

# Effect of Phenylephrine, Ephedrine and Phenylephrine Plus Ephedrine Infusions on Maternal Hypotension in Elective Caesarean Section: A Comparative Study

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## ABSTRACT

**Introduction:** Spinal anaesthesia especially with phenylephrine and ephedrine is considered the standard anaesthetic technique for elective caesarean section due to its rapid onset, intensity, symmetric sensory and motor block. We have tried to compare the efficacy of phenylephrine and ephedrine alone and in combination to monitor maternal hypotension in elective caesarian section.

**Materials and Methods:** 150 pregnant women of 36 weeks and above undergoing elective caesarian sections were categorised into 3 groups of 50 each. Patients in Group I were to receive phenylephrine (100mcg/ml), Group II ephedrine (3 mg/ml) and Group III both phenylephrine (50mcg/ml) and ephedrine (1.5 mg/ml).

**Results:** Age, weight, height and weeks of gestation were comparable in all the cases. Patients in Group I showed the least incidence of hypotension and had steady systolic pressure, while Group II had highest incidence of hypotension. Nausea and tachycardia also was seen highest in Group II.

**Conclusion:** Our study showed that phenylephrine was a better vasopressor than ephedrine or the combination of the two drugs for maintaining maternal hypotension during caesarian section.

**Keywords:** Phenylephrine, Ephedrine, Vasopressor, Caesarian section, Hypotension

## INTRODUCTION

Pregnancy is considered as one of the most common physiological conditions of women. Of all the deliveries conducted, about 10% of them end up as caesarian sections due to high risk conditions. This incidence is steadily rising especially in the developed world<sup>1</sup> resulting in caesarian section being one of the most commonly performed operations. This could be due to factors such as factors such as widespread use of fetal monitoring, high private insurance rates, restrictive insurance policies, advancing maternal age and high medical malpractice costs<sup>2,3</sup> In India, data collected from 30 medical colleges/ teaching hospital revealed that caesarean section rates increased from 21.8% in 1988-89 to 25.4% in 1993-94.<sup>5,2</sup> A population based cross-sectional study conducted in India, a caesarean section of 32.6% has been documented from Madras City in South India.<sup>2</sup>

Regional anesthesia in Cesarean section offers significant benefit over general anesthesia. Spinal anaesthesia (SA) has gained popularity a few years ago over epidural anesthesia and is nowadays considered the standard anaesthetic technique for elective caesarean section due to its rapid onset,

intensity, symmetric sensory and motor block.<sup>4</sup> But, the occurrence of hypotension due to spinal anesthesia is one of the consequences. Without prophylactic measures, the incidence of hypotension is known to be 80%.<sup>6,7</sup> Hypotension whether accompanied by bradycardia or not, is detrimental to the foetus. Although the incidence of hypotension can be lowered by several ways, no single method is known to completely prevent it.<sup>8,9</sup> Though preloading and left uterine displacement are very useful in treating hypotension, vasopressors have been shown to be more effective.

Epidural anesthesia provides the opportunity to extend surgical anesthesia to post-surgical analgesia via catheter and control of the level of anesthesia. Combined spinal-epidural anesthesia offers the benefit of both epidural and spinal techniques with less medication, better reliability and less incidence of hypotension.<sup>4</sup>

Systolic hypotension higher than 20% to 30% of patient's baseline blood pressure can lead to maternal low perfusion pressure, manifested as nausea-vomiting, dizziness, low conscious and utero-placental hypo perfusion with fetal hypoxia and acidosis. Therefore, prevention and treatment of this complication, with special medical agents for optimal keeping of mother's blood pressure and fetal circulation has been an important issue for both anesthesiologists and obstetricians

## MATERIALS AND METHODS

This randomized clinical trial was done at IMSR Medical College between Feb 2013 and Jan 2015 on 150 pregnant women undergoing elective caesarian. This study was conducted after obtaining ethical committee clearance from the institution and informed consent from the patients. All the patients in the ASA Grade 1 or 2, were included in the study when they were in over 36 weeks of pregnancy. Physical tests were carried out on all patients. Patients who had hypertension, diabetes, cardiac and renal disease, pregnancy induced hypertension were excluded from the study. Signs

