Prevention of Hypotension following Spinal Anaesthesia for Caesarean Section: Comparison of Pretreatment with Crystalloid and Ephedrine Infusion

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ABSTRACT

BACKGROUND

Regional anaesthesia has become the preferred technique for caesarean section because of higher incidence of maternal mortality and morbidity associated with general anaesthesia. Spinal hypotension occurs as a result of sympathetic blockade and decreased venous return due to decreased systemic vascular resistance and venous pooling. Such episodes of hypotension have been shown to cause decreased Apgar scores and foetal acidosis. Preloading with intravenous fluids, left uterine displacement and prophylactic/ therapeutic vasopressors have all been used in the prevention and management of hypotension traditionally. However no single method has been proved satisfactory. In terms of neonatal and maternal outcomes, prevention of hypotension is considered superior to treatment of established hypotension. In this study, we compare the efficacy of preloading of crystalloids with Ephedrine infusion in prevention of hypotension following spinal block in caesarean patients.

Objectives- Primary objective is to determine the incidence of hypotension following spinal anaesthesia in patients receiving preloading with crystalloids and preloading with Ephedrine. Secondary objective is to compare intraoperative maternal and foetal adverse effects of pre-treatment with crystalloids and Ephedrine.

METHODS

An observational study was conducted in 90 patients belonging to ASA I and II categories undergoing elective LSCS. One category received 10ml/kg Ringer Lactate and other category 10mg Ephedrine in 10ml/kg Ringer Lactate 15-30 minutes prior to spinal block. All patients received SAB with 22.2ml 0.5% Bupivacaine heavy at L3-L4 space. HR and BP were monitored periodically and fall in MAP of $\geq 20\%$ was noted and managed with rescue Ephedrine. Maternal adverse events, foetal APGAR scores and umbilical blood gas analysis noted.

RESULTS

Incidence of hypotension was significantly less in Ephedrine category as compared to crystalloid category. Incidence of maternal adverse events as well as foetal parameters was not significantly different.

CONCLUSIONS

Preloading with Ephedrine decreases the incidence of maternal hypotension when compared to crystalloids alone.

KEY WORDS

Caesarean Section, Crystalloids; Ephedrine, Foetal Acidosis, Mean Arterial BP, Preloading, Spinal Hypotension.

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BACKGROUND

August Bier introduced spinal anaesthesia into medical practice in 1898.^{1,2} Since its introduction it has been widely used as the anaesthetic method of choice in lower limb and lower abdominal surgeries. Lower segment caesarean sections are the most commonly done surgeries in obstetric practice and spinal anaesthesia is the choice of anaesthesia in nonemergent caesarean deliveries.^{3,4} There is evidence of higher risk of foetal acidosis with GA as compared to regional techniques including spinal and epidural.^{5,6} Superiority of spinal anaesthesia over general anaesthesia in pregnant women is due to faster action, technical simplicity, cost effectiveness and less adverse events.⁷ In addition, spinal anaesthesia avoids airway manipulation, aspiration of gastric contents and effects of general anaesthetic medications on foetus⁸ but spinal anaesthesia is not without adverse effects, the most common being hypotension.

Hypotension following spinal anaesthesia is especially problematic in parturients and is of profound importance as a major adverse event.⁹ The incidence of hypotension following SAB in pregnant women is roughly estimated to be between 55-90%.¹⁰ Hypotension results from comparatively faster onset of sympatholysis due to increased sensitivity to local anaesthetics during pregnancy and aggravated by aortocaval compression in supine position.¹⁰⁻¹² Prolonged maternal hypotension has been proved to cause foetal bradycardia and acidemia.⁸ Hypotension can be prevented by various methods including pharmacological and non-pharmacological methods. This is directed at reversing the physiological processes behind hypotension.

