

# Comparison: The Effect of Ephedrine and Phenylephrine in Treatment of Hypotension after Spinal Anesthesia during Cesarean Section

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**Abstract:** ***Background and Objective:** The effectiveness of ephedrine and/or phenylephrine, in treatment of hypotension secondary to spinal anesthesia for cesarean section and their effects on fetal/neonatal outcome were studied. **Methods and Materials:** Sixty healthy parturients were randomly assigned to two groups; Group A (n = 30) received boluses 5 mg/ml increments Ephedrine and, Group B (n = 30) received a boluses of phenylephrine 20 µg/ml increments for treatment of hypotension after spinal block during cesarean section. Changes in maternal blood pressure and heart rate, and incidence of nausea-vomiting, neonatal Apgar score at 1 and 5 minutes of delivery, and umbilical arterial blood gas values were recorded. **Results:** There were no differences in treatment of hypotension following sympathectomy after spinal block with two drugs. Neonatal outcome was similar in two groups. There were not significant differences in umbilical arterial values in two groups. **Conclusion:** Ephedrine and phenylephrine are both effective vasopressors for treatment of hypotension associated to spinal block during cesarean section without adverse effects on infants/neonates.*

**Keywords:** Cesarean Section; Spinal Anesthesia; Hypotension; Ephedrine; Phenylephrine; Fetal/Neonatal Outcome

## 1. Introduction

Hypotension is perhaps the most common complication of neuraxial anesthesia in obstetric patients. It has been estimated to occur in approximately 30% - 90% of cases .

Maternal hypotension produces unpleasant symptoms such as nausea, vomiting, and lightheadedness. More importantly, when severe and sustained, hypotension can impair uterine and intervillous blood flow and ultimately result in fetal acidosis and neonatal depression

Prevention measures include fluid preload, left lateral tilt, and use of vasopressors.

Traditionally, Ephedrine “which has a strong  $\beta$ -adrenergic and a weaker  $\alpha$ -adrenergic effects” has been recommended in this situation, but its position has been challenged because of potential complication that supraventricular tachycardia, tachyphylaxis, and most importantly fetal acidosis.

Phenylephrine, an  $\alpha$ -adrenergic agonist, can be used for prevention and treatment of maternal hypotension. Moreover, phenylephrine reduces the incidence of nausea and vomiting as well as fetal acidosis, but it may cause maternal bradycardia. Present study compared ephedrine with phenylephrine in treatment (not prevention) of maternal hypotension induced spinal anesthesia regarding the maternal cardiac response to hypotension in terms maternal hemodynamic and fetal/neonatal status.

## 2. Methods and Materials

This was a prospective, double-blind, and case-controlled study. After the approval of the hospitals ethics Committee and obtaining written informed consent, 60 parturients of ASA physical status I, age > 18 years, undergoing elective cesarean section under spinal anesthesia.

A prior excluded were patients with classic contraindications to spinal anaesthesia, allergy to local anesthetics, pre-existing systemic disease, known fetal abnormalities, and history of taking any medications that could influence hemodynamic responses. Patients were fasted for 6 hours.

In the operating room routine standard monitoring with non-invasive arterial pressure (NIBP), electrocardiography (ECG), and pulse oximetry was established. Baseline measurements were performed 5 minutes before spinal anesthesia. An iv cannula was introduced into a peripheral vein.

Each patient was preloaded 15 ml/kg of ringer lactate solution. With the patient in the sitting position, lumbar puncture was performed at the L3-4 or L4-5 interspaces with 2ml of 0.5% hyperbaric Bupivacaine via a 25-gauge Quincke spinal needle. Immediately after completing the intrathecal injection, patients were positioned supine on the operating table. The level of the sensory block was evaluated by loss of Pinprick discrimination at the time to incision and every 5 minutes. Sensory block to T6 dermatome considered adequate.

Parturients were assigned to receive one of two vasopressor solutions whenever maternal systolic arterial pressure (SAP) decreased to 80% of baseline or less.

Group A received boluses 6 mg/ml increments ephedrine if there was maternal decreased heart rate (HR 20% lower than baseline values) with a SAP  $\geq$  20% less than baseline;

Group B received a bolus of phenylephrine 20 µg/ml increments whenever there was increased heart rate ( heart rate 20% higher than baseline levels).

All hemodynamic evaluations were performed at 2-minutes interval until delivery. After that, these parameters were determined at 5-minutes interval until end of surgery.

