# ROLE OF PRELOADING WITH AND WITHOUT INTRAMUSCULAR EPHEDRINE TO PREVENT POST SPINAL HYPOTENSION IN ELDERLY PATIENTS

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## ABSTRACT

***Objective:*** To evaluate the efficacy of intramuscular ephedrine along with preloading in prevention of post spinal hypotension in elderly patients.

***Study Design:*** Randomized controlled trial.

***Place and Duration of Study:*** Department of Anaesthesia and Intensive Care Combined Military Hospital Peshawar, from 20th March 2007 to 20th March 2008.

***Material and Methods:*** A total of 100 patients of ASA I and II were selected. The patients were randomly divided by random numbers table into two groups of 50 each. Group A was preloaded with ringer solution 15 ml/kg and intramuscular injection of 1 ml normal saline as placebo was given. Group B preloaded with 7.5ml/kg and intramuscular injection of ephedrine 0.5 mg/kg was given. Heart rate and mean arterial pressure were monitored after the spinal blockade. Hypotension was treated with intravenous bolus of 5mg ephedrine and additional rapid infusion of lactated ringers.

***Results:*** In group A, hypotension occurred in 30 (60%) patients as compared to group B, where hypotension occurred in 11 (22%) patients. In group A, ephedrine 5mg (bolus) was given in 16 (32%) patients and ephedrine 10mg (2 boluses) were given in 14 (28%) patients, while in group B, ephedrine 5mg (1 bolus) was given in 11 (22%) patients.

***Conclusion:*** It is concluded from the results of this study that less preloading is required in intramuscular ephedrine group and hence preloading along with intramuscular ephedrine is more effective in preventing hypotension in elderly patients after spinal anaesthesia as compared to preloading alone.

**Keywords:** Ephedrine, Hypotension, Spinal anaesthesia.

## INTRODUCTION

Spinal anesthesia is one of the most popular techniques for the surgical procedures on lower abdomen and limbs. One of its important and predicted physiological effect is hypotension[1].

Overall incidence of hypotension during spinal anaesthesia is reported to be 8-33%[2]. Mechanical methods, volume loading and vasopressors have been tried for its prevention with variable results. Most of the studies are centered around the effects of pre-loading and vasopressors[3]. Preloading may be achieved in several ways with different solutions, fluid volumes and infusion rates. These differences determine the clinical responses in terms of preventing hypotension[4]. Occasional sympathomimetics with positive inotropic and vasoconstrictor effects are used to maintain perfusion pressure in first two minutes after institution of spinal anaesthesia[5].

Ephedrine is a direct and indirect acting sympathomimetic with mixed α and ß adrenoceptor activity. It maintains arterial pressure mainly by increase in cardiac output and heart rate by acting pre-dominantly on ß1 receptors[6].

The efficacy of prophylactic intramuscular ephedrine has been questioned and there is concern regarding the potential for causing harmful hypertension or tachycardia[7-10]. However, Hemmingsen et al[11] administered a combination of intravenous and intramuscular ephedrine after bupivacaine spinal anaesthesia, and found this regimen satisfactory in counteracting hypotension without undue hypertension or tachycardia.

Spinal anaesthesia is induced by injecting small amounts of local anaesthetics into cerebrospinal fluid[12]. Cardiovascular effects of spinal anaesthesia are similar to combined use of α and ß blockade i.e. decrease in heart rate and blood pressure[13,14]. Hypotension was

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defined as a decrease of 20% or more in mean arterial pressure (MAP) from the baseline level. The severity of bradycardia and hypotension depends upon the extent of sympathectomy that depends upon the height of blockade[15]. The sympathectomy typically extends for 2-6 dermatomes above the sensory level of block. This results in both arterial and venous vasodilatation[13]. Because large amount of blood is in the venous system so this effect predominates and there is decrease in right sided filling pressure and hence intracardiac stretch receptors reflexly decrease heart rate[16]. Other factors which are associated with bradycardia include age less than 50 years, ASA I physical status and concurrent use of beta blockers[17]. Usually bradycardia is mild to moderate but sometimes sudden severe bradycardia and asystole occurs during both spinal and epidural ananesthesia[18]. Sensory nerve transmit sensation such as touch and pain to the spinal cord and from there to the brain, whilst autonomic nerves control the caliber of blood vessels, heart rate, gut contraction and other function not under conscious control[19].

The objective of this study was to evaluate the efficacy of intramuscular ephedrine along with preloading in prevention of post spinal hypotension in elderly patients.

## MATERIAL AND METHODS

This was a randomized controlled trial of one year duration carried out from 20th Mar 2007 to 20th Mar 2008 at CMH Peshawar.