Prevention of maternal hypotension, rather than managing it has gained importance over the past few decades. The severity depends on the height of the block, the position, the volume status and indication (elective or emergency) caesarean section. Pharmacological methods include crystalloid or colloid preloading or co-loading along with the use of vasopressors including Ephedrine, Phenylephrine and Mephentermine. Non pharmacological methods including the use of TED stockings, leg wrapping, inflatable boots etc. some studies also depict that delaying supine position after spinal anaesthesia may decrease incidence of hypotension.¹³ No single method has been found successful in preventing spinal hypotension in parturients till date.¹⁴

The term preloading involves administering 0.5-2L of crystalloids, 1530 minutes before initiation of a spinal block. The effect of preloading in general is the filling of capacitance vessels which in turn limits the occurrence of hypotension when venodilation occurs.¹⁵ Preloading was considered the best way for preventing spinal hypotension for many years. Preloading was particularly important in view of possible fluid depletion due to prolonged fasting periods before elective procedures. Crystalloid preloading versus colloid preloading is an extensively studied topic. Colloid preloading was proved to be better than crystalloid preloading,¹⁶ but not used in view of cost effectiveness and risk of anaphylactic reactions.¹⁷ Even though crystalloid preloading is still practised, large volume and rapid prehydration could lead to maternal fluid overload, pulmonary oedema, finally causing hypooxygenation in fetus.¹⁸ The concepts of preloading versus co-loading are extensively being studied now.

Another method in prevention of hypotension is by use of vasopressors. Historically, Ephedrine was considered as the vasopressor of choice to manage hypotension following neuraxial anaesthesia in pregnancy.¹⁹ This is mainly attributed to the superior effects of Ephedrine in maintaining the uteroplacental blood flow even in presence of hypotension. Uteroplacental sparing action of Ephedrine has been explained by its partial agonism of Beta receptors. Although Ephedrine has been shown to be associated with foetal acidosis, the dosage associated with the same has not been proven. Significance of this acidosis in neonatal outcome is another field where much consensus is yet to be obtained.

Currently Phenylephrine has taken over as the vasopressor of choice (Miller's Anaesthesia 9th Edition) due to less risk of transfer to the foetus and subsequent foetal acidosis. The use of Phenylephrine has also been found associated with decreased intraoperative nausea and vomiting (IONV).^{20,21} This may be due to faster onset of action of phenylephrine.²²

Phenylephrine causes maternal bradycardia and thereby decrease in cardiac output. Phenylephrine and Ephedrine has been compared based on their respective maternal and foetal outcomes. Another vasopressor being studied is Norepinephrine. When compared to Phenylephrine, Norepinephrine had similar efficacy in maintaining arterial BP.

Prevention of hypotension following spinal anaesthesia in pregnant women has been one of the most widely studied areas in anaesthesia so far. But, a single most effective method is not yet available. Prophylactic vasopressor infusions are now being considered in this regard. The most recent and widely accepted method is a combination of vasopressors including Ephedrine and Phenylephrine along with judicious use of IV fluids tailored for the benefit of individual patient.

This study is an attempt to compare the prophylactic use of crystalloids and Ephedrine bolus in preventing hypotension following SAB. In addition, it also compares the foetal outcome to see if low dose Ephedrine bolus result in significant foetal acidosis.

Objectives

1. To compare the effect of crystalloid preloading and Ephedrine preloading in maternal hemodynamics for patients undergoing caesarean section under regional anaesthesia.
2. To determine the incidence of hypotension following spinal anaesthesia in patients receiving preloading with crystalloids.
3. To determine the incidence of hypotension following spinal anaesthesia in patients receiving preloading with Ephedrine.
4. To compare intraoperative maternal and foetal adverse effects of pretreatment with crystalloids and Ephedrine.

METHODS

This is an Observational study conducted in the Department of Anaesthesiology, TMC, Kollam, among Patients admitted for elective LSCS under spinal anaesthesia during the time

period between March 2020 to March 2021, after approval from institutional ethics committee and an informed written consent from the participants.

Sample Size

According to Kalpana Rajendra Kulkarni, Amrutha Girish Naik, Sunetra Girish Deshpande et al study, considering the incidence of episodes of hypotension in preloading with crystalloids as 58% and incidence of episodes of hypotension in preloading with Ephedrine as 28% at 95% confidence interval with 80% power, the sample size is calculated as

$$N = (Z1 - \alpha/2 + Z1 - \beta)^2 * 2 * p * (1 - p) / (p1 - p2)^2$$

$Z1 - \alpha/2$ - two tailed probability for 95% confidence interval = 1.96
 $Z1 - \beta$ - two tailed probability for 80% power = 0.84
 $p1$ (%) - incidence of episodes of hypotension in preloading with crystalloids = 0.58

$p2$ (%) - incidence of episodes of hypotension in preloading with Ephedrine =

0.28
 p - average incidence of episodes of hypotension in preloading with crystalloids & incidence of episodes of hypotension in preloading with Ephedrine = 0.43

$$N = (1.96 + 0.84)^2 * 2 * 0.43 * (1 - 0.43) / (0.58 - 0.28)^2$$

$$N = 42.75$$

Thus, the sample size required for each group is 45 and the total sample size is 90.

