

## Comparative study between pre-emptive intramuscular ephedrine and intravenous ephedrine to prevent hypotension during spinal anaesthesia in caesarean section

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### Abstract:

**Introduction:** There is a considerable dispute over use of different techniques for prevention of hypotension during caesarean section. Spinal Anesthesia induced hypotension in obstetric patients is still a challenge for many anaesthesiologists as it may lead to complications like reduced utero-placental blood flow leading to fetal acidosis.

**Aims:** The aim of the present study is to compare the effects and side effects of ephedrine administered via two different routes, that is intravenous and intramuscular route.

**Methods and materials:** Institutional Ethics Committee approval was taken before the commencement of the study. An informed and written consent was taken from every patient selected for the study. A randomized study was done on 60 parturient aged between 20-30years, divided into Group IM (n=30) where intramuscular ephedrine 30 mg given 10 min prior to spinal anaesthesia and Group IV (n=30) where intravenous ephedrine 12 mg given at the time of spinal anaesthesia. After intravenous preloading(10- 15 ml/kg), spinal anaesthesia was given, baseline maternal heart rate and arterial blood pressure were recorded before induction and every 2 min for first 10 min and thereafter every 5 min for 45 min.

**Results:** Mean age of patients in group IM and Group IV was 23.03±2.37 and 24.47±2.25 years respectively ( $p>0.05$ ). In the intramuscular group, the fall in mean blood pressure after spinal anesthesia was hardly about 10% of the preoperative blood pressure. In the intravenous group, there was a fall in the blood pressure after spinal anesthesia for a short period of time which was statistically significant ( $p<0.05$ ).

**Conclusion:** Prophylactic use of intramuscular ephedrine in parturient prevents hypotension when compared to intravenous ephedrine during caesarean section.

**Keywords:** Ephedrine, Hypotension, Caesarean Section

### I. Introduction

Spinal anaesthesia induced hypotension during caesarean section is still a challenge for many anesthetists. The incidence of hypotension is more than 80% without any prophylactic measures.<sup>1, 2</sup> Many complications are associated with intra-operative hypotension like decreased consciousness in parturient, reduced utero-placental blood flow, impaired fetal oxygenation with asphyxial stress and fetal acidosis.<sup>3, 4</sup> The incidence of hypotension can be lowered by several ways like avoidance of aorto-caval compression, preloading with fluids and administration of vasopressor drugs but till date, no single method completely prevents hypotension.<sup>4, 5</sup> Over the last few years, there is a trend to rely more on vasopressors than either crystalloid or colloid alone.<sup>6, 7</sup>

There are many vasopressors which are used in spinal induced hypotension like phenylephrine, ephedrine, mephentermine. Ephedrine is the drug of choice as vasopressor agents in obstetric anaesthesia. It is a sympathomimetic amine, acts on part of the sympathetic nervous system (SNS). The principle mechanism of action relies on its indirect stimulation of the adrenergic receptor system by increasing the activity of noradrenaline at the postsynaptic  $\alpha$ - and  $\beta$ -receptors.<sup>8</sup> It can be administered via both intramuscular and intravenous route.<sup>9</sup> Intramuscular ephedrine has shown mixed success in preventing spinal induced hypotension.<sup>10-12</sup> We have conducted the study to evaluate the role of intramuscular and intravenous ephedrine to prevent spinal induced hypotension in caesarean section.

## II. Materials and Methods

Institutional Ethics Committee approval was taken before the commencement of the study. An informed and written consent was taken from every patient selected for the study. The present study was done on 60 female patients with age between 20-35 years, ASA grade I and II, haemodynamically stable, having full term pregnancy posted for elective or emergency caesarean sections under spinal anaesthesia were included in the study. Patients with contraindications for spinal block, coagulopathies, hypersensitivity to local anaesthetic, pregnancy induced hypertension, chronic hypertension, cardiac disease, hyperthyroidism and renal disease were excluded from the study. The patients were randomly divided into two groups of 30 each.

- Group IM - where intramuscular ephedrine 30 mg given 10 minute prior to spinal anaesthesia.
- Group IV- where intravenous ephedrine 12 mg given at time of spinal anaesthesia.

