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Comparative Study of Effects of Preloading or Co-Loading with Crystalloids in Emergency LSCS on Fetal Acid Base Analysis in Normal Vs Preeclamptic Mothers

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Abstract
Caesarian section is one of the most commonly performed surgical procedure worldwide and 80-90% of them are performed under spinal anaesthesia. Maternal hypotension during spinal anaesthesia for caesarian section can lead to maternal complications (nausea, vomiting, giddiness) as well as fetal complications such as fetal hypoxia by impairing uteroplacental blood flow which can be detected by umbilical cord blood gas analysis. This study was conducted to compare the effectiveness of Preloading versus Co-loading with crystalloids in prevention of spinal anaesthesia induced maternal hypotension and fetal acidosis in normal and pre-eclamptic mothers during caesarian section and its role in preventing fetal hypoxia by monitoring umbilical cord blood gas analysis. 80 singleton full term pregnant patients (20-35yrs of age) scheduled for emergency caesarian section were randomly divided into 4 groups, 20 each. Group A with normal pregnant females and Group C with Pre-eclamptic females were Preloaded with crystalloids. Group B with normal pregnant females and Group D with Pre-eclamptic females were Co-loaded with crystalloids. We compare the HR and BP (SBP and DBP) every 2min for 10 mins and thereafter every 5 min till end of surgery. The umbilical cord blood samples were taken for acid-base analysis of the neonate and analysis done within 30 mins. The APGAR score of the newborn were recorded at 1min and 5min. All the four groups were comparable in patients age, weight and duration of surgery($p>0.05$). The baseline heart rate were comparable between group A and B and between group C and D but intraoperatively both SBP and DBP were significantly higher in group C and D at 5 min, 10 min interval whereas neonatal outcome with respect to APGAR score and acid base profile remained same across all the groups. On the basis of our study we concluded that crystalloid Co-loading is more effective than Pre-loading in both normal as well as pre-eclamptic mothers in preventing spinal anaesthesia induced maternal hypotension and neonatal acidosis during caesarian section but difference is not statistically significant.

INTRODUCTION

All obstetric patients undergoing caesarean section potentially require anaesthesia, whether emergency or planned. Central neuraxial blockade is considered as the gold standard technique for obstetric anaesthesia. Spinal anaesthesia is frequently used for caesarean section due to it's rapid onset, dense neural block, less maternal morbidity and mortality. The fatality rate directly attributed to anaesthesia was approximately 17-fold more frequent with general anaesthesia as compared to regional anesthesia[1].

Hypotension following spinal is a common physiological complication mainly occur due to sympathetic blockade leading to peripheral vasodilation and venous pooling of blood. As a result, there is decreased venous return and cardiac output leading to hypotension[2]. In pregnancy this is further aggravated by the effects of the gravid uterus and subsequent aortocaval compression. The spectrum of morbidity associated with hypotension may include but is not limited to a higher incidence of nausea, vomiting dizziness, aspiration, syncope and cardiac arrhythmias[3]. Preeclampsia is one of the maternal condition associated with both maternal and fetal complications. The increased incidence of perinatal morbidity and mortality seen in pregnancies complicated by preeclamsia, is primalily due to the need for premature delivery and uteroplacental insufficiency resulting in a compromise of blood flow to the fetus[4]. Umbilical cord blood gas analysis in a newborn is the gold standard measure for fetal hypoxia., especially when base excess is more than 12-16 mmol/l[5].

Several techniques and methodologies have been adopted for the prevention of this hypotension with varying degree of success. One of the most commonly used methods to reduce spinal anaesthesia induced hypotension is administration of intravenous fluids before implementation of subarachnoid block, a technique named preloading first described by Wollman and Marx[6]. A method of administration of intravenous fluid bolus immediately after the block-co-loading appears to be more physiological and rational approach. Co-loading seems to be more appropriate physiologically as the increase in intravascular volume brought about by Co-loading coincide with the time of maximal vasodilation effect of spinal anaesthesia thus reducing the degree of hypotension[7]. Based on this observation, the study was designed to evaluate hemodynamic changes and acid base analysis of newborn following preload and coload with crystalloids in normal and pre-eclamptic mothers who undergo emergency LSCS and to find out which method is effective to prevent hypotension following spinal anaesthesia.