Inclusion Criteria

- Women posted for elective LSCS with singleton pregnancy of 37-41 weeks of gestation
- Age between 20-35 yrs
- Weight between 45-80 kg
- Height between 145-165 cm
- Women belonging to ASA I and II category

Exclusion Criteria

- Parturients with obstetric complications like pregnancy induced hypertension, obesity, pre-existing hypertension
- Patients who develop labor pains before surgery
- Patients with contraindications for spinal anaesthesia

90 patients belonging to age group 20-35 yrs, weighing 45-80 kg, belonging to ASA I and II category, undergoing elective LSCS was included in the study. First patient will receive crystalloid pretreatment, second one will receive Ephedrine preloading and so on. All the patients receiving crystalloid pretreatment was named as category 1 and the ones receiving Ephedrine preloading was category 2.

A proper pre anaesthetic check-up was carried out preferably on the day before the procedure. All patients was advised fasting for a period of minimum 8 hrs prior to surgery and was pre-medicated with Tab. Pantoprazole 40mg PO, the night before and 2hrs prior to surgery. On arrival to OR, a baseline heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) was noted. Intravenous access was secured with 18G cannula. Half of the patients will then receive 10ml/kg of Ringer Lactate over a period of 15-

30 minutes whereas the other half will receive 10mg of Ephedrine as infusion in 10ml/kg Ringer Lactate, both of which was initiated 15-30 minutes before spinal block. All the patients will receive 5ml/kg/hr of crystalloids thereafter till the end of procedure.

Spinal block was performed in left lateral position with 25G Quincke needle in L3-L4 space. On free flow of CSF, 2-2.2 ml of 0.5% hyperbaric Bupivacaine was administered to all patients. Following this, all patients was positioned supine with a left tilt and waited till acquiring adequate sensory block. After spinal block, HR and BP was monitored every 2 minutes till delivery of the baby and thereafter every 5 minutes till the end of procedure and MAP was calculated. A fall in MAP of >20% of the baseline value was taken as hypotensive episode. Such episodes was treated with crystalloids and rescue doses of 6mg IV Ephedrine as required. Number of such episodes was recorded. Further, occurrence of nausea, vomiting, reactive hypertension was noted.

After delivery of the baby, all mothers will receive 20IU of IV Oxytocin. Umbilical cord blood was sampled for gas analysis and APGAR scores was recorded at 1 minute and 5 minutes by the attending Pediatrician.

Statistical Methods

The collected data were entered in Microsoft Excel data sheet and Statistical Package for the Social Science (SPSS; ver.20.0) was used for statistical analysis. Continuous data was represented as mean and standard deviation whereas categorical variables are present as numbers and percentages. Student's t-test was used as the test of significance to identify the mean difference between two categories. The p-value <0.05 was considered as statistically significant. Observations were recorded both graphically and numerically.

RESULTS

This observational study was conducted in Travancore Medical College, Kollam, Kerala after acquiring institutional ethical clearance. Study was conducted over a period of one year involving a total of 90 parturients. All of them belonged to ASA I or II category, posted for elective LSCS under spinal anaesthesia. Category 1 consisting of 45 patients received crystalloids as pretreatment and Category 2 of 45 patients received Ephedrine as pretreatment.

Demographic Data

All 90 patients were 20-35 years of age. Most patients belonged to 25-30 yrs (43 patients) and 30-35 yrs category had the least number (17 patients). The age distribution in category 1 and 2 were comparable. The mean age in category 1 was 27.02 ± 3.487 whereas in category 2 it was 26.84 ± 3.529 . The mean height in category 1 was 155.11 ± 4.007 and that in category 2 was 155.36 ± 4.931 . Similarly the mean weight in both categories was also comparable.

Mean MAP

As observed from the data there is fall in MAP in both categories after SAB, but the fall is greater in category 1 than category 2. Also, MAP was significantly lower in category 1 (p value <0.05) than category 2, during 3-9 minutes following spinal block.

Figure 1. Mean MAP before delivery at 2 min intervals

Figure 2. Mean MAP after delivery at 5 min intervals

Fetal Parameters

Fetal parameters including APGAR scores, umbilical blood pH were compared in two categories. The APGAR score at 1 min and 5 min were good in both the categories. There were no statistically significant differences between two categories.

