

**COMPARISON OF EPIDURAL INFUSION WITH FLUID PRELOADING:  
PREVENTION OF HYPOTENSION DURING CAESAREAN SECTION UNDER SUB  
ARACHNOID BLOCK****Lt. Col. Apple Mahmud Anwar<sup>1\*</sup>, Lt. Col. Nasrin Hasan<sup>2</sup> and Lt. Col. Abu Hasnat MD Habibur Rahman<sup>3</sup>**<sup>1</sup>DA, MCPS, CCD, Graded Spl in Anaesthesiology, Department of Anaesthesiology, CMH, Mymensingh, Bangladesh.<sup>2</sup>FCPS, MCPS, Classified Gynaecologist, Department of Gynae and Obstratics, CMH, Mymensingh, Bangladesh.<sup>3</sup>MPH, MPHIL, CO, CMH, Mymensingh, Bangladesh.**\*Corresponding Author: Lt. Col. Apple Mahmud Anwar**

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Article Received on 17/11/2020

Article Revised on 07/12/2020

Article Accepted on 27/12/2020

**INTRODUCTION**

Subarachnoid block in caesarean section has become a popular technique. Its popularity has grown further due to introduction of narrower gauge spinal needle. This has remarkably lessened the incidences of postdural puncture headache. But the most common serious problem associated with subarachnoid block in caesarean section is rapid onset of profound hypotension. The anaesthetic texts continue to emphasize both uterine displacement and intravenous volume preloading prophylactic measures to reduce the incidence of hypotension. Recent invasive studies have confirmed the decrease in cardiac output associated with the supine position and hence, the mandatory use of lateral tilt. However the incidences of hypotension varying between 4.1% and 83%, may compromise the welfare of both mother and foetus. The acceptable explanation of these are excess peripheral vasodilatation resulting from sympathetic block leading to decreased venous return enhanced by pre-existing pregnancy induced low vessel tone, induced by falling of gravid uterus on inferior vena cava. Marx and co-workers suggested that hypoglycaemia might be a factor involved in the genesis of hypotension during regional anaesthesia, especially when the parturients fasting period is prolonged beyond 11 hours. Various prophylactic measures have been taken to prevent the incidence and severity of hypotension and related untoward effects include intravascular volume expansion using IV fluid (preload) immediately before spinal anaesthesia, use of left lateral tilt or manual uterine displacement, or both, and administration of IV fluids and IM or IV vasopressor drugs both prophylactically and in response to the cardiovascular changes subsequent to neural block. The rate of administration, total volume and type of fluid used remain controversial. Volumes in excess of 2 litre have been infused rapidly and while the normal healthy patient can tolerate this without difficulty, there may be problems if practice routinely. Colloids may stay in the intravascular compartment longer but is more expensive and some of the solutions confer small but significant risk of anaphylaxis. It may also affect blood grouping and cross-matching, so caesarian section patient where blood transfusion is essential may be problematic. The aim of the study was to evaluate the efficacy of ephedrine infusion to replace the conventional preblock crystalloid administration in reducing the incidence of hypotension during spinal Anaesthesia.

**MATERIALS AND METHODS**

With institutional approval and informed consent, sixty healthy parturient scheduled for elective caesarean section were randomly assigned in two groups (fluid group and ephedrine group) before transferring to the operating theatre. Patient with medical diseases or obstetric complications, weighing more than 75kg were excluded from the study to minimize technical difficulty. Baseline measurements of heart rate, oxygen saturation and noninvasive arterial blood pressure were recorded in 15° left lateral tilted position. A 18 G intravenous cannula was inserted into a peripheral vein and woman in the fluid group received a preload of 20ml/kg of Ringer's lactate solution over 10-15 min immediately before institution of block. The ephedrine group received no

fluid preload. With the patient in the left lateral position, 25G Quincke needle was inserted at the L<sub>3-4</sub> spinal interspace and 10-11.5 mg of 0.5% hyperbaric bupivacaine was injected into the subarachnoid space. The parturient were repositioned promptly in the supine position and a wedge was placed under the right buttock. Intravenous ephedrine 0.30 mg/kg over 5 minutes was administered to parturient in the ephedrine group immediately after block using syringe. The level of sensory block was assessed at 2min, 4min, 6min, 10min, and 15min after block using pinprick technique. Blood pressure and heart rate were recorded at 1 minute intervals for the first 10min, at 2min intervals for the 2<sup>nd</sup> 10 min and subsequently at 3-min intervals and SpO<sub>2</sub> was monitored continuously until the end of the surgery.