Aim and Objectives: To compare the effectiveness of preloading versus coloading with crystalloids in prevention of spinal anaesthesia induced maternal hypotension and fetal acidosis in normal as well as preeclamptic mothers in emergency caesarean section.

MATERIALS AND METHODS

After obtaining approval from hospital ethical committee and informed written consent from patients the study was conducted on 80 singleton full term pregnant patients (aged 20-35 years), scheduled for emergency caesarean section. The patients were randomly divided into four groups of 20 patients each

Group A: Normal pregnant females pre-loaded with Crystalloids
Group B: Normal pregnant females co-loaded with Crystalloids
Group C: Pre-eclamptic females pre-loaded with Crystalloids
Group D: Pre-eclamptic females co-loaded with Crystalloids

Patients with Diabetes, Cardiovascular or Cerebrovascular disease, Known fetal abnormalities, Multiple gestation pregnancy and any contraindication to spinal anaesthesia were excluded from the study. A detailed history and complete general physical and systemic examination was done and baseline values of pulse, blood pressure and respiratory rate were recorded. Basic demographic characteristics like age, weight and height were noted. Routine investigations including haemoglobin (Hb), bleeding time (BT), clotting time (CT), electrocardiography (ECG), renal function tests (RFT), serum electrolytes, blood sugar and complete urine examination was done. A good intravenous line with 16 or 18 gauge cannula was established. Each patient received injection ranitidine 50mg intravenously and injection metoclopramide 10mg intravenously 30 min. before anaesthesia. Ringer's lactate solution in the dose of 10-15 ml\kg was used for pre-loading the patients in Group A and C, thirty minutes before Spinal Anaesthesia; and for co-loading in group B and D immediately after giving Spinal Anaesthesia.

Anaesthetic Technique: Baseline monitors, non-invasive blood pressure (NIBP), electro cardiographic (ECG) monitor with modified chest leads and pulse oximeter (SpO_2) were attached. With careful aseptic preparation, spinal anaesthesia was given in lateral or sitting postion with hyperbaric 0.5% injection bupivacaine 10/15mg in the subarachanoid space through a 25G Quincke needle at L2/L3 or L3/L4 space. The patient was turned to supine position and after 5

min, wedge was placed under the right flank. Oxygen was administered at a rate of 3 L/min by a face mask to all the patients until the umbilical cord is clamped. Injection oxytocin was given after clamping the cord. Heart rate, Blood pressure (SBP and DBP) and SpO_2 were recorded after subarachnoid block and labelled as 0 min and at every 2 min for 10 min and thereafter every 5 min till the end of the surgery.

The umbilical cord were clamped on both sides right after delivery and blood samples from umbilical cord were taken in pre-heparinized syringe for acid-base analysis of neonate. APGAR score of neonate was also noted at 1 and 5 min.

Statistical Analysis: Data was tabulated using Microsoft excel (2010) software and was analysed using Epi info software version 7.2.2 mean of two groups were compared using independent student t-test. Chi-sq test/Fischers exact test was used in analyzing association between categorical variables. $P<0.05$ was considered to be statistically significant.

RESULTS AND DISCUSSIONS

All the four groups were comparable in patients age, weight, height and duration of surgery ($p>0.05$). The baseline mean heart rate, systolic BP and diastolic BP were also comparable between group A and B and between group C and D but intraoperatively both SBP and DBP were significantly higher in group C and D at 5 min, 10 min interval whereas neonatal outcome with respect to APGAR score and acid base profile remained same across all the groups.

Intraoperatively heartrate shows no significant difference in between all groups at 0 min, 5 min, 10 min whereas blood pressure both SBP and DBP was significantly higher in group C and D. $p(<0.001)$ at all time intervals 0 min, 5 min, 10 min as compared to group A and B.

Neonatal outcome, with respect to Apgar score and acid base profile (pH, pCo2, pO2 and HCO3) was similar between the group A and B and between the group C and D. But for pH and pO2, there was a significant difference between groups showing lower pO2 and pH in mothers with pre-eclampsia compared with healthy mothers in both pre-loading as well as coloading groups.

