ORIGINAL ARTICLE

Comparison of prophylactic ephedrine vs prn ephedrine during spinal anesthesia for caesarian sections

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ABSTRACT

Objective: The objective of this study was to compare the hemodynamic effects of use of prophylactic intravenous ephedrine with ephedrine use on as needed basis in patients receiving spinal anesthesia for caesarean sections.

Study design: A double blind, randomized, comparative trial

Setting: Department of Anaesthesiology, Critical Care, and Pain Management, Shifa International Hospital Islamabad.

Duration: October 2007 to March 2008

Methodology: Seventy patients were recruited who were scheduled to receive spinal anaesthesia for C-section. The patients were randomized into two groups (A and B). In patients of Group A (control group) ephedrine was used to treat h ypotension when indicated, while in Group B (inter vention group), patients receiv ed prophylactic ephedrine soon after the subarachnoid block. Hemodynamic changes were recorded and the data was analysed.

Results: In Group A, the blood pressure dropped in a higher number of patients [23 (65.7%)], as compared to Group B [6(17.1%)]. This difference was statistically significant ($p<0.001$).

Conclusion: Prophylactic ephedrine is better than ephedrine prn in prevention of hypotension in patients receiving spinal analgesia for C-Section.

Key Words: Subarachnoid block; hypotension; caesarean section; ephedrine.

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INTRODUCTION

Hypotension in patients who receive subarachnoid block (SAB) is a potentially serious issue, which is known to lead to significant morbidity if not manag ed effectively and urgently. In obstetric applications, profound hypotension can potentially lead to serious hypoxia and hypovolemia in the mother and the fetus. As placental blood flow is directly proportional to the maternal blood pressure, the hypotension can lead to to placental hypoperfusion and fetal asphyxia.[1] The current incidence of hypotension following SAB is up to 8o% of patients without prophylactic therapy.1 To prevent this problem, various methods have been considered appropriate. Expansion of intravascular volume can be achieved with preload with crystalloids or colloids. Though this is a common practice for electi ve cases, it does not offer full protection against hypotension.[2] Other options include, but are not limited to, left uterine displacement (LUD) and occasional use of ionotropic suppor t.

Ephedrine has been the vasopressor of choice to control spinal hypotension for many years, but the controversies still exist about the best regimen of its use; whether to use it in intermittent boluses or in infusion, whether to use it prophylactically or just to use it prn to control hypotension

once it does occur. We conducted this study to compare the hemodynamic control by ephedrine when used prophylactically with its prn use after the occurrence of hypotension.

METHODOLOGY

A double blind, randomized, comparative trial was conducted at Department of Anesthesiology, Critical Care, and Pain Management, Shifa International Hospital, Islamabad, after getting approval from Hospital Ethics Committee and informed consent of the parturients, from October 2005 to March 2006. Seventy obstetric patients scheduled for elective caesarean section with American Society of Anesthesiologist's physical status (ASA-PS) I or II were randomly divided into two groups A and B with 35 patients in each group. Patients on antihypertensives, diabetics, and pregnancy induced hypertensive patients were excluded. Patients with pre-eclampsia and eclampsia were also excluded from the study. Patients with fixed cardiac output (mitral stenosis or aortic stenosis), coagulopathy (platelet count less than 80,000), abruptio placentae, placenta previa, severe fetal distress and cord prolapse were also excluded from the study as SAB is contraindicated in these cases.

After appropriate preoperative preparation, patients were transferred from the ward to the obstetric operating room. Baseline BP and HR were measured. An intravenous line with 18G IV cannula was established. Lactated Ringer's solution 15ml/kg was infused to all patients 30 minutes before the SAB as a standard protocol. Patients were then divided into two groups A and B in random order.

Spinal hypotension was defined as a $\geq$ 30% drop of systolic BP from the baseline reading.

SAB was instituted in left lateral position with hyperbaric bupivacaine bupivacaine 0.75% with dextrose 8.25% (Abocaine Spinal™ -Abbott Laboratories (Pakistan) Ltd®) 1.6 ml injected in the subarachnoid space over 15 sec at L3-4 through 25G pencil point needle (Unises Corporation Tokyo-Japan) after infiltrating 1% lignocaine 1 ml locally. Patients in Group B received prophylactic ephedrine 15mg intravenously, simultaneously with the administration of hyperbaric bupivacaine. Then patients were placed in a supine position with the table in left lateral tilt. Oxygen with facemask was initiated at 3 litres/min to all patients. BP and HR were measured every two minutes initially, till delivery of the baby and then every five minutes till the end of the operation. Lactated Ringer's solution 5 ml/kg/hr was infused as a maintenance fluid. Synthetic oxytocin (Syntocinon™) 5 IU was injected IV after delivery of the baby in all patients. In both groups, hypotension if occurred was treated by a second dose of ephedrine 10mg IV in order to maintain the systolic BP within ±10% of the baseline. The patients were shifted to post anaesthesia care unit (PACU) and vital signs monitored.

The data collected included systolic, diastolic and mean arterial pressures and heart rates. Statistical analysis was performed through SPSS version 12. Descriptive statistics were presented as tables. Chi-square test was applied to compare the mean values of systolic blood pressure. P value $\leq$ 0.05 was considered statistically significant.

RESULTS

The demographic data of the patients and the indications of the surgery are given in Table 1. No statistical difference was found between two groups regarding mean age, body weight and indications of c-section.