Pre-operative pulse, non invasive blood pressure (NIBP), ECG and oxygen saturation were noted. Peripheral venous access with 20 gauge intravenous cannula was established. Intravenous preloading was done with 15 ml/kg of Ringer's lactate. Baseline maternal hemodynamic variables were recorded. Spinal anaesthesia was administered in the sitting position under all aseptic precautions at L3-L4 interspinous spaces using 26 G quincke's spinal needle. A dose of 2.2ml of 0.5% hyperbaric bupivacaine was given. Baseline maternal heart rate, systolic and diastolic blood pressure were noted before induction. After administration of spinal anaesthesia vitals were recorded every 3 minutes for the first 15 minutes and every 5 minutes for the next 45 minutes. Further rescue boluses of ephedrine 6 mg were given if fall in systolic blood pressure was more than 20 % from baseline value. Presence of any complications intraoperatively was noted. Oxygen was administered at a rate of 3Lmin<sup>-1</sup> by a face mask to all the patients until the umbilical cord was clamped. Presence of any complications intraoperatively was observed. Apgar score of the new born was also measured.

**Statistical Analysis:** Statistical analysis was done by using SPSS. t-Test, Chi Square, Repeated ANOVA were applied according to the requirement. The level of significance was fixed at 95%. P value < 0.05 was considered as statistically significant.

## III. Results

The demographic data and duration of surgery were similar in each group (Table 1) (p > 0.05). Mean heart rates in both the groups are not statistically significant (Table 2) (p > 0.05). Mean systolic blood pressure at 9<sup>th</sup>, 12<sup>th</sup>, 15<sup>th</sup> minutes in Group IM was statistically significant (p < 0.05) (Table 3). Mean diastolic pressure at 12<sup>th</sup> and 15<sup>th</sup> minutes in Group IM was statistically significant (p < 0.05) (Table 4). Mean arterial pressure at 6<sup>th</sup>, 12<sup>th</sup>, 15<sup>th</sup> and 20<sup>th</sup> minutes in Group IM was also statistically significant (p < 0.05) (Table 5). Apgar score in both the groups were statistically not significant (p>0.05) (Table 6).

**Table 1:** Demographic Data in Group IV and Group IM

Demographic Data	Group IV	Group IM	P value
AGE (Years)	24.9 ± 2.32	25.2 ± 2.71	0.68
WEIGHT (Kg)	63 ± 9.52	64.5 ± 8.71	0.53
GESTATION (Weeks)	38.3 ± 0.8	38 ± 0.9	0.49

\*P Value < 0.05 statistically significant.

**Table 2:** Comparison of Mean Heart Rate (HR) in Group IV and Group IM

PARAMETERS	Mean Heart Rate (BPM)		P value
	Group IV	Group IM	
Baseline	102	99	0.44
Immediately after induction	96	98	0.59
3 min after induction	94	91	0.45
6 min after induction	91	90	0.77
9 min after induction	92	87	0.12
12 min after induction	89	86	0.39
15 min after induction	86	88	0.44
20 min after induction	87	85	0.38
25 min after induction	84	86	0.28
30 min after induction	81	83	0.36
35 min after induction	86	84	0.59
40 min after induction	85	81	0.12
45 min after induction	84	82	0.50

\*P value < 0.05 is statistically significant.

**Table 3:** Comparison of Mean Systolic Blood Pressure (SBP) in group IV and group IM

PARAMETERS	Mean Systolic Blood Pressure (BPM)		P value
	Group IV	Group IM	
Baseline	120 ± 12.3	122 ± 11.2	0.53
Immediately after induction	124 ± 8.2	121 ± 7.2	0.89
3 min after induction	125 ± 8.8	120 ± 9.2	0.82
6 min after induction	123 ± 7.8	121 ± 8.7	0.61
9 min after induction	116 ± 8.8	125 ± 5.2	0.01*
12 min after induction	112 ± 11.3	122 ± 8.2	0.04*
15 min after induction	111 ± 7.45	122 ± 8.5	0.00*
20 min after induction	114 ± 8.1	120 ± 10.9	0.09
25 min after induction	114 ± 5.8	119 ± 11.1	0.23
30 min after induction	110 ± 10.1	122 ± 8.5	0.00*
35 min after induction	116 ± 8.7	118 ± 8.9	0.48
40 min after induction	115 ± 11.1	120 ± 9.8	0.28
45 min after induction	113 ± 8.5	122 ± 6.5	0.01*

\*P value <0.05 is statistically significant.