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Details	Group I (with phenylephrine)	Group II (with ephedrine)	Group III (with combination)	P value
Age	25.4 ± 3.2	25.7 ± 4.1	24.9 ± 3.9	0.42
Weight	58.1 ± 4.2	59.2 ± 3.6	58.6 ± 5.1	0.44
Height	154 ± 6.1	153 ± 5.2	154 ± 5.7	0.23
Gestation	38.2 ± 1.1	38.4 ± 0.6	38.1 ± 0.9	0.39

**Table-1:** Demographic details of the patient

Group	No of cases	% in Group	% overall
Group I	2	4%	1.3%
Group II	14	28%	9.3%
Group III	8	16%	5.3%

**Table-2:** Incidence of maternal hypotension

and symptoms of antepartum hemorrhage by placenta previa and abruption placenta were also excluded from the study.

All the 150 women were randomly categorized into 3 groups of 50 each. Patients in Group I were to receive phenylephrine (100mcg/ml), Group II ephedrine (3 mg/ml) and Group III both phenylephrine (50mcg/ml) and ephedrine (1.5 mg/ml). One day before surgery, hemodynamic levels were noted and the patients were advised a minimum of 6 hour fast.

On the day of surgery, Non invasive blood pressure, Heart rate and oxygen saturation were recorded before anaesthesia was given for all patients. They were monitored using SpO<sub>2</sub>, non-invasive blood pressure (NIBP), electrocardiogram (ECG). Intravenous preloading was done with 15 ml/kg lactated Ringer's solution over 15 min. The patient was positioned in the right lateral position with thigh and legs, hip and knees and flexion at the head. The spinal anesthesia was given at L3, L4 or L5 interspace. After the SA, the patients received IV lactated Ringer's solution at the rate of 5 ml/min till umbilical cord clamping. Patients were turned to supine position with a wedge under the right buttock.

Blood pressure, Heart rate and oxygen saturation, respiratory rate, was monitored every 2 mins for the first 15 minutes, every 5 mins for the next 15 minutes and every 15 minutes thereon till the end of surgery. Hypotension i.e. Systolic Blood pressure less than 80% the base line was treated with 6mg ephedrine given intravenously and repeated if need occurs Bradycardia i.e if the heart rate of the mother is less than 50 per minute id treated with 0.6mg IV atropine especially if associated with hypotension. If clinically tolerable, the infusion was temporarily stopped.

The time of vasopressor administration, baby extraction, and duration of surgery were noted. After birth, the neonatal monitoring was performed by the neonatologist based on the Apgar score.

## RESULTS

The demographic details for all the patients in the three groups were similar with reference to age or weight (table 1). All patients were given vasopressor therapy for hypotension. Of the 150 patients, caesarians were performed due to repeat caesarian in 89(59.3%) cases, due to complications in pregnancy ( breech condition of fetus, cephalopelvic disproportion and other anomalies) in 43 cases (28.7%) and patient's request in 18 cases (12%).

The vital signs which were monitored throughout the surgery were systolic Blood pressure, Diastolic blood pressure, saturated oxygen levels and heart rate and additional vasopressor therapy details were also monitored. Diastolic blood pressure was recorded at the same times as the systolic blood pressure and was very similar to the same. Heart rate and saturated oxygen levels also were regularly monitored and were in the normal limits. Therefore, both these readings did not show any significant change from the normal levels.

The systolic blood pressure in all the three groups were in the normal levels at the start of the surgery. After 10 minute of surgery, the SBP decreased to almost 92 in Group II while it remained steady in Group I. Slight lowering of the SBP was seen in Group III. After a bolus of vasopressor, the SBP was brought to normal levels within 15 minutes of surgery (Fig:1).

Hypotension was seen in 29 (19.3%) of the cases overall. The incidence was 3(6%) in Group I, 16 (32%) in Group II and 10 (20%) in Group III. The incidence of hypotension in overall patients was 2%, 10.7% and 6.7% respectively. Several episodes of hypotension was observed during the surgery (Table: 2).

Among the complication, hypertension was observed in all the groups but there was a predominance in Group II. Although this was not found to be significant. Neither were bradycardia and nausea whose incidence also was marginally varying in all the 3 groups (Fig: 2). Tachycardia was very high in Group II where Ephedrine was given as vasopressor, while they were significantly lower in the other groups.