Changes in maternal BP (SAP, DAP) and HR throughout anesthesia, incidence of nausea and vomiting, total dose and the number of boluses of vasopressors, sensory block level (dermatome), and total volume of fluids, were recorded. Apgar scores at 1 and 5 minutes of delivery for all newborns were noted and a score < 8 was considered low. Umbilical arterial blood sampling was obtained for determination of acid-base status.

### 3. Results

Total 60 patients were enrolled in this study, 30 patients for Ephedrine group and 30 patients for Phenylephrine group. The groups were comparable with respect to age, weight, height, gravidity, iv fluid volume, and median level of sensory block.

**Table 1:** Patient's characteristics and intraoperative variables in two groups

	Group A	Group B	P
Age (yr)	28.10 ± 4.86	29.56 ± 4.89	0.72
Weight (kg)	73.42 ± 9.48	75.03 ± 10.17	0.89
Height (cm)	159.53 ± 5.50	161.77 ± 4.05	0.62
Gestational age (wk)	39 (37 - 39)	39 (37 - 39)	1.00
Upper sensory level (median, range)	T6 (T4 - T6)	T6 (T4 - T6)	1.00
Duration of anesthesia (min)	75.52 ± 8.65	73.24 ± 8.42	0.65
Duration of surgery (min)	54.46 ± 6.61	51.71 ± 6.85	0.82
Total fluid during anesthesia (ml)	1850 ± 120	2050 ± 150	0.75
Total dose of vasopressor	8.36 ± 0.85 (mg)	23.33 ± 8.96 (µg)	-
Number of vasopressor administration	2 (1 - 3)	2 (1 - 2)	0.25
Incidence of nausea-vomiting (%)	5 (15.1)	2 (7.1)	0.34

**Table 2:** Neonatal outcome in two groups

Apgar score at:	Group A	Group B	P
1 min	8.46 ± 0.32	8.58 ± 0.30	0.22
5 min	9.70 ± 0.59	9.86 ± 0.40	0.15
Apgar score < 8 at 1 and 5 min	0	0	-
Umbilical artery blood gas analysis:			
pH	7.26 (7.24 - 7.32)	7.28 (7.25 - 7.33)	0.12
PCO2 (mmHg)	51 (48 - 57)	53 (49 - 66)	0.26
PO2 (mmHg)	14 (12 - 18)	12 (11 - 16)	0.27
HCO3(mmol)	23 (18 - 22)	21 (16 - 23)	0.61
Base deficit (mmol)	1.6 (0.1 - 2.3)	1.9 (0.3 - 3.2)	0.20

### 4. Discussion

In this study, we showed that there was no difference between ephedrine and phenylephrine in their efficacy for managing hypotension in healthy parturients undergoing cesarean section. In addition, results of our study have shown that the neonatal outcome was similar between groups. There were no differences in Apgar scores at 1 and 5 minutes of birth. So that, there were differences between groups in umbilical artery pH and base excess

values. The severity of these differences was small and true acidosis (pH ≤ 7.20) was not seen in any of neonates.

The prevention and treatment of maternal hypotension-induced spinal anesthesia remains the most important problem, with no consensus to the optimal mode of management.

Clinical data have suggested that α-adrenergic agonists such as ephedrine or phenylephrine may be given safely for prevention or treatment of hypotension during administration of regional anesthesia for cesarean section. Earlier studies have confirmed the beneficial phenylephrine effects on umbilical pH, as phenylephrine has been recently the first line drug for this purpose. However, more recent studies results show that some caution with the use of phenylephrine may be warranted.

Although phenylephrine is efficient for managing blood pressure, it causes reflexes bradycardia and it may reduce cardiac output. The clinical significance of this, is more reduction of utero-placental blood flow. Ephedrine also is associated with tachycardia.

Unlike of the previous studies, a recent study reported that phenylephrine was associated with higher values of fetal lactate. There is evidence that fetal lactate may be a better predictor of severe neonatal morbidity than PH. In the study by NganKee et al., they compared the phenylephrine with ephedrine in non-elective cesarean section. They concluded that despite small differences between groups in umbilical cord blood lactate concentration and PO2, there were no differences in fetal acid-base status or clinical neonatal outcome between the two vasopressors.

In this study, we didn't administer vasopressors as prophylaxis, for two reasons. First, it is not ethically right; for example we couldn't administer ephedrine to a patient had tachycardia. Second, clinical studies have not supported the prophylactic use of vasopressors for prevention of spinal hypotension.

### 5. Summary

The results of this study, shows that phenylephrine and ephedrine (with respect to maternal hemodynamic changes) are both efficient and suitable vasopressors for treatment (not prophylaxis) hypotension following spinal block in patients undergoing cesarean section. Both drugs have similar effects on neonates.

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