**Table 4:** Comparison of Mean Diastolic Blood Pressure (DBP) in group IV and group IM

PARAMETERS	Mean Diastolic Blood Pressure (BPM)		P value
	Group IV	Group IM	
Baseline	78 ± 9	80 ± 8.4	0.55
Immediately after induction	80 ± 9.1	81 ± 7.8	0.79
3 min after induction	84 ± 8.12	80 ± 7.8	0.33
6 min after induction	83 ± 8.2	82 ± 8.9	0.7
9 min after induction	79 ± 8.7	81 ± 9.1	0.69
12 min after induction	75 ± 7.2	84 ± 7.2	0.01*
15 min after induction	74 ± 9.3	83 ± 7.9	0.04*
20 min after induction	76 ± 7.2	80 ± 9.1	0.38
25 min after induction	77 ± 7.5	79.5 ± 8.6	0.55
30 min after induction	73 ± 7.1	82 ± 5.74	0.01*
35 min after induction	76 ± 10.3	80 ± 7.5	0.44
40 min after induction	75 ± 7.3	82 ± 9.3	0.08
45 min after induction	76 ± 6.9	81 ± 11.7	0.31

\*P value <0.05 is statistically significant.

**Table 5:** Comparison of Mean Arterial Pressure (MAP) in group IV and group IM

PARAMETERS	Mean Arterial Pressure (MAP)		P value
	Group IV	Group IM	
Baseline	91 ± 5.06	92 ± 5.79	0.55
Immediately after induction	90 ± 4.36	91 ± 4.2	0.57
3 min after induction	95 ± 6.48	92 ± 6.29	0.34
6 min after induction	96 ± 6.04	91 ± 5.33	0.05*
9 min after induction	91 ± 6.1	93 ± 6.3	0.55
12 min after induction	87 ± 6.24	94 ± 6.69	0.04*
15 min after induction	88 ± 6.17	95 ± 5.64	0.02*
20 min after induction	89 ± 5.76	96 ± 4.93	0.01*
25 min after induction	90 ± 4.28	93 ± 3.71	0.15
30 min after induction	88 ± 5.17	95 ± 4.06	0.64
35 min after induction	91 ± 4.76	92 ± 4.66	0.10
40 min after induction	92 ± 5.5	93 ± 4.78	0.70
45 min after induction	90 ± 6.24	92 ± 5.67	0.46

\*P value <0.05 is statistically significant.

**Table 6:** Comparison of Mean Arterial Pressure (MAP) in group IV and group IM

Apgar Score	Group IV	Group IM	P value
Severely depressed	4	3	>0.05
Moderately depressed	8	6	>0.05
Excellent condition	18	21	>0.05

\*P value <0.05 is statistically significant.

#### IV. Discussion

The prevention and treatment of maternal hypotension associated with spinal anesthesia for lower segment caesarean section (LSCS) still remains as a challenge to all anesthesiologists. Several pharmacologic

like vasopressors and non-pharmacologic methods like leg elevation, left uterine displacement and preloading have been used for management of hypotension. No single method has been proved to be superior. Though the ideal prophylactic sympathomimetic drug has not yet been identified, ephedrine is still in use, mostly in Asian countries due to its cost effectiveness. There are very limited studies which had compared efficacy and safety of ephedrine given by two different routes i.e., intravenous and intramuscular. However, intravenous ephedrine is commonly used in many centers to prevent hypotension in LSCS following subarachnoid block. Intravenous single bolus is effective for 5-10 min. So to treat hypotension during intraoperative period, 3-4 boluses are required under spinal anaesthesia in a parturient. On the other hand drugs given by intramuscular route will be available for long time and prevent fall of BP for more than 30-40 min after spinal anaesthesia.<sup>13</sup>

The use of prophylactic ephedrine may be beneficial to prevent maternal hypotension and to potentially avoid fetal late decelerations. Intramuscular prophylactic vasopressors have also been advocated for preventing hypotension associated with spinal anaesthesia for LSCS.<sup>14</sup> There has been concern about reactive hypertension in previous studies that used intramuscular ephedrine before cesarean delivery, but only a 50-mg dose was associated with hypertension in those studies.<sup>15, 16</sup> Though many studies have been performed in order to identify a suitable prophylactic dose of intramuscular ephedrine, a proper dosage regime is yet to be finalized. Because of the nature of ephedrine's effects on the autonomic nervous system, prophylactic ephedrine should be used with caution in patients with cardiovascular disorders. Intramuscular ephedrine was not associated with any maternal and fetal side effect. Prophylactic treatment with 25 mg intramuscular ephedrine did not cause any adverse maternal side effects.<sup>17</sup>

