

Comparative Evaluation of Preloading and Coload of Crystalloids to Prevent Spinal Induced Hypotension in Caesarean Section

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ABSTRACT

Introduction: Most routine and emergency caesarean sections are done under spinal anaesthesia because it is a safe, quick in onset and reliable technique. Maternal hypotension is most common cardiovascular response of spinal anaesthesia that can lead to nausea, vomiting and cardiovascular collapse in mother and hypoxia in neonate. Administration of crystalloids before spinal block have been common practice to prevent hypotension. But some investigators have questioned the efficacy of preloading. We conducted this study to compare effectiveness of preloading and coload in prevention of spinal anaesthesia induced maternal hypotension during caesarean section.

Material and Methods: 60 parturients, ASA physical status of I and II, uncomplicated pregnancy posted for caesarean section under spinal anaesthesia were randomized into two group. Preload group received 15 ml/kg of RL solution over 20 min and coload group were given same volume of RL solution over 20 min after CSF tapping. Hypotension was defined as a decrease in systolic blood pressure of more than 20% from the baseline or a decrease of systolic blood pressure to less than 90 mmHg as absolute value. Episodes of hypotension were treated with fluid boluses and inj. Ephedrine.

Results: Incidence of hypotension was 40% in preload group and 46.66% in coload group, which was statistically not significant ($p=0.602$). Incidence of nausea and vomiting, vasopressor requirement and neonatal outcome were comparable in both groups.

Conclusion: Coload with crystalloids is equally effective as preloading to prevent spinal anaesthesia induced maternal hypotension.

Keywords: Coload, Crystalloids, Caesarean Section, Hypotension, Preloading, Spinal Anaesthesia

may be the reason. Recently rapid fluid administration at the time of spinal block have been advocated because it expands intravascular volume at the time of maximum vasodilatation^{11,12} and avoids unnecessary delay in surgery.

We conducted this study to compare effectiveness of preloading and coload in prevention of maternal hypotension during elective caesarean section under spinal anaesthesia. Secondary outcome studied were vasopressor requirement for maintaining blood pressure, incidence of nausea and vomiting and neonatal apgar score.

MATERIAL AND METHODS

This prospective randomized control trial was conducted after obtaining ethics committee approval and written informed consent of patients. This study included 60 parturients of ASA grade I and II posted for elective caesarean section under spinal anaesthesia. Patients with chronic hypertension or PIH, fetal distress, APH, eclampsia, cardiovascular disease, anaemia and any contraindication to spinal anaesthesia were excluded from study. Patients were randomized using computer generated random number into preload (P) and coload (C) group each including 30 patients.

All patients were premedicated with ranitidine and metoclopramide on the day of surgery. On arrival to the operation theatre ECG, SPO₂, NIBP instituted and baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) were recorded.

All the patients were given spinal anaesthesia using 2.2 ml of 0.5% hyperbaric bupivacaine in left lateral position in L3-4 / L2-3 intervertebral space using 23/25G quincke's spinal needle under all aseptic preparation. In group P, patients were given 15ml/kg of ringer lactate (RL) solution over 20 min before spinal block and in group C patients, RL were infused over 20 min after CSF tapping. Sensory level was assessed after block and surgery was allowed to proceed as T5 level was achieved.

Patients were observed for HR, SBP, DBP, MAP and SPO₂ every 2 min till 10 min, every 5 min till 30 min and every 10 min till end of surgery. Maternal hypotension was defined as a decrease in SBP by 20% or more from baseline value or systolic blood pressure less than 90 mmhg as absolute value. Hypotensive episodes were treated with inj. ephedrine 3 mg in incremental doses and fluid boluses. Bradycardia was defined as HR less

INTRODUCTION

Most routine and emergency caesarean sections are done under spinal anaesthesia because it is a safe, quick in onset and reliable technique and also avoids chances of airway complications like failed intubation associated with general anaesthesia.^{1,2} Hypotension is the most common cardiovascular response with spinal anaesthesia leading to nausea, vomiting and dizziness in parturient.³ Sustained hypotension in mother can cause fetal hypoxia and acidosis due to placental hypoperfusion.⁴ Incidence of post spinal hypotension can be very high without preventive measures. Many techniques have been used to prevent or treat maternal hypotension including preloading, left uterine displacement to avoid aortocaval compression and vasopressor drugs.⁵ Rapid administration of crystalloid fluid over 20 min before spinal anaesthesia is common practice.⁶ However other investigators has questioned preloading⁷⁻¹⁰ who find that even large volume of fluids can not reduce incidence of hypotension significantly. Short intravascular half life of 15-20 min of crystalloids due to rapid redistribution into interstitial space

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How to cite this article: Parul Jain, Deepali Valecha. Comparative evaluation of preloading and coload of crystalloids to prevent spinal induced hypotension in caesarean section. International Journal of Contemporary Medical Research 2017;4 (2):411-414.

than 55 /min and treated with inj. atropin 0.6 mg. Total fluid used in both groups were also noted. Incidence of nausea and vomiting were noted. Apgar score at birth was evaluated at 1 min and 5 min by paediatrician unaware of group allocation.