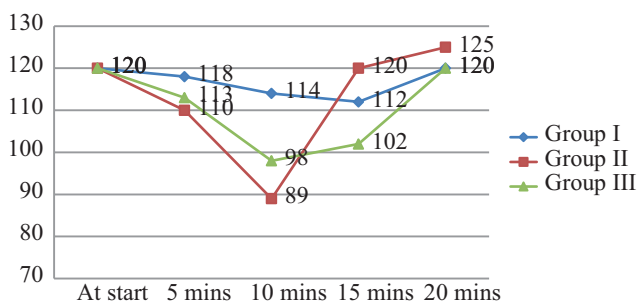
The Apgar score was comparable in all the three groups.

## DISCUSSION

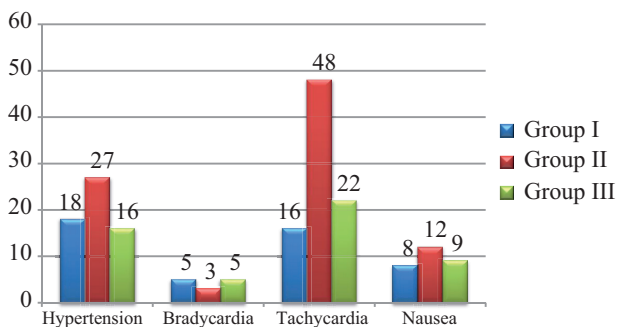
Availability of fine-gauge pencil-point needles, painless anesthetic conditions, with addition of spinal opioids to hyperbaric bupivacaine has made spinal anesthesia a preferred method for caesarian deliveries.<sup>4</sup> However, the major drawback with this technique is maternal hypotension.

After subarachnoid block for caesarean section, the use of IV fluid preload, avoidance of aortocaval compression and judicious use of vasopressor agent can reduce the incidence of hypotension. It has been shown that the percentage decrease in placental perfusion is related to the percentage reduction in maternal arterial pressure.<sup>10,11</sup>

Our study showed the efficacy of Phenylephrine as a better vasopressor agent for controlling hypotension in caesarian sections in mothers undergoing spinal anesthesia compared to ephedrine and to the combination of Phenylephrine and ephedrine. It was also observed that the combination of the two was better than ephedrine alone but not as good as phenylephrine alone. The same was also observed by other



**Figure-1:** Mean levels of systolic blood pressure



**Figure-2:** Complications in patients in the three groups

researchers in similar studies. Das et al observed similar results in a randomized double blind study<sup>12</sup> and Saravanan et al found phenylephrine to be a more potent drug compared to ephedrine.<sup>6</sup>

However no difference between the two types of vasopressors in managing maternal hypotension was observed by Atashkhoyi Simin et al<sup>13</sup> Kee et al also found both these vasopressors to be equally effective.<sup>15</sup> In yet another study by Aziz et al, phenylephrine was found to be less efficient than ephedrine.<sup>14</sup>

Normally, it is not uncommon to have a few patients having nausea even though they have a stable SBP. We had an incidence of 29 cases of nausea with 12 of them being in Group II, 9 in Group III and 8 in Group I. Our study showed a high incidence of hypertension in Group II but it was not significantly different in the other two groups. Bradycardia was similar in all the three groups but there was a significantly higher tachycardia in Group II. Although lesser but high incidence of tachycardia was seen in Group III as compared to Group I. Kee et al found an increasing trend in tachycardia in patients administered ephedrine rather than in patients with phenylephrine.<sup>15</sup> Same was observed by Das et al in yet another study.<sup>12</sup> However Aziz et al reported that nausea and vomiting were more predominant with phenylephrine than ephedrine.<sup>14</sup> Although phenylephrine is very efficient for managing maternal hypotension, it causes reflex bradycardia and may reduce cardiac output.<sup>8,18,19</sup>

## CONCLUSION

Infusion of phenylephrine alone as spinal anaesthesia was associated with a lower incidence of not only hypotension but also other complications like nausea, tachycardia, vomiting etc. In fetuses, it was associated with lower incidence

of fetal acidosis.

Therefore, we conclude that phenylephrine is a better vasopressor than ephedrine or the combination of the two drugs for maintaining maternal hypotension during caesarian section.

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