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COMPARISON OF PRE-LOADING AND CO-LOADING WITH CRYSTALLOID IN ELECTIVE CESAREAN SECTION UNDER SPINAL ANESTHESIA

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ABSTRACT

Background: Maternal hypotension is the major complication associated with subarachnoid block (SAB). It can be prevented by judicious intravenous fluid administration and vasopressors. However, the optimal fluid and timing of infusion are yet to be determined.

Objective: To compare the effect of preloading and coloading on prevention of hypotension after spinal anesthesia and determine ideal timing of fluid administration.

Material And Methods: A prospective study conducted at tertiary care hospital in department of Anaesthesia from April 2019 to March 2020 in 60 parturients randomized into preload group (Group P) and coload group (Group C).

Result: This study demonstrated that coload is more efficient than preload i.e. administering crystalloids at the actual time of intravascular volume deficit is more efficient than prophylactic administration with crystalloid.

Conclusion: It is not necessary to spend time to deliver preload and delay surgery. Routine co-loading would increase OT turnover also besides reducing incidence of hypotension.

KEYWORDS : Coloading, Preloading, Spinal anaesthesia induced hypotension, Cesarean.

INTRODUCTION

Anaesthesia for caesarean section, whether for elective or emergency has always been a challenging proposition. Spinal anaesthesia is most frequently used technique for caesarean section due to its rapid onset, dense neural block, less risk of anaesthetic toxicity and minimal transfer of drug to the fetus[1]. Maternal hypotension is the major complication associated with subarachnoid block (SAB). Prolonged hypotension may lead to organ ischemia, uteroplacental hypoperfusion, loss of consciousness and cardiovascular collapse[2]. It can be prevented by ensuring proper positioning of patient, low dose spinal, inflatable splints, anti thromboembolic stockings, judicious intravenous fluid administration and vasopressors[3-5]. Intravenous Fluid administration is a daily practice to prevent and treat maternal hypotension. However, the optimal fluid and timing of infusion are yet to be determined.

Some studies have proved superiority of colloids over crystalloids for preventing hypotension[6-7]. However, crystalloids are still fluid of choice in preventing hypotension due to several disadvantages associated with colloids, such as cost, allergic reactions, and their effects on coagulation. The timing of crystalloid infusion is of great importance because it distributes rapidly from intracellular to extracellular space and the volume expanding effect is maximal at the early stage. Traditionally, preload of fluids is used to prevent hypotension in spinal anesthesia, but its efficacy has been questioned. Many studies proposed that fluid given at the time of actual block during spinal anesthesia was more effective[8-9]. A meta-analysis suggested that the timing of fluid loading did not influence the incidence of hypotension, but it combined crystalloid and colloid with only a limited data for crystalloid[10].

In this prospective randomized controlled study, we hypothesized that coload of crystalloid as compared to preload, would be more effective for preserving effective intravascular volume during vasodilatation induced by spinal blockade, and that coload is useful for preventing maternal hypotension during spinal anesthesia for cesarean delivery.

MATERIAL AND METHODS

After approval from institutional ethical committee, this prospective randomized controlled study was carried out in 60 parturients, aged between 19 to 35 years of ASA grade I and II, posted for elective caesarean section over a period of one year. Participants were equally divided into preload group (Group P) and coload group (Group C).

The exclusion criteria included patient's refusal, ASA grade III, IV and V, inadequate fasting status, weight > 100 kg, height of <150 cm or >180 cm, any contraindication to spinal anaesthesia and history of hypertension.

Preoperatively all routine investigations including blood group, haemoglobin, urine (routine & microscopy), serum urea and serum creatinine of the patients were checked. Written informed consent and fasting status of the patient was confirmed and IV line was secured with 20G cannula in preoperative room. In the operation theatre, standard monitors were attached (five lead ECG, Non-invasive blood pressure, pulse oximeter) and baseline recordings were noted in supine position.