Umbilical Blood Gas Analysis

The blood gas analysis data in both categories of the study. Mean blood pH was 7.2438 ± 0.06383 in crystalloid category and 7.2378 ± 0.06299 in Ephedrine category. The p value was 0.655 which was not considered statistically significant. Similarly, the pO_2 and pCO_2 values compared also revealed no statistical significance in two categories.

Variable	Category	N	Mean	SD	Independent sample t test	p value
pO ₂	Category 1	45	22.56	4.892	1.495	0.138
	Category 2	45	24.36	6.425		

Table 1. Umbilical blood pO₂

p value was calculated by independent sample test, $p < 0.05$ considered as statistically significant.

Variable	Category	N	Mean	SD	Independent sample t test	p value
pCO ₂	Category 1	45	42.93	5.319	1.528	0.130
	Category 2	45	41.27	5.024		

Figure 2. Comparison of pO₂

Maternal Adverse Events

Nausea / vomiting and reactive hypertension were studied as the possible maternal adverse outcomes. Incidence of nausea or vomiting was less in both categories and was comparable with no statistical significance. Reactive hypertension was not actually observed in any category.

N/V	Category 1	Category 2	Total	Chi square value	p value
Yes	7(15.6%)	5(11.1%)	12(13.3%)	0.385	0.535
No	38(84.4%)	40(88.9%)	78(86.7%)		
Total	45(100%)	45(100%)	90(100%)		

Table 3. Nausea / vomiting in two categories

p value was calculated by chi square test, $p < 0.05$ considered as statistically significant

Incidence of Hypotension

The overall incidence of hypotension in crystalloid category was higher than Ephedrine category. A total of 43 patients developed hypotension out of the 90 patients studied. With 45 patients in each category, 28 patients in category I and 15 patients in category II had significant hypotension requiring rescue Ephedrine. Incidence of hypotension was 62.2% in category I and 33.3% in category II with a p value of 0.006 which is highly significant.

Hypotension	Category 1	Category 2	Total	Chi square value	p value
Yes	28(62.2%)	15(33.3%)	43(47.8%)	7.526	0.006
No	17(37.8%)	30(66.7%)	47(52.2%)		
Total	45(100%)	45(100%)	90(100%)		

Table 4. Incidence of hypotension in each category

p value was calculated by chi square test, $p < 0.05$ considered as statistically significant.

DISCUSSION

Caesarean sections have emerged to be the most common surgery in obstetric practice. In practice almost 90% of these patients undergo LSCS under spinal anaesthesia. Hypotension following spinal anaesthesia, even though a well-marked complication is not 100% preventable.

Anaesthesiologists around the world have not yet reached at an equivocal prevention for this problem. Even though there are a variety of practices to prevent spinal hypotension, a single effective solution is not established till date. Preloading with crystalloids is widely practiced over the years and has not lost its significance, especially in peripheral centres.

A combination of pharmacological as well as non-pharmacological preventive methods adjusted for each patient's unique features might help in successfully preventing or combating hypotension following spinal anaesthesia.²³

Fluid preloading with crystalloids for Caesarean section under regional anaesthesia has been practiced as routine and considered to be a safe and effective method of reducing the incidence of hypotension especially in developing countries. Many regimens have been recommended, including preload volumes of up to 3-4 litres. Even though recent studies suggest co-loading to be more advantageous, preloading is still widely practiced.²⁴ These are time consuming and may prove to be dangerous to the pregnant mother due to risk of

circulatory overload, and also by causing significant hemodilution and over distension of the bladder.²⁵⁻²⁷

Similarly, Ephedrine was considered as the sympathomimetic of choice for spinal hypotension in pregnancy for ages. The ability of Ephedrine to maintain an unaltered uteroplacental flow is thought to be reason behind this. In recent times, Ephedrine is increasingly replaced by phenylephrine boluses as well as infusion claiming that risk of foetal acidosis is more with Ephedrine.²⁸ Ephedrine also has weak prophylactic ability. Studies comparing various dose regimens for phenylephrine has also been well established. Most of the studies comparing Ephedrine and phenylephrine has come to conclude that both are equally effective in preventing spinal hypotension.^{29,30,31}

This observational study conducted in our institution compared effects of preloading with crystalloids and low dose Ephedrine infusion on prevention of hypotension following spinal anaesthesia in patients undergoing elective LSCS. Primary objective was to compare the incidence of hypotension and the secondary objective was to look at the foetal and maternal complications in individual groups. Of a total 90 patient studied, 45 patients were preloaded with 10ml/kg of Ringer Lactate and others with 10mg Ephedrine in 10ml/kg of Ringer Lactate 15-30 minutes prior to sub arachnoid block.

