

## ORIGINAL ARTICLE

# Frequency of Hypotension after Subarachnoid Block for Elective C-Section: A Comparison Between Prophylactic Intramuscular Ephedrine and Phenylephrine

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## ABSTRACT

**Objectives:** To compare the frequency of hypotension after giving prophylactic intramuscular ephedrine and intramuscular phenylephrine in parturients undergoing elective caesarean-section in subarachnoid block.

**Study Design:** Randomized Controlled Trial.

**Setting:** Department of Anaesthesia, Sir Ganga Ram Hospital, Lahore.

**Subjects and methods:** A total of 270 cases (135 in each group) were included in this study, group-A received intramuscular ephedrine and group-B received intramuscular phenylephrine.

**Results:** Mean age was 26.15±5.27 and 26.53±5.23 in group-A and group-B, respectively. Frequency of hypotension in group-A was found to be 47 patients (34.8%) and in group-B frequency of hypotension was found to be 68 patients (50.4%). Difference was statistically significant between two groups (P=0.013). ASA-I status was in 77.8% and 74.0% in group-A and B, respectively. Similarly, ASA-II status was found in 22.2% patients of group-A and 26.0% of group-B.

**Conclusion:** In conclusion, phenylephrine 4 mg i.m., and ephedrine 45 mg i.m., reduces the severity of hypotension during spinal anaesthesia for Caesarean section. However, in i.m. Phenylephrine (4mg) group was significantly effective in preventing hypotension when compared with i.m ephedrine (45mg) group.

**Key Words:** Spinal anaesthesia, Hypotension, ephedrine, phenylephrine.

## INTRODUCTION

Regional anaesthesia is associated with less maternal morbidity and mortality than general anaesthesia<sup>1</sup>. Spinal anaesthesia provides a fast, profound, and symmetrical sensory and motor block of high quality in patients undergoing caesarean delivery<sup>2</sup>. Spinal anaesthesia, a frequently used technique for caesarean delivery may be associated with maternal hypotension in as many as 85% of patients. Prolonged and marked maternal hypotension may result in fetal acidemia due to decreased utero-placental blood flow<sup>3</sup>. Maternal hypotension, the most frequent complication of spinal anaesthesia for caesarean section, can be associated with severe nausea or vomiting which can pose serious risks to the mother (unconsciousness, pulmonary aspiration) and baby (hypoxia, acidosis and neurological injury<sup>4</sup>).

Hypotension is defined as a 25% decrease in mean arterial blood pressure (MAP) from baseline<sup>5</sup>. Preventive measures include the administration of fluids, correct positioning of the

patient with decompression of abdominal vessels and the use of vasopressors<sup>6</sup>. Traditionally, ephedrine has been recommended in this role, but its position has been challenged because of potential complications that include supraventricular tachycardia tachyphylaxis and fetal acidosis. Advocates of phenylephrine claim better fetal acid-base status and similar efficacy in blood pressure control but its use is associated with bradycardia<sup>7</sup>. Previously a research was conducted in which the incidence of hypotension was 33% in the phenylephrine group 4mg compared with 48% in the ephedrine group<sup>[5]</sup>.

The obstetrics units of Sir Ganga Ram Hospital are among the busiest in Lahore. Thirty to thirty five caesarean sections are performed daily and above 90% are performed under spinal anaesthesia. Objective of the study was to compare the frequency of hypotension after giving prophylactic intramuscular ephedrine and intramuscular phenylephrine in parturients undergoing elective caesarean-section in subarachnoid block.

## MATERIAL AND METHODS

It was Randomized controlled trial. The study was conducted at the Department of Anaesthesia, Sir Ganga Ram Hospital, Lahore. Sample size of 270 cases (135 in each group) was calculated using WHO software with 80% power of test, 5% level of significance and taking expected percentage of hypotension in both groups Phenylephrine group i.e 33% and ephedrine group i.e. 48% in parturient undergoing elective caesarean section in subarachnoid block (SAB)<sup>5</sup>. Non-probability purposive sampling. Parturient of 18-40 years of age; parturient of ASA grade-I and grade-2; parturient with singleton pregnancy (confirmed on U/S) undergoing elective caesarean section in subarachnoid block; and parturient with baseline MAP 70-105mmHg were included in the study. Parturient having contraindications to spinal anaesthesia (patient refusal, local sepsis) – local sepsis was assessed if patient is having fever > 99°F were excluded. Parturient with known hypertensive disorders of pregnancy (pregnancy induced hypertension. Pre-eclampsia and eclampsia) was determined by seeing the antenatal records were also excluded. And finally, parturients with placenta praevia type 3 and type 4 was determined by seeing the antenatal records and were excluded from study. After hospital ethics committee approval, 270 patients from the obstetrics ward fulfilling the inclusion criteria were selected by random numbers table into 2 groups designated, ephedrine intramuscular as group-A and phenylephrine intramuscular as group-B. Written informed consent from each patient was taken (attached as annexure-B). Two intravenous lines were saved with 18 gauge cannula and 500ml of ringers lactate solution given as preload. Mandatory monitoring for arterial pressure, ECG heart rate and oxygen saturation was applied. Baseline non-invasive arterial pressure readings were recorded at 2.5 minutes intervals by an automated non-invasive “bedside monitor” (Nihon Kohden – Model BSM-2301K) for 10 minutes before administering SAB in both groups by the researcher. The baseline was taken as the lowest MAP recorded in four readings in 10 minutes before receiving the intramuscular ephedrine and phenylephrine injections. Group-A received phenylephrine intramuscular 4mg in the gluteus maximus and group-B received intramuscular