Anaesthesia to a parturient is not only unique but requires highest degree skill and care because the anaesthesiologist has to look after two individuals, the mother and foetus. Regional anaesthesia has been considered as the most appropriate for caesarean section in parturient due to beneficial effects on mother and foetus[8]. The linear relationship between maternal BP and CO is somewhat offset by significant changes in peripheral resistance. These clinical changes are further strengthened by the fact that instead of maternal hypotension, correlation of decreased CO with spinal anaesthesia, increased umbilical artery pulsatility index and acidic changes in umbilical arterial blood are better predictors of uteroplacental perfusion[9]. The aim of this study was to compare the beneficial effects of preloading versus coloading with crystalloids on haemodynamic changes of the mother as well as fetal acidosis in normal as well as preeclamptic mothers in emergency caesarean section under spinal anaesthesia.

Eighty patients were randomly divided into four groups of 20 patients each. In Group A, Normal pregnant females pre-loaded with Crystalloids. In Group B, Normal pregnant females co-loaded with Crystalloids. In Group C, Pre-eclamptic females pre-loaded with Crystalloids. And in Group D Pre-eclamptic females co-loaded with Crystalloids. Vital parameters like Heart rate, Blood pressure (systolic and diastolic) were recorded preoperatively and postoperatively. Any side effects observed were also recorded.

In our study crystalloids co-loading was more effective than pre-loading in preventing maternal hypotension and neonatal acidosis. The result of our study was similar to the study done by Arnab Banerjee[10] where they compared a fluid preload with Coload in patients undergoing spinal anaesthesia for elective caesarean delivery. They recorded the incidence of hypotension, lowest BP, incidence of maternal nausea and vomiting, umbilical cord ph and APGAR score. In their study incidence of hypotension in coload gp was 59.3% compared with 62.4% in the preload gp where as in our study.

The mean values of HR did not change significantly in all groups throughout all time intervals after the induction of spinal anaesthesia. This finding was in line with other studies[11]. Another study by Chowdhury *et al*. found that minimum SBP, DBP and MAP were always higher in pre-eclamptic group as compared to normotensive group. Our study shows the similar results[11].

Artawan[12] has done similar study to compare the effect of preloading and coloading with crystalloid fluid on incidence of hypotension after spinal anaesthesia in caesarean section and found that coloading was significantly better in reducing hypotension incidence after spinal anaesthesia in cesarean section compared to preloading and control groups. Another similar study done by Neha Bharadwaj[13] show, SBP dropped in both (preloaded and coloaded) groups after spinal anaesthesia but drop was more in preloaded group. Coloading is found to be safer technique accept for few concern related to decrease O_2 carrying capacity MacLennan[14] as in our study we also found that

Table 1: Patients characteristics.

	Group A	Group B	Group C	Group D	p-value
Age (years) (Mean ± SD)	26.60 ± 4.07	28.60 ± 4.10	27.70 ± 5.40	27.85 ± 4.91	F-value 0.63 P-value 0.598 (NS)
Weight (kg's) (Mean ± SD)	70.55 ± 5.16	71.80 ± 4.14	69.25 ± 6.99	67.05 ± 9.87	F-value 1.73 P-value 0.172 (NS)
Height (inchs) (Mean ± SD)	59.20 ± 3.12	57.40 ± 2.89	59.05 ± 3.33	59.80 ± 3.27	F-value 2.12 P-value 0.112 (NS)
Duration of surgery (mins) (Mean ± SD)	69.50 ± 20.89	72.75 ± 21.97	68.10 ± 21.08	65.45 ± 21.77	F-value 0.401 P-value 0.749 (NS)

Table 2: Group comparison of patients for heart rate (beats/min.)