The patients in preload group received 15 ml/kg of ringer's lactate solution (approximately 1000 ml) over a period of 20 minutes before spinal anaesthesia and no additional fluid was given. Spinal anaesthesia was administered in both the groups using 2 ml of 0.5% of hyperbaric bupivacaine injected slowly at L3-4 interspace with 23G Quinckes spinal needle under all aseptic precautions in lateral decubitus position. Patients of coload group received identical fluid load of 15 ml/kg just after intrathecal administration of local anesthetic via a pressurized giving set with a pressure of 300 mmHg applied.

Systolic blood pressure measurements were recorded in both the groups at 2 min interval from the start of the regional block for the first 5 min and then at 5 min interval till 40 min and recorded till the end of surgery. Similarly heart rate and SPO2 readings were also recorded. No wedge was applied under the buttock of any patient as it may interfere in the blood pressure readings. Hypotension was defined as a decrease in systolic blood pressure more than 20% of baseline or < 90 mmHg and it was treated with incremental doses of IV Mephentermine starting from 3 mg. Bradycardia was defined as decrease in heart rate >15% from baseline or heart rate <60/min which was treated with injection Atropine. Continuous monitoring of oxygen saturation was done. After delivery of the baby 15 IU of injection oxytocin was given to the mother as an infusion in the running intravenous fluid.

Statistical Analysis

Data was tabulated using Microsoft excel (2016) and was analyzed using SPSS software. Means of two groups were compared using independent Student's t-test, ANOVA test or Mann-Whitney Test depending on the distribution of the population in two groups. P-value of <0.05 was considered to be statistically significant.

RESULTS

The demographic profile of all the patients in group P and group C were comparable. The differences in baseline systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were also not statistically significant. ***(Table 1)***

Table 1: Demographic Profile Of Patients

Variable	Group P (Mean ± SD)	Group C (Mean ± SD)	P Value
Age (Years)	26.82 ± 4.30	26.84 ± 4.10	0.846
Weight (Kg)	69.72 ± 7.26	69.68 ± 8.74	0.860

Height (Cm)	158.52 ± 5.92	160.87 ± 6.34	0.482
Duration of surgery (Min)	74.38 ±10.37	75.36 ± 11.02	0.301
Basal SBP (mm Hg)	116.40 ± 6.07	117.07 ± 4.65	0.827
Basal DBP (mm Hg)	72.35 ± 8.61	71.24 ± 7.04	0.631

The minimum recorded mean SBP in group P and group C was 95.80 mm Hg and 104.28 mm Hg respectively, seen 5 minutes after spinal anaesthesia. The difference in the fall of SBP between two groups was found statistically significant. ***(Table 2)***

Table 2: Comparison Of Changes In SBP (mm Hg) At Different Time Intervals

SBP	Group P (Mean ± SD)	Group C (Mean ± SD)	P value
1 min	105.0 ± 5.34	110.89 ± 5.52	<0.001
3 min	99.50 ± 4.79	105.40 ± 4.26	<0.001
5 min	95.80 ± 6.39	104.28 ± 4.32	<0.001
10 min	99.46 ± 4.21	106.24 ± 4.82	<0.001
15 min	100.46 ± 5.88	110.68 ± 4.89	<0.001
20 min	106.58 ± 6.98	113.69 ± 4.82	0.008
25 min	110.94 ± 5.56	114.72 ± 5.60	0.048
30 min	112.13 ± 5.82	114.96 ± 5.80	0.256
35 min	113.14 ± 5.90	116.04 ± 4.09	0.348
40 min	116.68 ± 5.78	116.72 ± 5.88	0.657

However, the mean HR at different intervals were comparable in two groups and the difference was not statistically significant. ***(Table 3)***