STATISTICAL ANALYSIS

Statistical analysis was done using student t test for quantitative data and chi square test for qualitative data and p value <0.05 were considered statistically significant.

RESULTS

Both groups were comparable in terms of age, weight and height. Baseline HR,SBP,DBP, MAP were also comparable in two groups (Table 1). Data are presented as Hypotension was noted in 12 patients (40%) in preload group and in 14 patients (46.66%) in coload group ($p=0.602$). Mean no. of bolus doses of ephedrine administered was 1.43 ± 1.72 in coload group and 1.27 ± 1.74 in preload group which was insignificant ($p=0.7101$) and mean total dose of ephedrine administered was 4.3 ± 5.14 and 3.8 ± 5.22 in coload and preload group respectively ($p=0.7099$). Nausea and vomiting was found in 4 patients in preload group patients and 2 patients in coload group ($p=0.389$). There was no statistical significant difference in total fluid requirement in

both groups (Table 2). Apgar score after birth at 1 min and 5 min were comparable in both groups (Table 2). Trends of SBP and HR were similar in both groups (Figure 1 and 2).

DISCUSSION

Spinal anaesthesia is most commonly used for caesarean section because it is easy to perform, fast in onset and airway complications of general anaesthesia are avoided.^{1,2} Though it has several advantages, high incidences of hypotension has been cause of concern for anaesthetists because it can lead to nausea, vomiting, fetal hypoxia even cardiac arrest.¹³ So different techniques have been used to prevent hypotension. Hemodynamic changes after spinal anaesthesia occurs because of sympathetic block. This sympatholysis results in vasodilatation resulting in pooling of blood in vessels. So number of studies focused on fluid administration to fill vessels. Muzlifah and Choy¹⁴ compared two doses of ringer lactate 10mg/kg and 20mg/kg in preloading and found that there was no difference between two group, so no benefit of giving larger doses. Comparison of colloid and crystalloid done by Siddik et al¹⁵ using 500 ml of 10% hydroxyethylstarch and 1000 ml of ringer's lactate and found that hydroxyethylstarch more effective than ringer lactate in prevention of maternal hypotension. However, Tamilselvan

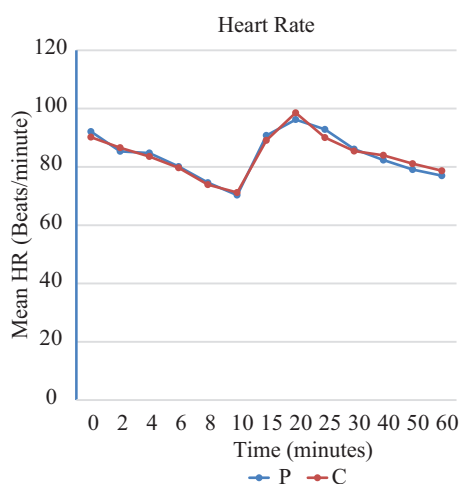


Figure-1: Trends of heart rate

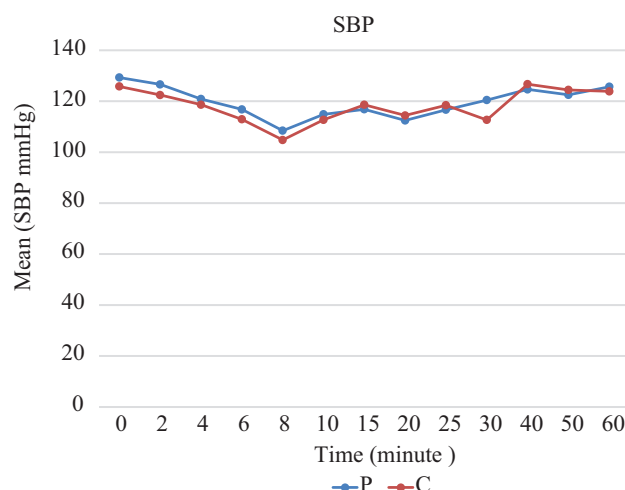


Figure-2: Trends of systolic blood pressure

	Preload group (N=30)	Coload group (N=30)	P value
Age (year)	30.5±3.5	31.7±4.2	0.234
Weight (kg)	72.5±8.0	71.2±7.2	0.510
Height (cm)	149.57±3.47	149.72±3.68	0.871
Preoperative Heart rate (bpm)	92.13±14.19	90.20±13.23	0.587
Preoperative SBP (mmHg)	129.37±11.48	125.87±13.52	0.284
Preoperative MAP (mmhg)	78.46±13.69	79.34±10.83	0.783