Morphological characteristics and demography were comparable in both groups namely age, height and weight. There was no statistically significant difference in between the groups. Baseline vital signs including HR, SBP, DBP and MAP was calculated. For research purpose, mean arterial BP is considered in our study as it was thought to be more reliable.

The primary objective was to compare the incidence of hypotension in each group. We found that the incidence of hypotension in Category 1 (crystalloid group) was 62.2% whereas in Category 2 (Ephedrine group), it was 33.3%. A p value of < 0.05 proved statistical significance. The number of patients who developed hypotension in each group is well depicted in Table 4. These results were comparable with those obtained in a study by Kalpana Rajendra et al.

The difference in our study as compared to the abovementioned study is that we have considered MAP as the basis when they have considered SBP. They considered a fall in SBP $\geq$ 20% as criteria for hypotension.

On considering MAP in our study, the fall in BP was most evident at 3-9 minutes following SAB which was evident from the statistically significant p values at these respective time intervals. This fall could explain the fast onset sympatholysis following SAB along with the assumed supine position after block. Also, fall in BP was also observed in the time following delivery of the baby, which was also found to be significant. This fall could possibly be also attributed to rapid infusion of oxytocin following delivery of foetus.

Secondary objectives were to compare foetal and maternal complications in respective groups. Maternal adverse events were compared on basis of occurrence of nausea, vomiting and reactive hypertension. While none of the 90 patients developed a reactive hypertension ($\geq$ 20% increase from baseline MAP), incidence of nausea/vomiting was comparable in both groups. Incidence was 15.6% in Category 1 and 11.1% in Category 2 which was found to be statistically not significant.

Foetal parameters compared included APGAR scores at 1 min and 5 minutes along with umbilical cord blood gas analysis. The mean APGAR score at 1 minute was 8.47 in category 1 and 8.6 in category 2. At 5 minutes the mean scores were 9.11 and 9.09 in the respective categories. The APGAR scores at 1 minute and 5 minutes were similar with p=0.209 and p=0.729 respectively. These findings were in agreement with similar studies.³²

Umbilical blood gas analysis compared pH, pO₂ and pCO₂ between two categories. While comparing pH in two categories, we observed that the mean pH in category 1 was 7.23 and that of category 2 was 7.34. Our study did not find any significant foetal acidosis in the category with ephedrine preload. There were no significant differences in mean pO₂ and pCO₂ in two categories. All three parameters were comparable in two groups with no statistical significance in individual categories.

A randomized single blind comparative study done by Bhagat Kumar Hegde et al in 90 patients showed similar results (2017). In this study, patients were randomly allocated into three groups of which one group received crystalloids, second group received Ephedrine and third group received half dose of both. Incidence of hypotension was 43.33%, 16.66% and 3.33% respectively which was in line with the results of our study.³³

Heba Omar et al published a study in 2016 in which 50 patients were randomly allocated into two groups.³⁴ One group was preloaded with 15ml/kg RL and the other received bolus doses of Ephedrine 5mg after 1 minute, 5 mg after second minute and 1 mg thereafter till 15 minutes after spinal block. Incidence of hypotension was 24% and 48% in these respective groups. Incidence of nausea/vomiting was also significantly higher in fluid group. These findings were similar to those obtained in our study also.

Another study conducted in 2017 by Madhu D et al compared crystalloid preloading with Ephedrine infusions in lower abdominal surgeries. Here Ephedrine was administered at the rate of 5mg/min for the first two minutes followed by 1mg/min for the next 18 minutes following spinal block. Hypotension was found to be 82.2% in control group as opposed to 22.5% in Ephedrine group. They also noted incidence of reactive hypertension of 7.2% in Ephedrine group, which was not present in our study.³⁵

A randomized study by Desalu et al (2005) compared preloading with 0.9% normal saline and 30mg Ephedrine infusion in 60 subjects. Hypotension incidence was 70% in group 1 and 40% in group 2. Incidence of adverse events was also less in group 2. APGAR scores at 1 minute and 5 minutes were comparable.³⁶

