-anaesthetic evaluation and work-up was carried out a day prior to the surgery. Written and informed consent was taken from the patients. Consent from the obstetrician was also taken.

On the day of surgery, two IV lines (18 gauge) were secured in peripheral veins and Ringer lactate was kept ready. Premedication with Injection Rantidine 50mg IV, Inj. Metoclopramide 10mg IV was given to every patient. Patients were placed in left lateral position and baseline non-invasive blood pressure and heart rate were measured.

Patients were randomly divided into two groups.

Group PK – Parturients in this group received 15ml per kg of balanced crystalloid solution as preload over 20 minutes before subarachnoid block was performed.

Group CK – Parturients in this group received 15ml per kg of balanced crystalloid solution as co-load over 20 minutes, after CSF was seen in the spinal needle.

Spinal anaesthesia was administered in both groups using 2.0ml of 0.5% of bupivacaine, with a 23 gauge, Quinke’s spinal needle with aseptic precautions.

Non invasive blood pressure measurements were recorded in both groups immediately after giving subarachnoid block, then every 3 minutes for next 20 minutes and for every 5 minutes thereafter till the end of surgery. Surgery was allowed to proceed after a block to T8 was established and the block level at the end of surgery was documented. If the systolic arterial blood pressure decreased to less than 20% of the calculated baseline value or <90mmHg, 6mg Mephentermine was administered. The following parameters were monitored.

- Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure — baseline, every 3 minutes up to 20 minutes and after that at 5 minutes till the end of surgery.
- Number of hypotensive episodes
- No. of mephentermine doses required
- Total dose of mephentermine given
- Post operative nausea and vomiting

Result

The demographic data like age, weight and ASA grade was comparable in both the groups in our study.

Table 1. Demographic characteristics

	Group PK	Group CK	P value
Age(yrs)	23.84 ± 1.23	24.11 ± 1.20	0.39
Weight(kg)	55.76 ± 4.83	53.80 ± 5.41	0.14
ASA grade (I:II)	21:9	18:12	

Duration of surgery(min)	43.87 ± 13.12	45.23 ± 12.60	0.68
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Table 2. Mean heart rate changes