Table 3: Comparison Of Changes In Heart Rate (BPM) At Different Time Intervals

HR	Group P (Mean ± SD)	Group C (Mean ± SD)	P value
1 min	87.70 ± 11.57	89.72 ± 10.44	0.750
3 min	87.80 ± 14.74	86.48 ± 11.44	0.540
5 min	86.70 ± 10.86	85.46 ± 11.40	0.436
10 min	84.40 ± 7.46	86.73 ± 10.58	0.328
15 min	87.08 ± 9.13	88.74± 9.58	0.302
30 min	88.08 ± 7.92	82.92± 7.04	0.851

The mean number of doses of Inj. Mephentermine required for stabilization of blood pressure were more in group P as compared to group C and the difference were statistically significant. ***(Table 4)***

Table 4: Required Mean Dose Of Inj Mephentermine

Drug	Group P (Mean ± SD)	Group C (Mean ± SD)	P value
Mephentermine (mg)	6.56 ± 3.78	3.36 ± 2.84	< 0.001

DISCUSSION

Hypotension is a worrisome complication after spinal anesthesia. A general practice for prevention of maternal hypotension is preloading of crystalloids before SAB. However, the timing of the infusion of the crystalloid is very crucial, as it has shorter intravascular stay. Intravascular volume can be raised by 10 % whenever rapid infusion of crystalloid is given to the patient. But the volume is decreased, as soon as infusion is stopped[11].

This present study demonstrated that during administration of crystalloids for prevention of maternal hypotension after spinal anesthesia in cesarean delivery, coload is more efficient than preload i.e. administering crystalloids at the actual time of intravascular volume deficit is more efficient than prophylactic administration with crystalloid. The result of our study is in consensus with the study done by *Oh AH et al* which recommends co-hydration with crystalloid than pre-hydration before the block[12]. *Dyer et al* also studied role of 20 ml/kg of crystalloid solution as preload and coload in 25 patients in each group[8]. Similar study was also performed by *Khan et al* who found rapid crystalloid infusion at the time of neuraxial blockage more effective at preventing hypotension than preload[13]. The same findings were published by *Mojica et al* but in non-obstetric patients[14]. American Society of Anesthesiologists (ASA) clinical practice guideline recommendation concerning spinal anesthesia for cesarean delivery states: "Although fluid preloading reduces the frequency of maternal hypotension, initiation of spinal anesthesia should not be delayed to administer fixed volume of intravenous fluid[15].

Our study contradicts the finding of *Bose et al*[16] and *Jacob et al*[17] who did not found significant difference of hypotension between preload and coload group. *Sayyid et al*[18] and *Nishikawa et al*[19] also found pre-loading and co-loading similar with no superiority. However, the above analysis combined crystalloids and colloids both, and there are limited data available for crystalloids. These two different types of fluid should be evaluated separately. It is the known fact that colloids remain in intravascular space longer than crystalloids. So, after volume loading in the patients with colloid no significant difference in the incidence of hypotension or vasopressor requirement was found between the preload and coload groups[18-19]. Despite the mentioned advantage over crystalloid, Colloids are not frequently used in clinical practice because of being expensive and having a potential risk of allergic reactions.

Our study also shows that total number of doses and cumulative dose of Inj mephentermine used in coloading group were statistically lower than preloading group for treatment of hypotension. Similar results were shown in studies done by R*ao et al*[9]*, Jacob et al*[12] and *Artawan et al*[17]. So in conclusion hypotension cannot be individually prevented by coloading alone. We should always have other methods rapidly available like vasopressors for treatment of hypotension.

We also found in our study that there was no statistically significant difference in the heart rate and SPO2 in both the groups which is comparable to other studies[15].

One of the limitations of our study was that we did not record the mean arterial pressure which would have been more specific in defining hypotension rather than systolic blood pressure alone. In the future this study can be extended using larger sample size, invasive arterial monitoring and ASA III/IV patients as study population patients.

CONCLUSION

The method of rapid co-loading with 15 ml/kg of crystalloid immediately after SAB is associated with fewer incidences of hypotension and less Inj mephentermine consumption without causing any adverse effects. It is needless to spend time to deliver preload and delay surgery. Routine co-loading would increase OT turnover also besides reducing incidence of hypotension.

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