Table-1: Maternal characteristics and preoperative vital parameters

	Preload group (N=30)	Coload group (N=30)	P value
Incidence of hypotension, N (%)	12 (40%)	14 (46.66%)	0.602
Incidence of nausea and vomiting	4 (13.33%)	2 (6.66%)	0.389
Total fluid required (ml)	1310±187	1319±163	0.843
Mean bolus doses of ephedrine (no)	1.27±1.74	1.43±1.72	0.7101
Mean total dose of ephedrine (mg)	3.8±5.22	4.3±5.14	0.7099
Neonatal apgar score <7 at 1 min	1	0	0.313
Neonatal apgar score <7 at 5 min	0	0	P=1

Table-2: Incidence of hypotension and vasopressor requirement

et al¹⁶ compared 6% hydroxyethylstarch and ringer lactate and found that preload increases cardiac output and flow time. This effect is more with colloid but still not sufficient to prevent hypotension.

Results of Teoh and Siah¹⁷ were also same who did comparison of colloid preload and colloid coload on maternal cardiac output and they concluded that cardiac output increases initially in preload group, but that effect is transient. Hypotension occurred in both group. In preload group 90% patients had 10% decrease in systolic B.P., whereas 75% had same effect in coload group ($p=0.41$).

Yokoyama et al¹⁸ compared colloid preload, crystalloid preload and no preload and find no difference in all three group on maternal hemodynamics.

Siddik et al¹⁹ compared colloid preload and colloid coload and results were similar to our study. They could not find difference in incidence of hypotension and concluded that both are ineffective when used alone.

McDonald et al²⁰ compared crystalloid and colloid coload and found no difference in cardiac output, vasopressor requirement and hemodynamic parameters.

In our study we did comparison of crystalloid preloading and crystalloid coload because there are studies which show that ringer lactate given after spinal anaesthesia increases cardiac output and crystalloid are inexpensive in comparison of colloid and have lower side effects like anaphylactic reactions.²¹

Similar study also conducted by Dyer et al²² who also compared ringer lactate preloading and coload. Dose used in their study was 20 ml/kg and they included 50 patients, rather than 60 which we included. They favoured coload because vasopressor requirement was significantly less in coload group ($p=0.047$). In our study vasopressor requirement in both groups does not show statistical significant difference.

Our study confirms the findings of Baustita, Mojica et al²³, they compared three group, one which received preloading at a dose of 20 ml/kg and second received coload with same volume and third group received 1-2 ml/kg of fluid and they termed this group as placebo, but we did not include a placebo group for ethical reason. They also noted cardiovascular side effects. They defined these effects as development of nausea, vomiting and fainting. They found that frequency of hypotension was more in preloading group as compared to placebo, but this difference was not significant. It was similar in coload and placebo group. They found coload better when they took cardiovascular side effects in consideration.

Our findings are also similar to those of Bannerjee et al. who report the incidence of hypotension in the coload group as 59.3% compared with 62.4% in the preload group in a meta analysis of the use of coload or preload during spinal anesthesia for cesarean section. They found the difference between the two groups to be statistically not significant.²⁴

Our results are also similar to those of Jacob JJ et al²⁵ who compared preloading with 15 ml/kg of ringer lactate and coload with same volume and found incidence of hypotension 60% in preloading group and 46% in coload group, which was statistically insignificant ($p=0.1607$). Incidence of nausea was higher in preload group which was statistically significant ($p=0.0473$). Incidence of vomiting was also higher in preload group ($p=0.0455$). but in our study incidence of nausea and

vomiting were comparable.

We have compared coload with preloading. Due to absence of control group, efficacy of preloading in prevention of hypotension can not be commented upon. In our study, incidence of hypotension in preload group is 40% and in coload group is 46.66%, this difference is statistically not significant ($p=0.602$). Difference in incidence of nausea, vomiting, fluid and vasopressor requirement were statistically insignificant. Neonatal outcome were comparable in both groups.

In busy schedule of operation theatre when there is rapid turnover of cases, coload would be better method for prevention of spinal induced hypotension. however caution should be exercised in high risk cases.

CONCLUSION

We conclude that coload with ringer lactate solution in dose of 15 ml /kg is as effective as preloading with same volume to prevent spinal induced maternal hypotension.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 23-01-2017; **Published online:** 03-03-2017