	Mean ± Standard Deviation						
Time interval	**Group A**	**Group B**	**Group C**	**Group D**	**F-value**	**p-value**	**Remarks**
Pre-operative							
Baseline	81.95 ± 13.54	84.20 ± 15.45	87.60 ± 14.01	84.95 ± 10.79	0.59	0.619	NS
Intra-operative							
0 min	84.10 ± 11.45	86.50 ± 15.63	93.80 ± 13.72	84.30 ± 12.11	2.33	0.081	NS
5 min	80.60 ± 9.48	80.20 ± 10.59	83.70 ± 11.92	79.70 ± 9.93	0.61	0.621	NS
10 min	79.10 ± 6.21	77.25 ± 6.83	79.75 ± 7.24	80.70 ± 8.27	0.82	0.482	NS

Table 3: Group comparison of patients for SBP (mmHg)

	Mean ± Standard Deviation						
Time interval	**Group A**	**Group B**	**Group C**	**Group D**	**F-value**	**p-value**	**Remarks**
Pre-operative							
Baseline	124.15 ± 3.47	122.30 ± 4.84	151.90 ± 8.98	154.65 ± 9.09	21.93	<0.0001	S
Intra-operative							
0 min	126.20 ± 5.93	125.60 ± 8.01	146.05 ± 8.36	146.40 ± 10.19	40.35	<0.0001	S
5 min	106.20 ± 5.55	115.15 ± 12.75	126.70 ± 12.30	132.25 ± 13.03	21.19	<0.0001	S
10 min	100.60 ± 9.29	108.75 ± 12.90	116.10 ± 12.74	117.40 ± 13.72	7.95	<0.0001	S

Table 4: Group comparison of patients for DBP (mmHg)

	Mean ± Standard Deviation						
Time interval	**Group A**	**Group B**	**Group C**	**Group D**	**F-value**	**p-value**	**Remarks**
Pre-operative							
Baseline	76.70 ± 4.27	77.05 ± 7.54	102.30 ± 5.37	98.90 ± 4.75	119.91	<0.0001	S
Intra-operative							
0 min	74.25 ± 10.21	79.35 ± 9.43	95.35 ± 4.92	93.30 ± 5.74	34.32	<0.0001	S
5 min	63.30 ± 8.29	70.25 ± 8.61	83.65 ± 9.70	86.25 ± 9.37	29.40	<0.0001	S
10 min	61.95 ± 9.10	66.65 ± 7.72	72.60 ± 9.47	70.60 ± 11.01	5.01	<0.0001	S

APGAR score at 1 min and 5 min were similar in both groups

Table 5: Group comparison of Neonatal for APGAR score

	Mean ± Standard Deviation						
Time interval	**Group A**	**Group B**	**Group C**	**Group D**	**F-value**	**p-value**	**Remarks**
1 min	9.50 ± 0.69	9.50 ± 0.83	9.25 ± 0.97	9.20 ± 0.95	0.68	0.561	NS
5 min	10.00 ± 0.00	10.00 ± 0.00	9.80 ± 0.52	9.80 ± 0.41	2.41	0.072	NS

Table 6: Group comparison of Neonatal for umbilical cord blood gas profile

Umbilical cord blood gas profile	Mean ± Standard Deviation						
	Group A	**Group B**	**Group C**	**Group D**	**F-value**	**p-value**	**Remarks**
pH	7.33 ± 0.04	7.35 ± 0.03	7.31 ± 0.03	7.32 ± 0.02	5.89	<0.0001	S
pCo_2	49.60 ± 6.53	48.80 ± 4.80	52.85 ± 5.63	50.80 ± 5.37	1.97	0.130	NS
po_2	15.10 ± 7.50	18.65 ± 4.00	14.15 ± 5.05	15.20 ± 3.12	2.90	0.040	S
HCo_3	24.34 ± 3.44	24.21 ± 3.07	26.16 ± 2.20	25.80 ± 2.30	2.56	0.062	NS

decrease PO_2 and pH value on umbilical cord blood gas profile in pre-eclamptic mother as compared to normal mothers in both preloading and coloading groups. APGAR score was similar between group A and B and between C and D. Similar findings were recorded by Borse[15]

CONCLUSION

The present study concluded that crystalloids co-loading is more effective than pre-loading in both normal as well as pre-eclamptic mothers in preventing spinal anaesthesia induced maternal hypotension and neonatal acidosis but the difference is not statistically

significant. And there are more chances of neonatal acidosis in preeclamptic mothers than normal mothers in both preloaded and co-loaded groups.

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