Table 1: Comparison of demographic data of mothers in two groups

	Group A n=35	Group B n=35
Age (yrs) (Mean±SD)	31±4	27±4
Body wt. (Kg) (Mean±SD)	63±4	64±5
Indications for c-section [N(%)]		
Breech	13(37.1)	11(31.4)
Feto-pelvic disproportion	12(34.2)	17(48.6)
Previous c-sections	10(28.5)	7(20)

The baseline hemodynamic parameters in two groups were comparable, with no statistical difference (Table 2).

Table 2: Comparison of hemodynamic parameters in two groups (Mean±SD)

Parameter	Group A (Control Group) n=35	Group B (Intervention Group) n=35
Systolic	116±7	118±10
Diastolic	66±13	68±10
Mean	82±12	87±11
Baseline HR	102±12	95±15

The total blood loss in two groups was comparable, with no statistical difference (Table 3). Total quantity of ephedrine used in Group B was more, 12.2±4mg vs. 16.7±4mg, but the difference was statistically not significant (Table 3). A higher proportion of patients in the control group suffered from nausea than in the interventional group, 5 (14.2%) vs. 2 (5.7%). It was relieved promptly with administration of additional ephedrine.

Table 3: Comparison of clinical parameters of mothers in two groups

Parameter	Group A (Control Group) n=35	Group B (Intervention Group) n=35
Preload (ml) Mean±SD	945±60	960±75
Total ephedrine (mg)	12.2±4	16.7±4
Patients requiring extra ephedrine (N)	8	6
Blood loss (ml)	180±60	150±60
Nausea (N)	5(14.2%)	2(5.7%)

In Group B, only 17.1% of the patients received supplemental 10mg ephedrine when their systolic blood pressure dropped below the cut off mark. In Group A, ephedrine was administered when hypotension occurred, and 23 (65.7%) patients received rescue dose of 10mg ephedrine when they developed hypotension ($p<0.001$). A small proportion of patients developed tachycardia after administration of ephedrine. (Table 4).

Table 4: Comparison of development of hypotension in the groups

Parameter	Group A (Control Group) n=35	Group B (Intervention Group) n=35	Chi-square	P value
Frequency of Hypotension	23(65.7%)	6(17.1%)	17	<0.001

DISCUSSION

Hypotension is the most common complication of SAB for caesarean sections and is a potential threat to both the mother and fetus. In obstetric applications, profound hypotension can potentially lead to serious hypoxia and hypovolemia in the mother and the fetus. As placental blood flow is directly proportional to the maternal blood pressure, the hypotension can lead to to placental hypoperfusion and fetal asphyxia.1 The current incidence of hypotension following SAB is up to 80% of patients without prophylactic therapy.[1]

To prevent this complication various methods are in practice. Preload with crystalloids or colloids, is a common practice for elective cases, but it does not prevent hypotension reliably[2]. Left uterine displacement and vasopressors are the other measures in use. Incorporation of measures that reliably prevent maternal hypotension may improve maternal and fetal outcome.

Phenylephrine and ephedrine are helpful vasopressor to counteract the hypotension. Phenylephrine is purely alpha stimulant and it is effective in increasing blood pressure due to vasoconstriction. On the other hand it may lead to placental hypoperfusion and reflex maternal bradycardia. Ephedrine is an alpha and beta stimulant, which increases both maternal blood pressure and heart rate. The predominant beta effect of ephedrine increases arterial pressure by increasing cardiac output. [3] Kang YG et al. recommended prophylactic intravenous ephedrine infusion during spinal anaesthesia for caesarean section.[4] Simmon L et al. proved that a single bolus of intravenous ephedrine with doses of 15 mg or 20 mg decreased significantly the incidence of maternal hypotension as compared to a single bolus of ephedrine.[5] In later years, Loughery JP et al. proved in their study that 12 mg prophylactic ephedrine could better counteract spinal hypotension.[6] In 2005, Berends N et al. proved that prophylactic use of ephedrine is effective and safe to prevent and treat spinal hypotension[7]. Lionel Simon et al. observed that the incidence of maternal hypotension associated with spinal anaesthesia for caesarean section was unacceptably high in women receiving only a 10mg prophylactic bolus of ephedrine. Increasing the dose of the prophylactic bolus of ephedrine to 15mg significantly reduced the incidence of hypotension without increasing the incidence of undesirable tachycardia and/or hypertension. There are some drawbacks to the use of ephedrine. Ephedrine can induce a dose-related, undesirable maternal tachycardia and its use for the treatment of hypotension does not completely restore preanesthetic levels of uterine blood flow even when it restores maternal blood pressure to baseline measurements.[8] It has been shown to cross the placenta and does affects fetal and neonatal heart rate.[9] A greater proportion of low umbilical artery pH has been observed in patients treated with ephedrine than in patients treated with either phenylephrine[10] or angiotension-II. [11-12] Chan et al. [13]

compared ephedrine infusion and fluid preload for the prevention of spinal hypotension during caesarean section. The best prophylaxis of maternal hypotension during caesarean section is still controversial. McGrathe et al.[14] showed that ephedrine was superior to phenylephrine in restoring uterine blood flow and fetal oxygenation during ritodrine infusion and epidural anaesthesia induced hypotension in gravid ewes. Hall et al.[15] compared infusions of ephedrine and phenylephrine during spinal anaesthesia, Some authors proposed using angiotension-II instead of ephedrine to avoid maternal tachycardia and fetal academia, but it is not readily available. Thus, ephedrine remains the vasopressor of choice in obstetrics.

We used prophylactic ephedrine in a dose of 15 mg with intermittent boluses of ephedrine prn, and found that the former was better in controlling maternal hypotension ($p<0.001$).

CONCLUSION

We conclude that prophylactic use of ephedrine is more efficient for maintenance of blood pressure during spinal anaesthesia for caesarean section as compared to its prn use.

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