Gajraj et al found that the incidence of hypotension was 55% in the crystalloid group and 22% in the infusion group. They concluded that a prophylactic Ephedrine infusion is effective for minimizing and managing hypotension associated with spinal anaesthesia and compares favourably with crystalloid administration in terms of efficacy and incidence of side effects.³⁷

Bhovi et al. studied the efficacy of Ephedrine for preventing hypotension in patients undergoing caesarean section under spinal anaesthesia. Patients were randomly allocated to receive either Ephedrine infusion 50 mg in 500 ml of Ringer's Lactate immediately after administration of spinal anaesthesia at a rate of 50 ml/min for first 2 minutes,

and 10 ml/min for next 18 min or 20 ml/kg of Ringer's Lactate solution as a preloading solution before the subarachnoid block. The study revealed that the incidence of hypotension was significantly higher in the patient group who received fluid preload (60%) compared with (12%) in the patients group who received Ephedrine infusion. The incidence of hypotension in the Ephedrine group in this study was (12%) in comparison with our study the incidence of hypotension in the Ephedrine group was (24%), this difference may be due to different doses of Ephedrine used and different volume of infusion.

Loughrey et al conducted a study on 68 patients posted for elective LSCS with different doses of prophylactic Ephedrine boluses rather than infusion. After patients had received an intravenous preload of 0.5 L of lactated Ringer's solution, patients were randomized to receive a simultaneous 2 mL bolus intravenously of either 0.9% saline, Ephedrine 6 mg, or Ephedrine 12 mg. There was a significantly higher incidence of hypotension in control group (60%) compared to Group E-12 (27%), but not in Group E-6 (50%). There were no significant differences in the incidence of maternal nausea or vomiting, or of neonatal acidemia between groups.³⁸

Young Oh et al studied the influence of timing of administration of crystalloid in preventing spinal hypotension. The incidence of hypotension was lower in the co-load group compared to the preload group (53% vs. 83%). The incidence of nausea was also lower in the co-load group. Neonatal outcome measures were comparable between two groups.

In an observational study conducted by Bhattacharya D et al, 80 parturients in the age group of 20 to 40 years, posted for elective caesarean section were selected. After preloading with 500 ml of ringer lactate solution, all the patients received spinal anaesthesia with 2ml Inj. Bupivacaine 0.5% (heavy). The infusion of Ephedrine at the rate of 1.25 mg/min via an infusion pump was started and was continued till clamping of the umbilical cord. The incidence of hypotension was 11% which was found to be lower when compared with other studies.³⁹

Jain et al conducted a study in 60 parturients posted for elective LSCS by comparing crystalloid co-loading and preloading. Incidence of hypotension was 40% in preload group and 46.66% in co-load group, which was statistically not significant ($p=0.602$). Incidence of nausea and vomiting, vasopressor requirement and neonatal outcome were comparable in both groups. Hence they concluded that co-loading with crystalloids is equally effective as preloading to prevent spinal anaesthesia induced maternal hypotension.³⁹ These results were different from many similar studies.⁴⁰

Another area where extensive studies were done is crystalloid versus colloid loading to prevent spinal hypotension. Dahlgren et al, did a randomized, double-blinded study of 110 patients presenting for elective cesarean section with 1 L lactated Ringer's solution or 1 L 3% dextran 60 solution immediately before spinal anesthesia. Dextran reduced the incidence of clinically significant hypotension from 60 to 30% compared to Ringer's solution. There were no significant differences in neonatal outcome between treatment groups.⁹

Limitation

1. Sample size was small considering easily available participants.
2. A fixed dose of drug only used. Different drug doses could have been compared.
3. Mixed umbilical blood was used for blood gas analysis instead of arterial blood.
4. Widely studied topic.
5. Recently practiced coload is not considered.

CONCLUSIONS

Post spinal hypotension is a major challenge for Anaesthesiologists worldwide especially in a pregnant patient. This study concludes that preloading with Ephedrine 10mg is better as compared to preloading with crystalloids (RL) in preventing maternal hypotension following spinal anaesthesia. Also with the used dose of intravenous Ephedrine, there were no significant maternal adverse events or evidence of foetal acidosis. Thus use of prophylactic Ephedrine infusion may be beneficial in low doses.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

Financial or other competing interests: None.

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