ephedrine 45mg into the left gluteus maximus muscle 10 minutes prior SAB injection.

The lumbar puncture was then performed at L2-3 interspace in sitting position and 12mg of 0.75% hyperbaric bupivacaine was injected intrathecally. Intraoperative arterial pressure monitoring at 2.5 minutes interval was started immediately by the researcher after the completion of intrathecal injection 12mg of 0.75% of hyperbaric bupivacaine and was continue until the surgery is completed. If hypotension occurs that is MAP less than 25% from the baseline was corrected by taking all necessary and adequate measures. They hypotension is decreased of  $\geq 25\%$  in MAP which was calculated from the difference between baseline and the recorded MAP, during the study period, data was entered on a predesigned research proforma.

## RESULTS

A total of 270 patients (135 cases in each group) were included in this study during the study period of six months from 02-08-2011 to 01-02-2012.

Group-A received phenylephrine intramuscular 4mg in the gluteus maximus and group-B received intramuscular ephedrine 45mg into the left gluteus maximus muscle 10 minutes prior SAB injection.

Regarding age distribution of patients, 9 patients (6.7%) in group-A and 10 patients (7.4%) in group-B were between < 20 years old. 94 patients (69.6%) in group-A and B were 20-30 years of age, while 32 patients (23.7%) in group-A and 31 patients (23.0%) in group-B were between 31-40 years old. Mean age was  $26.15 \pm 5.27$  and  $26.53 \pm 5.23$  in group-A and group-B, respectively (Table-1).

Frequency of hypotension in group-A was found to be 47 patients (34.8%) and in group-B frequency of hypotension was found to be 68 patients (50.4%). Difference was statistically significant between two groups ( $P=0.013$ ) (Table-2).

Distribution of patients by American Society of Anaesthesiologists Status (ASA) shows ASA-I status in 105 patients (77.8%) and 100 patients (74.0%) in group-A and B, respectively. Similarly, ASA-II status was found in 30 patients (22.2%) of group-A and 35 patients (26.0%) of group-B (Table-3).

**Table 1:** Distribution of cases by age

Age	Group-A (I/M Phenylephrine 4mg)		Group-B (I/M ephedrine 45mg)	
	No.	%	No.	%
< 20	09	06.7	10	07.4
20-30	94	69.6	94	69.6
31-40	32	23.7	31	23.0
<b>Total</b>	<b>135</b>	<b>100.0</b>	<b>135</b>	<b>100.0</b>
<b>Meant±SD</b>	<b>26.15±5.27</b>		<b>26.53±5.23</b>	

**Table 2:** Frequency of hypotension in both trial groups

Hypotension	Group-A (I/M Phenylephrine 4mg)		Group-B (I/M ephedrine 45mg)	
	No.	%	No.	%
Yes	47	34.8	68	50.4
No	88	65.2	67	49.6
<b>Total</b>	<b>135</b>	<b>100.0</b>	<b>135</b>	<b>100.0</b>

Chi square = 6.059

Df = 1

P value = 0.013

**Table 3:** Distribution of patients by American Society of Anaesthesiologists Status (ASA)

ASA status	Group-A (I/M Phenylephrine 4mg)		Group-B (I/M ephedrine 45mg)	
	No.	%	No.	%
I	105	77.8	100	74.0
II	30	22.2	35	26.0
<b>Total</b>	<b>135</b>	<b>100.0</b>	<b>135</b>	<b>100.0</b>

## DISCUSSION

Subarachnoid block is one of the most commonly used anaesthetic techniques for caesarean section because of its simplicity, rapid onset of action, intense analgesia, awake mother and less complications on both the mother and the neonate.