After approval from Hospital Ethical Committee, 100 patients of ages between 55 to 85 years, ASA I and II, from different wards scheduled to undergo surgical procedures on lower extremities, gynecological procedures like vaginal hysterectomy and urological procedures like transurethral resection of prostate etc, with duration of 45 minutes to 2 hours and willing for spinal anaesthesia were randomly divided by using random numbers table into two groups of 50 each. An informed consent was taken from the patients by explaining them the risks and benefits of preloading and ephedrine. None of the patient was premedicated. Patients with hypertension, ischemic heart disease, history of allergic reactions to local anaesthetics, bleeding die sthesis, mentally retarded patients and kyphoscoliosis were excluded from study.

Group A patients were preloaded with 15 ml/kg of ringer's lactate solution over 20 minutes period preceding the subarachnoid block, followed by the intramuscular injection of 1 ml placebo (0.9% saline). Group B patients were preloaded with 7.5 ml/kg of ringer's lactate solution over 20 minutes period preceding subarachnoid block, followed by intramuscular injection of ephedrine 0.5mg/kg immediately after spinal blockade. Appropriate monitors were connected and baseline heart rate, mean arterial pressure and oxygen saturation were recorded. Subarachnoid puncture was performed by using 25 G spinal needle at L4-5 level with patients in sitting position under strict aseptic measures. Two mililitres of 0.75% hyperbaric bupivacaine were injected intrathecally. Surgery was allowed after confirmation of sensory blockade at T-10 in both the groups. An infusion of ringer's lactate solution at 20 ml/kg/hr was administered peroperatively.

The time of intramuscular injection was taken as time zero. Heart rate; mean arterial pressure were recorded at interval of 5 min for first 30 min and then every 10 min subsequently after the performance of spinal blockade. Hypotension (more than 20% fall in MAP) was treated with intravenous bolus of 5 mg ephedrine and additional rapid infusion of lactated ringers. Total dose of rescue ephedrine required by the patients was also recorded. Bias was not controlled, as it is same for both the groups. All data was entered in the research proforma.

All the data collected through proforma was entered into statistical package for social sciences (SPSS) version 10 and analyzed through its statistical package. Descriptive statistics were used to calculate mean and standard deviation for age, heart rate, mean arterial pressure, oxygen saturation and dose of ephedrine and were compared between two groups using 't' test to determine significance of difference. Frequency and percentage were

calculated for hypotension, ASA status, and level of sensory block. These were compared between two groups by using Chi Square test. *p* value <0.05 was taken as significant.

## DISCUSSION

Spinal anaesthesia is induced by injecting small amounts of local anaesthetic into the cerebrospinal fluid (CSF)[12]. The cardiovascular effects of spinal anaesthesia are often taken as its complications[13]. The cardiovascular effects of spinal anaesthesia are similar to the combined use of intravenous α and ß blockade i.e. decrease in heart rate and blood pressure[13-14]. The severity of hypotension and bradycardia depend upon the extent of sympathectomy that depends on the height of the block[15]. The sympathectomy typically extends for two to six dermatomes above the sensory level of the block, resulting in both arterial and venous vasodilatation[13]. Because large (75%) amount of blood is in the venous system so this effect predominates, and there is a decrease in right sided filling pressure and hence the intracardiac stretch receptors reflexly decrease heart rate[16]. Other factors that are associated with bradycardia include, age less than 50 years, ASA-I physical status and concurrent use of β-blockers[17]. Usually bradycardia is mild to

**Table-1: Distribution of patients by mean arterial pressure.**

| Time (minutes) (After SAB) | Group A (n=50) | Group B (n=50) | *p* -value |
|---|---|---|---|
| | MAP (Mean±SD) | MAP (Mean±SD) | |
| Baseline | 86.9±8.2 | 85.60 ± 6.91 | 0.3 |
| 5 | 72.4±9.9 | 85.34 ± 9.64 | 0.001 |
| 10 | 70.94±7.5 | 84.02 ± 9.27 | 0.05 |
| 15 | 70.6±8.9 | 81.50 ± 9.42 | 0.001 |
| 20 | 72.1±6.6 | 77.16 ± 9.56 | 0.005 |
| 25 | 69.5±7.1 | 75.74 ± 7.44 | 0.001 |
| 30 | 68.2±6.2 | 72.54 ± 7.00 | 0.003 |
| 40 | 64.6±9.0 | 69.16 ± 7.02 | 0.001 |
| 50 | 68.6±7.9 | 67.58 ± 6.30 | 0.5 |
| 60 | 70.0±7.5 | 67.06 ± 7.37 | 0.04 |
| 70 | 70.6±6.5 | 70.78 ± 5.94 | 0.8 |
| 80 | 70.0±6.1 | 71.94 ± 6.08 | 0.1 |
| 90 | 70.1±6.0 | 71.08 ± 4.51 | 0.3 |