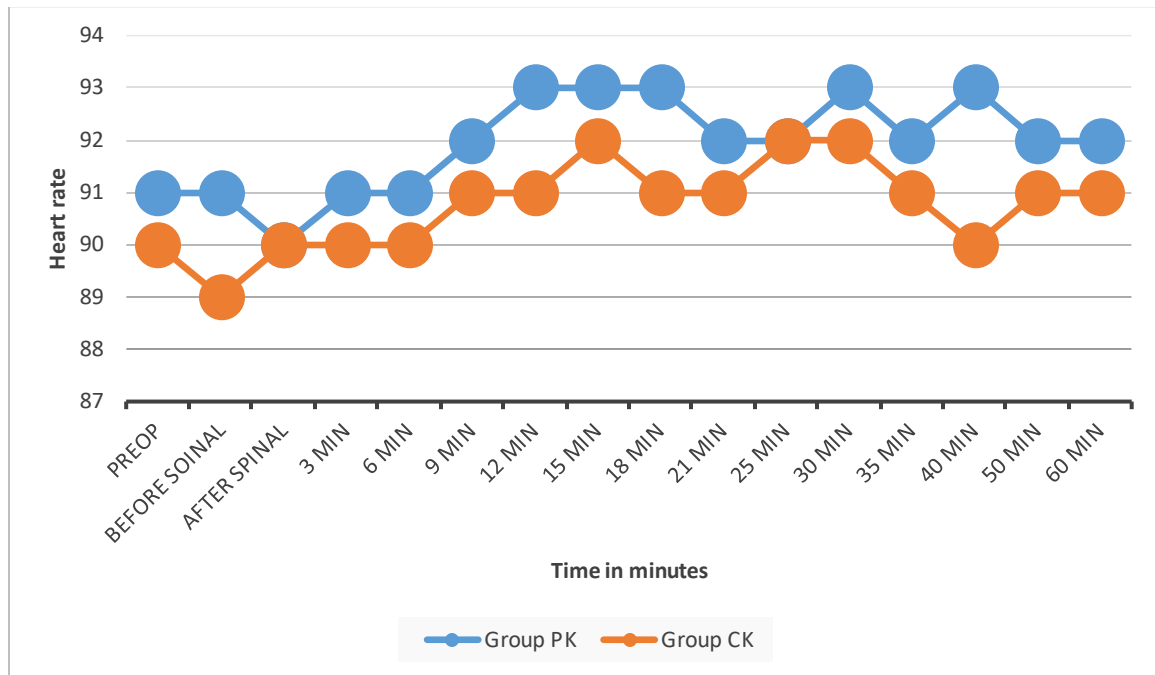


Table 3. Mean Arterial Pressure changes

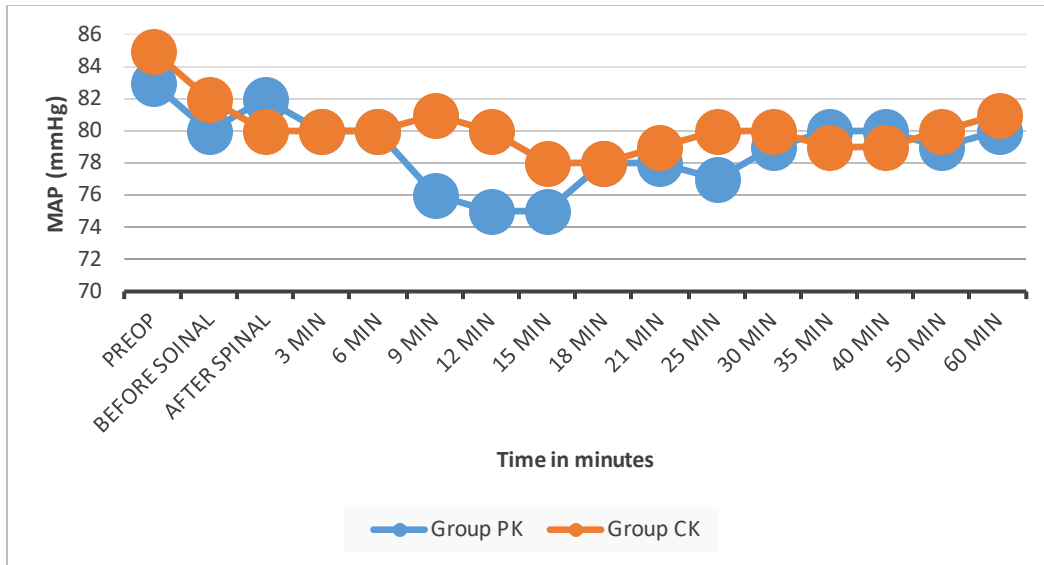


Table 4. Number of episodes of hypotension

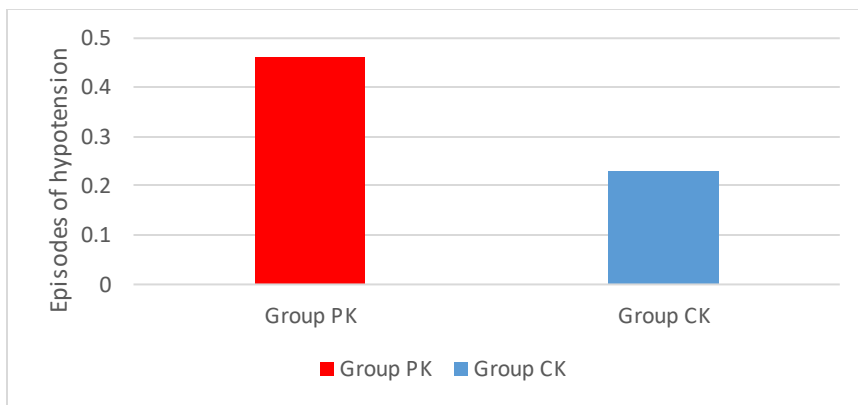


Table 5. Comparison of use of Mephentermine

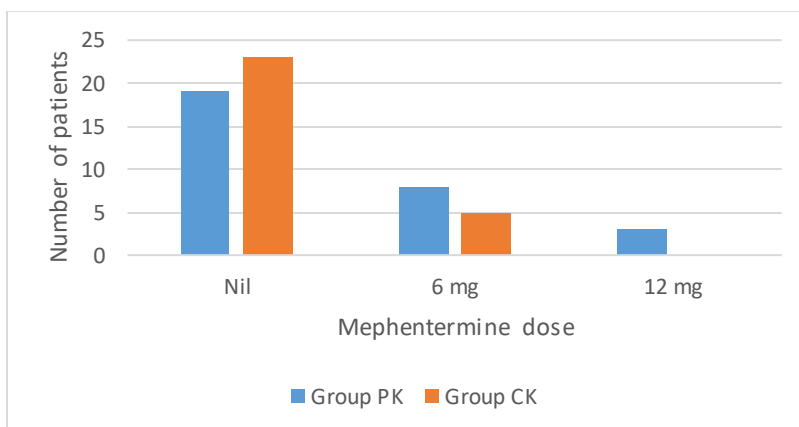


Table 6. Evaluation of parameters

	Group PK	Group CK	P value
Episodes of hypotension (Mean \pm SD)	0.47 \pm 0.67	0.16 \pm 0.37	0.036
Total Mephentermine dose (Mean \pm SD)	2.8 \pm 4.01	1 \pm 2.23	0.0358

Discussion

Hypotension is the most common and an immediate complication of spinal anaesthesia which is due to sympathetic blockade leading to decrease in venous return. Spinal induced hypotension may be associated with significant patients discomfort and even mortality. It decreases utero-placental blood flow and it adversely affects the foetal and maternal outcome. So it is very important to prevent any fall in blood pressure after spinal anaesthesia. Various measures have been tried for prevention of hypotension induced by spinal anaesthesia. The most commonly used methods are crystalloid preloading and coload.

The results of preloading with crystalloid solution for prevention of spinal hypotension are unsatisfactory. Ringer lactate is used as a preloading fluid because it is most physiological fluid, its osmolality is similar to plasma. The crystalloids can be used to maintain water and electrolytes and to expand intravascular volume. 75% of its volume diffuses into interstitial space; hence its effect in expanding plasma volume is only transient. Whereas, coload makes available extra fluid in intravascular space during period of highest risk of hemodynamic changes occurring just after giving spinal anaesthesia.