Hypotension during spinal anaesthesia for caesarean section remains a common scenario in our clinical practice. Certain risk factors play a role in altering the incidence of hypotension. Aortocaval compression counteraction does not help to prevent hypotension. Intravenous crystalloid prehydration has poor efficacy.<sup>[8]</sup>

The prevention and treatment of maternal hypotension associated with spinal anaesthesia for Caesarean section remains a difficult problem, with no consensus as to the optimal mode of management. Hypotension is defined arbitrarily in most studies, with values ranging from a 20–30% reduction from baseline systolic arterial pressures (SAP) to absolute values less than 90–100 mmHg.<sup>[9,10]</sup>

Measurement of SAP and MAP using non-invasive automated oscillometry has been found to be a valid method for non-invasive measurement of arterial pressure.<sup>[11]</sup> We chose

MAP rather than SAP, as this is the component of arterial pressure that is most accurately determined by this method.

The incidence of hypotension can be as high as 80%, the severity depends on the height of the block, the position of the parturient, and whether prophylactic measures were taken to prevent the hypotension.<sup>[12]</sup>

Ephedrine has been the drug of choice for more than 30 years in the treatment of maternal hypotension in obstetric spinal anesthesia when conservative measures fail. It has a good safety record, ready availability, and familiarity to most anesthesiologists. Ephedrine is a sympathomimetic that has both a direct (alpha and beta receptor agonist) and an indirect (release of norepinephrine from pre-synaptic nerve terminals) mechanism of action.<sup>[8]</sup>

However, Ngan Knee et al<sup>[13]</sup> showed that ephedrine crosses the placenta more readily than phenylephrine. This was associated with greater fetal concentrations of lactate, glucose and catecholamine, and thus supports the hypothesis that depression of fetal pH and metabolic effects secondary to stimulation of fetal beta- adrenergic receptors cause base excess with ephedrine.

## Frequency of Hypotension after Subarachnoid Block for Elective C-Section: A Comparison

Ephedrine, with its long duration of action still has a role in obstetric anesthesia to prevent or treat spinal induced hypotension when given in an appropriate dose. The optimal method to administer ephedrine, whether combined with other vasopressor therapy or non-medication therapy, awaits future study<sup>[13]</sup>.

Phenylephrine is a short-acting, potent, vasoconstrictor that causes an increase in both systolic and diastolic blood pressure. It counteracts the vasodilatation due to neuraxial anaesthesia directly, restoring baseline blood pressure. Traditionally, it was used as a second line vasoconstrictor in obstetrics because of the concerns that it caused vasoconstriction in the uteroplacental circulation. Interest in phenylephrine was rekindled in 1988 by Ramanathan and Grant<sup>[14]</sup> who found that it did not cause fetal acidosis when treating maternal hypotension. Numerous studies have confirmed these findings and almost all have reported higher umbilical artery(UA) pH values in neonates born to phenylephrine treated mothers<sup>[15]</sup>.

Hypotension was better controlled with tight control of blood pressure using aggressive vasopressor administration. Phenylephrine appears to have survived the period of intense suspicion and concern over its use in obstetric anesthesia. It is reliable in its effect, although short acting, and its effect on the fetus appears to be even less than that of ephedrine<sup>[16]</sup>.

Phenylephrine effectively restores SAP, MAP and diastolic arterial pressure, but decreases heart rate and CO when given by infusion to patients undergoing elective surgery under spinal anaesthesia<sup>[17]</sup>.

Another study found a 58% incidence of bradycardia (heart rate <60 beats min<sup>-1</sup>) when phenylephrine was given as an i.v. bolus after the induction of spinal anaesthesia<sup>[18]</sup>.

None of the patients in the present study developed bradycardia. This may have been because of the overriding chronotropic effect of ephedrine when it was given as a rescue vasopressor. Alternatively, the absence of bradycardia may have been because of a baroreceptor-mediated reflex tachycardia in response to the reduction in systemic vascular resistance after the induction of spinal anaesthesia. Metaraminol, another  $\alpha$ -agonist, has also been shown to be effective in restoring SAP and SVRI within 10–15 min, when given by continuous infusion in an elderly population<sup>[19]</sup>.

Ephedrine is not a potent arterial vasoconstrictor; it maintains SAP mainly by increases in CO and heart rate<sup>[20]</sup>.

In present study, hypotension was recorded in 35% patients in group-A (phenylephrine 4mg) and 51% patients in group-B (ephedrine 45mg). These findings are consistent with the results of Ayorinde et al<sup>[5]</sup>.

## CONCLUSION

In conclusion, phenylephrine 4 mg i.m., and ephedrine 45 mg i.m., reduces the severity of hypotension during spinal anaesthesia for Caesarean section. However, in i.m Phenylephrine (4mg) group was significantly effective in preventing hypotension when compared with i.m ephedrine (45mg) group.

Further studies are warranted to determine the optimum dosage and timing of i.m. phenylephrine and ephedrine in terms of efficacy and safety before they can be recommended for routine clinical use in obstetric anaesthesia.

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