Surgery was allowed to proceed when the upper sensory level extended to T6 or above. Hypotension was defined as a decrease of 20% or more of systolic blood pressure from the base line value and was treated with further increments of ephedrine (5mg every increment) and an increase in the intravenous fluid infusion rate until the blood pressure returned to the normal range. Skin incision to uterine incision time and uterine incision to delivery time was recorded and the parturient were asked to report any discomfort. A paediatrician blinded to the study recorded APGAR scores at 1 and 5 min. After delivery of anterior shoulder of the neonate, 5unit of oxytocin was administered to all patients as a bolus.

Statistical significance was determined with Students t-test or Chi- square tests where appropriate. P value of < 0.05 was considered as significant.

## RESULTS

Patient characteristics and base line haemodynamic variable are show in table- I. there were no significant differences in age, body weight, height, base line blood pressure and heart rate. The height of block, skin incision-delivery time, uterine incision-delivery times and was not different between the groups. Patients in the fluid group received a larger volume of crystalloid than those in ephedrine group who received a larger total dosage of ephedrine expressed in table-II. Both groups needed similar doses of ephedrine after preloading but the ephedrine group was given more fluid intraoperatively. There were no significant changes of heart rate compared with base line in either group (Fig-1) The fall of heart rate is maximum within the first seven minutes in the fluid group but in ephedrine group the heart rate is comparatively greater than the preoperative level all through the first fourteen minutes.

**Table I: Patient characteristics and base line haemodynamic variables.**

Groups		
Characters	Fluid (n=30)	Ephedrine (n=30)
Age (years)	26.86 (1.23)	27.97(1.01)
Weight (kg)	62.04(1.72)	65.01(1.89)
Height (cm)	155.2(6.87)	153.3(6.54)
Baseline recordings Systolic blood pressure (mmHg)	125.9(14.20)	120.8(16.01)
Heart rate (beat/min)	92.03(12.12)	82.9(13.39)

Values are expressed as Mean (SEM)

**Table II: Intraoperative data.**

Groups		
Characters	Fluid (n=30)	Ephedrine (n=30)
Level of block at 6 min (Thoracic dermatome)	4(0.63)	4(0.71)
Total fluid (ml)	1400(39.46)	600(48)
Fluid after preload (ml)	120(54)	600(48)
Total ephedrine (mg)	23.47(6.7)	33.56(8.5)
Ephedrine after Preload (mg)	23.47(6.7)	14.06(6.79)
ID time (min)	9.2(3.21)	9.3(6.52)
UD time (sec)	91.8(28.5)	79.1(29.2)

Values are expressed as Mean (SEM)

There was fall of blood pressure in both groups but comparatively more in fluid group than ephedrine group in comparison with base line value. (P<0.01) (Fig-2). Fluid group had a greater number of patients with more severe hypotension but there was no significant difference between the groups in the number of patients who had a moderate degree of hypotension (Table-III).

**Table III: Incidence of hypotension.**

Groups		
Characters	Fluid (N=30)	Ephedrine (N=30)
>20% reduction in SBP	24 (80%)	21 (70%)
>30% reduction in SBP	20 (67%)	10 (33%)

Within parenthesis values are expressed as percentage over column total.

The ephedrine group shows lower incidence of shivering, nausea / vomiting and dizziness (table-IV). Nausea / vomiting was of short duration self-limiting. There was no difference in Apgar scores at 1 and 5 minutes between the groups (table-V).

**Table IV: Incidence of side effects.**

Groups		
Characters	Fluid (N=30)	Ephedrine (N=30)
Shivering	10 (33%)	4(13%)
Nausea / vomiting	12(40%)	9(30%)
Dizziness	10(33%)	8(27%)

Within parenthesis values are expressed as percentage over column total.

**Table V: Neonatal status.**

Characters	Groups	
	Fluid (N=30)	Ephedrine (N=30)
Apgar scores 1 min	8.5 (7-10)	8.5(7-10)
Apgar scores 5 min	10 (9-10)	10 (9-10)

Values are expressed as mean (SEM)

