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 hypotension when indicated, while in Group B (intervention group), patients received 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.


INTRODUCTION

Hypotension in patients who receive subarachnoid block (SAB) is a potentially serious issue, which is known to lead to significant morbidity if not managed 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 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 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 elective 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 support.

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 use after the occurrence of
hypotension.

**METHODOLOGY**

A double blind, randomized, comparative trial was
directed at Department of Anesthesiology, Critical Care,
and Pain Management, Shifa Inter national 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 hypertension 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), abruption
placenta, 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 ≥ 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 (Unisces 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 ≥ 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(%)]

<table>
<thead>
<tr>
<th>Indication</th>
<th>Group A [n(%)]</th>
<th>Group B [n(%)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breech</td>
<td>13(37.1)</td>
<td>11(31.4)</td>
</tr>
<tr>
<td>Feto-pelvic disproportion</td>
<td>12(34.2)</td>
<td>17(48.6)</td>
</tr>
<tr>
<td>Previous c-sections</td>
<td>10(28.5)</td>
<td>7(20)</td>
</tr>
</tbody>
</table>

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) | Group B (Intervention Group) |
|                   | n=35               | 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

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group A (Control Group) n=35</th>
<th>Group B (Intervention Group) n=35</th>
<th>Chi-square</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of Hypotension</td>
<td>23(65.7%)</td>
<td>6(17.1%)</td>
<td>17</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**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 vasopressors 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. 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 affect 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 phenylephrine10 or angiotension-II.11-12 Chan et al. 13
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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. McGrath 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.

REFERENCES