SD: Standard deviation, SAB: Subarachnoid block

**Table-2: Distribution of patients by rescue ephedrine given at any point post subarachnoid block.**

| Ephedrine (mg) | Group A (n=50) | | Group B (n=50) | |
|---|---|---|---|---|
| | n | Percentage | n | Percentage |
| 5 | 16 | 32.0 | 11 | 22.0 |
| 10 | 14 | 28.0 | 0 | 0 |
| 0 | 20 | 40.0 | 39 | 78.0 |
| Mean ± SD | 4.6 ± 3.2 | | 2.2 ± 1.1 | |

T 5.2, Df=49, *p*=0.001

## RESULTS

The mean age of the patients in group A was 66.1 ± 8.0 years and in group B 65.0 ± 8.4 years. In group A, there were 32 (64%) male and 18 (36%) female patients. In group B, there were 36 (72%) male and 14 (28%) female patients.

Distrubution of patients in two groups with respect to MAP is given in table-1. In group A, hypotension occurred in 30 (60%) patients as compared to group B, where hypotension occurred in 11 (22%) patients (*p*= 0.01).

In group A, rescue ephedrine 5 mg (1 bolus) was given in 16 (32%) patients and ephedrine 10mg (2 boluses) were given in 14 (28%) patients, while in group B, ephedrine 5mg (1 bolus) was given in 11 (22%) patients and ephedrine 10mg was not given in any patient (Table-2).

moderate but sometimes sudden severe bradycardia and asystole occur during both spinal and epidural anaesthesia[18].

Clinically significant alterations in pulmonary physiology are usually minimal with neuraxial block because the diaphragm is innervated by phrenic nerves with fibers originating from C3-C4[19].

Volume expansion alone with colloid or crystalloid solutions has not been consistently effective in attenuating hypotension induced by subarachnoid block. Pharmacokinetic studies have suggested that the peak effect of intramuscular ephedrine or phenylephrine is 10-15 minutes after administration[7]. In this study, pre-emptive intramuscular ephedrine and phenylephrine were compared with ringer lactate pre-loading in patients undergoing cesarean-section. The results showed incidence of hypotension of 48% in ephedrine group as compared to 70% in pre-loading alone.

In our study at 5 minutes, in group A there were 8% patients of hypotension and in group B there was no patient of hypotension. As compared with the study of Sternlo et al[20], in placebo group there were 6.25% patients of hypotension while in ephedrine group there was no patient of hypotension, which is almost same and comparable with our study. Bhagat et al[1] studied effect of pre-loading alone, intravenous ephedrine alone, and combination of pre-loading and intravenous ephedrine for prevention of hypotension and concluded that combination of preloading and intravenous ephedrine was more effective than any measure alone and that preloading alone was the least effective. The incidence of hypotension was very low (3.33%) in patients who received pre-loading with ringer lactate and intravenous ephedrine pre-emptively as compared to the patients who either received pre-loading (43.31%) or ephedrine (16.66%).

In our study at 10 minutes, in group A there were 16% patients of hypotension and in group B there were 4% patients of hypotension. As compared with the study of Sternlo et al[20], in placebo group there were 21% patients of hypotension while in ephedrine group there was no patient of hypotension, which is comparable with our study.

In our study at 15 minutes, in group A there were 14% patients of hypotension and in group B there were 6% patients of hypotension. As compared with the study of Sternlo et al[20], in placebo group there were 12.5% patients of hypotension while in ephedrine group there were 4% patients of hypotension, which is comparable with our study.

Chohedri et al[21] conducted a study in patients undergoing elective cesarean section with a different regime of ephedrine. They used prophylactic ephedrine (25 mg) orally, intramuscularly, and intravenously in 60 patients divided in three equal groups. The results were comparable with our study with hypotension occurring in 4 out of 20 patients in intramuscular ephedrine group, 9 out of 20 patients in oral ephedrine group and none in intravenous ephedrine group.

Data regarding local studies conducted in Pakistan with same combination of ephedrine and pre-loading in elderly patients is not available on internet.

Our study has certain limitations, all the patients were of ASA-1 and ASA- II physical status, and it was performed on elective procedures, so it cannot be applied for emergency procedures. And also the study was not blinded. Lack of blinding may have an effect on the observation and reporting of different occurrences.

## CONCLUSION

It is concluded from the results of this study that less preloading is required in intramuscular ephedrine group and hence preloading along with intramuscular ephedrine is more effective in preventing hypotension in elderly patients after spinal anaesthesia as compared to preloading alone.

## CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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