## DISCUSSION

Hypotension during subarachnoid block is common problem despite different preventing measure. Acute hydration for the prevention of hypotension during SAB in the parturient was first published in 1986 by Wollman et al, who administered 5% dextrose in Ringer's lactate solution over 14-20 min before block. Fluid preloading for caesarean section under regional anaesthesia has been established as routine and considered to be safe and effective method of reducing the incidence of hypotension.<sup>[7]</sup> Many regimens have been recommended, including fluid infusion up to 3-4 litres but evidence is accumulating that this technique may not be effective.<sup>[8]</sup> This is probably because fluid is rapidly redistributed into the interstitial space after intravenous infusion. On the other hand, these are time consuming to administer and effects are only transient. These are dangerous to the parturient with cardio-renal impairment by risking circulatory overload after delivery or block regression, significant haemodilution, bladder distension and large amounts of fluid may cool the patient if not properly warmed during administration. Furthermore, a recent study has found that rapid intravenous volume loading causes releases of atrial natriuretic peptide and endothelin-1 that decreases vessels tone and may attenuate the effects of volume loading.<sup>[9]</sup> Our results indicate that an ephedrine infusion without preblock crystalloid administration is more effective than crystalloid administration in reducing the incidence / severity of hypotension during spinal anaesthesia. Although crystalloid administration is safe in most patients, it may be disadvantageous in certain group of patients such as those with renal impairment or congestive cardiac failure.<sup>[10]</sup> There is evidence to suggest that postpartum patients might be more susceptible to pulmonary oedema after rapid administration of crystalloid solutions, possibly because of an increase in lung water during pregnancy. Grace PE et al reported a large decline in maternal colloid osmotic pressure (COP) in the 20 and 30 ml/kg groups than the 10ml/kg group and concluded that increasing the amount of IV crystalloid in the healthy parturient dose not beneficial.<sup>[11]</sup> It has been well established that COP decreases throughout normal pregnancy and in the postpartum period. The association of increasing intravenous fluids with decrees in COP has raised some concern regarding the potential risk of maternal and possibly, foetal pulmonary edema.<sup>[12]</sup>

The effect of rapid administration of crystalloid 20ml/kg over 10 min and 20 min has been evaluated. Rapid administration of preload failed to reduce the incidence

of spinal hypotension and was accompanied by a significant increase in central venous pressure (CVP) up to 19 mmHg. An important additional finding of this study was the rapidity with which CVP decreases at the onset of spinal anaesthesia, despite preload.<sup>[13]</sup>

Jackson et al have now show that there was no advantages in giving 1 litre of crystalloid preload compared with 200ml, to reduce the incidence, severity or duration of hypotension after spinal anaesthesia for elective caesarean section.<sup>[14]</sup> Neonatal outcome, as assessed by Apgar scores was similar between the groups.

Since vasodilatation is the primary cause of hypotension, it seems logical to use vasopressors to correct it. Ephedrine stimulates both  $\alpha$  &  $\beta$  adrenoceptors, dose not decrease uteroplacental blood flow probably to the release of nitric oxide and can be given quickly and conveniently. It is also apparent that most patients still need intravenous ephedrine to correct hypotension despite preloading.<sup>[15]</sup>

We administered ephedrine by intravenous infusion contemporaneously with the onset of sympathetic block and found this simple and less time-consuming technique to be more effective in maintaining blood pressure than a 20 ml/kg prophylactic fluid preload. Although the incidence of moderate hypotension was similar, the ephedrine group had fewer severe episodes. The fact that no difference was found in the amount of additional ephedrine given after the initial preloading is probably explained by the similar incidence of moderate hypotension in both the groups since this was stimulus for giving ephedrine. The peak incidence of hypotension occurred during the 5<sup>th</sup> minute after intrathecal local injection and perhaps either a larger prophylactic dose of ephedrine or a larger dose infused over longer of time might have been more effective in prevention. Ephedrine is both a direct and indirect acting sympathomimetic agent. Theoretically its efficacy is reduced with repeated administration, since tachyphylaxis can occur<sup>[16]</sup>. Additional research would be useful to determine the optimal dose required to attenuate the hypotension whilst minimizing side effects and to investigate whether ephedrine alone is capable of preventing hypotension.

The anaesthetist needed to administer more fluid in the ephedrine group intraoperatively, probably attempting to compensate for the blood loss<sup>[17]</sup> Despite using a higher dose of ephedrine in the prophylactic ephedrine group, there was no significant increase in the heart rate compared with baseline values and no episode of dysrhythmias.<sup>[18]</sup> Our study is comparable to that produced by Gajraj et al, who administered crystalloid 15ml/kg over 10 min and ephedrine 5mg/min for the first 2 min and 1 mg / min for the next 18 min. the incidence of hypotension was 15/27(55%) in the crystalloid group and 6/27 (22%) in the infusion (P<0.05) and concluded that a prophylactic ephedrine infusion is effective for

minimizing and managing hypotension associated with spinal anaesthesia and compares favorably in terms of efficacy and incidence of side effects.

### CONCLUSION

Nausea and vomiting are commonly associated with hypotension. Treatment of the cardiovascular problems may not relieve these symptoms in every case and the use of conventional antiemetic's can sometimes be unrewarding. The incidence of shivering was significantly higher in the preload group and can probably be explained by infusion of fluids at room temperature. This is in consistent with Chan et al. studies. We found similar APGAR scores in the two groups. The dose of ephedrine we administered have not any detrimental effect on neonatal outcome.

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