Raskaran et al did a study on 90 patients and reported that in intramuscular ephedrine group 26.66% patients were observed to have hypotension and only 7% patients complained about nausea and vomiting and 10 patients required rescue ephedrine.<sup>18</sup> Varathan et al did a similar study on 49 patients and concluded that 15 mg of intramuscular ephedrine when given 10 min before, decreased hypotension and provided more hemodynamic stability.<sup>13</sup> Webb et al, concluded that a large dose (37.5mg) of intramuscular ephedrine prevented hypotension without causing reactive hypertension or tachycardia and also provided more sustained cardiovascular support than intravenous ephedrine. In the present study, we demonstrated that 30mg intramuscular ephedrine given 10 min prior to the subarachnoid block (Group IM) prevented hypotension without causing any fluctuation in the blood pressure. Group IV showed mild decrease in mean diastolic and mean arterial pressure from 10 minutes to 30 minutes after induction (P<0.05). No reactive hypertension was observed in both the groups. Apgar scores in Group IV and IM did not show much differences (P>0.05).

Figure 1: Line diagram showing Comparison of Mean HR in Group IV and Group IM

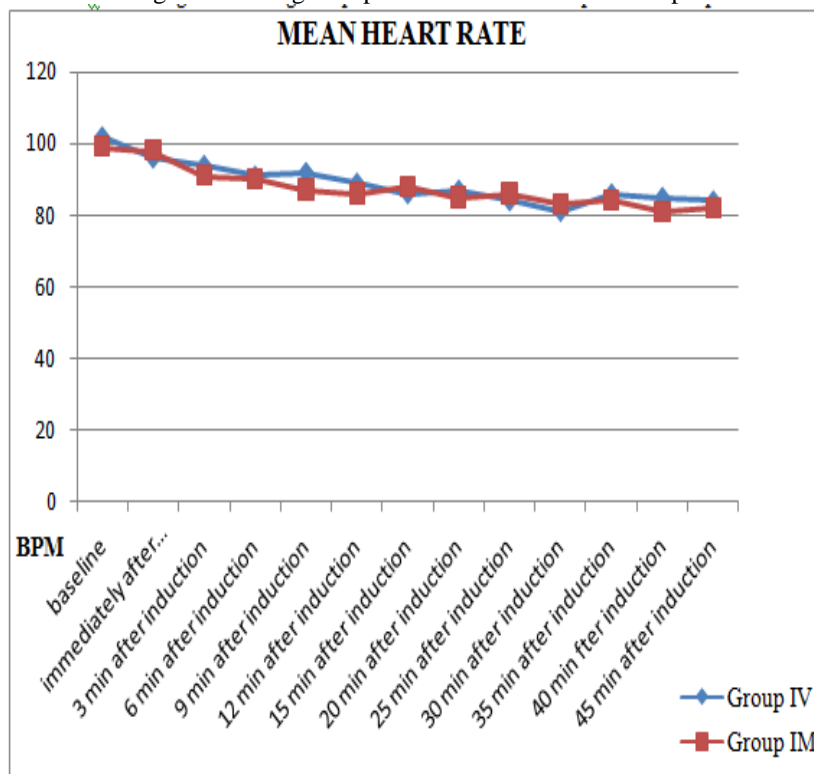


Figure 2: Line diagram showing Comparison of Mean SBP in Group IV and Group IM

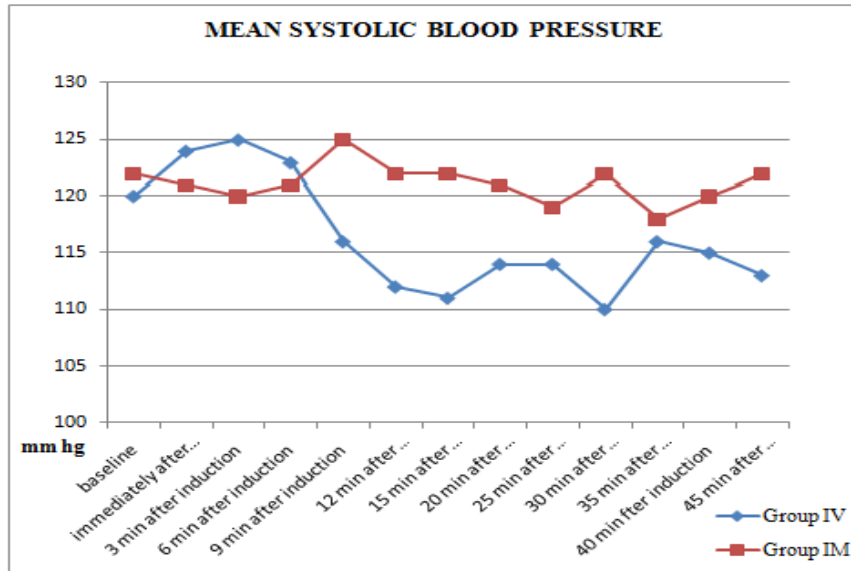


Figure 3: Line diagram showing Comparison of Mean DBP in Group IV and Group IM

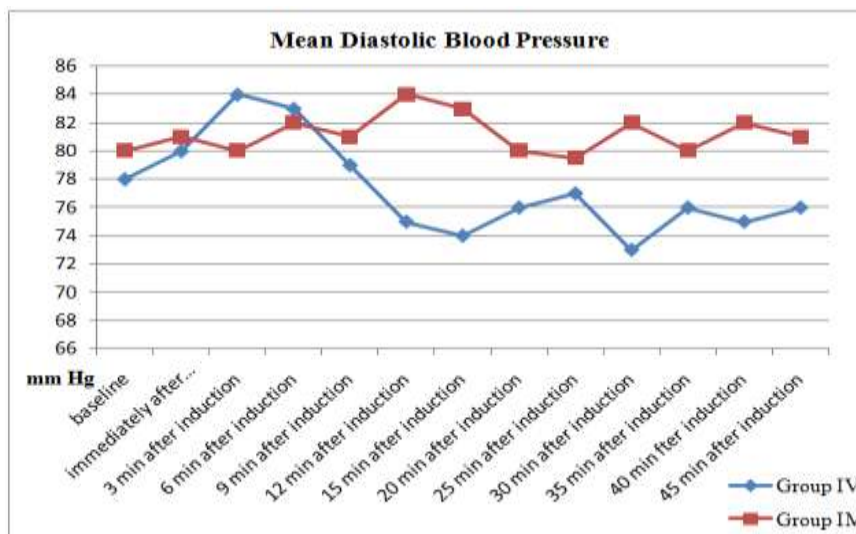
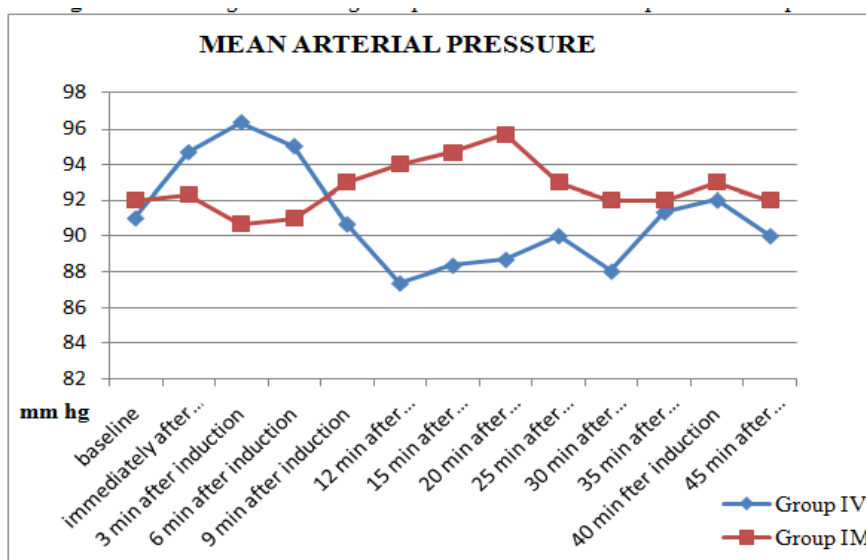


Figure 4: Line diagram showing Comparison of MAP in Group IV and Group IM



## V. Conclusion

The study shows that prophylactic administration of intramuscular ephedrine had lower incidence of hypotension as compared to intravenous ephedrine following spinal anaesthesia for caesarean section.

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