In our study, the number of hypotensive episodes were significantly lower in patients in coload group compared to preloading group ($p=0.036$). The mean number of supplemental Mephentermine doses (6mg boluses) administered and the mean total dose of ephedrine administered was more in the preload group than in the co-load group and this difference was statistically significant among the groups ($p=0.0358$).

Crystalloid administration seems to be more effective in preventing hypotension when the fluid is administered at a very rapid rate beginning at the time of the intrathecal injection; this crystalloid "coload" technique was described in an elegant kinetic study by Ewaldsson and Hahn¹ in 2001 and seemed to improve mean arterial blood pressure after spinal anaesthesia in non-obstetric patients when compared with a conventional crystalloid preloading technique.

Crystalloid coload for cesarean delivery was then studied by Dyer et al². Fifty parturients undergoing scheduled cesarean delivery were randomized to receive 20 mL/kg Ringer lactate solution IV either by rapid infusion (on average in 10 minutes) immediately after induction (coload) or for 20 minutes before induction of spinal anaesthesia (preload). The incidence of hypotension was significantly decreased in the coload versus preload group (36% vs 60%) and

ephedrine requirements before delivery were also reduced (median: 0 vs 10 mg). Our study correlated well with the above study.

Conclusion

Crystalloid coload while giving spinal anaesthesia is beneficial to prevent post-spinal hypotension in patients undergoing elective cesarean delivery, as compared to patients receiving preloading fluid before giving spinal anaesthesia

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