DOI: 10.14260/jemds/2014/3512

# ORIGINAL ARTICLE

## EFFICACY OF A SINGLE PROPHYLACTIC DOSE OF EPHEDRINE TO PREVENT HYPOTENSION IN PATIENTS DURING SPINAL ANESTHESIA

Madhu Tiwari[1], Pawan Tiwari[2], Krishan Lal Garg[3], Balbir Chhabra[4]

**HOW TO CITE THIS ARTICLE:**
Madhu Tiwari, Pawan Tiwari, Krishan Lal Garg, Balbir Chhabra. "Efficacy of a Single Prophylactic Dose of Ephedrine to Prevent Hypotension in Patients during Spinal Anesthesia". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 48, September 29; Page: 11556-11561, DOI: 10.14260/jemds/2014/3512

**ABSTRACT: OBJECTIVE:** The aim of the study was to assess the efficacy of single prophylactic dose (10mg) of ephedrine given to prevent hypotension in patients during spinal anesthesia. **STUDY DESIGN:** Semi experimental. **Place and Duration of Study:** This study was conducted at Anesthesia Department of our institution over a period of 6 months from June 2010 to November 2010. **MATERIAL AND METHODS:** Sixty patients, who were to be operated under spinal anesthesia, for lower abdominal general surgery, obstetric-gynecological and lower limb orthopedic surgery, were divided into two groups. Group I (n=30) received Ringer's lactate solution 15 ml/kg as preload and group II (n=30) received Ringer's lactate solution 15 ml/kg as preload along with single prophylactic dose of injection ephedrine 10 mg intravenously which was given after administering spinal anesthesia. Various parameters of the patients were recorded and the comparison was made between groups I and group II. Heart rate, systolic and diastolic blood pressures and oxygen saturation were monitored at 5 minutes interval till the completion of surgery. **RESULTS:** Out of 60 patients 36 were males and 24 were females. 37 patients belonged to American Society of Anesthesiologist (ASA)-1 and 23 patients belonged to ASA II. In group I the average age of the patients was 26.24±6.4 years while in group II it was 24.12±3.2 years. There were no significant statistical differences for age, weight and height of the patients between two groups. The changes in heart rate, systolic and diastolic blood pressures were compared between groups, after taking baseline readings, at 5 minutes interval till the end of surgery. The base line readings were not significantly different statistically but subsequent readings showed significantly low incidence of hypotension in group II as compared to group I. **CONCLUSION:** Administration of single prophylactic dose (10mg) of ephedrine prevents hypotension in patients during spinal anesthesia

**KEYWORDS:** Blood Pressure, Ephedrine, Heart Rate, Ringers lactate, Spinal Anesthesia.

**INTRODUCTION:** In anesthesia practice the role of neuraxial anesthesia is gaining more and more importance with passage of time. There is a big list of surgeries which can be performed under this form of anesthesia. With the advancement in drugs and equipment, the use of local anesthetic technique is increasing day by day.

According to studies, neuraxial block is efficient in reducing the postoperative morbidity and mortality. It has been claimed that neuraxial block reduces the incidence of venous thrombosis, pulmonary embolism, bleeding and transfusion requirements, cardiac complications, vascular graft occlusion, pneumonia and respiratory depression following lower abdominal surgeries.[1] It has also been involved in sympathetic mediated increase in tissue blood flow and suppression of neuroendocrine response.

As far as caesarean section is concerned, there is no exposure of neonate by depressant drugs and mother remains awake at birth of her child.[2] Therefore currently it is the technique of choice in obstetric practice all over the world.[3]

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Spinal anesthesia is associated with some disadvantages as well i.e. hypotension and bradycardia which commonly occur during this technique. A number of strategies for preventing hypotension have been tried like fluid administration as pre-load, anticholinergics, compression devices on the legs, and prophylactic vasopressors.[4] How-ever, no method has been proved entirely satisfactory. Of the available vasopressors, ephedrine is most commonly used. Ephedrine, an indirectly acting sympathomimetic amine, is probably the vasopressor of choice.

Although ephedrine has mixed α and ß-adrenoreceptor activity, it maintains arterial pressure mainly by positive inotropic and chronotropic effects as a result of its predominant activity on ß1-adrenoreceptors. Use of Intramuscular ephedrine has been described, but its efficacy has been inconsistent[5], and its use may be associated with unacceptable hypertension, particularly if spinal anesthesia is unsuccessful[6]. As an alternative, intravenous ephedrine given immediately after the induction of spinal anesthesia has been described.[7, 8] The aim of this study was to determine the efficacy of single dose (10mg) of ephedrine given prophylactically to prevent hypotension in patients during spinal anesthesia.

**PATIENTS AND METHODS:** This Semi experimental study was conducted in anesthesia department of our institution after approval from ethical committee, over a period of 6 months from June 2010 to November 2010. Sixty patients belonging to ASA I and II, undergoing elective surgeries under spinal anesthesia, for lower abdominal general surgery, obstetrics-gynecological and lower limb orthopedic surgery, were included. Informed consents were taken from the patients at pre-anesthetic visit. Following patients were included and excluded.

**INCLUSION CRITERIA:** All those patients with ASA I and II, age above 20 years of both sexes undergoing elective surgery were included in this study.

**EXCLUSION CRITERIA:** All those patients who refused to enter in this study, patients with history of local anesthetic allergy, patients with coagulation abnormalities and patients with infection at lumbar puncture site were excluded in this study.

These 60 patients were divided into two groups: Group I and group II. Group I (n=30) received Ringer's lactate solution 15 ml/kg as preload and group II (n=30) received Ringer's lactate solution 15 ml/kg as preload along with single prophylactic dose of ephedrine 10 mg intravenously.

Intravenous line was secured routinely in all patients after arrival in operation theatre; monitors were applied; base line readings of heart rate and blood pressure were taken. Ringer's lactate was used to preload the patients which were given according to body weight of the patient (15ml/ kg). The patient was placed in sitting position. After explaining the procedure and taking all aseptic precautions, interspinous space between L3 and L4 was identified and skin overlying was infiltrated with 2 % lidocaine.

25 G spinal needle was then introduced between interspinous space L3 and L4 and after confirming its intrathecal position by observing clear outflow of CSF, 1.5-3.0 ml of 0.5% hyperbaric bupivacaine was injected, dose depending upon type and duration of surgery. After removing spinal needle, sterile dressing was applied and patient was put in supine position. 10 mg of ephedrine was then injected in group II intravenously. Heart rate, systolic and diastolic blood pressures and oxygen saturation were monitored at 5 minutes interval, starting immediately after spinal anesthesia till the end of surgery.

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The level of sensory block reached was up to umbilicus and it remained so till the completion of surgery.

**STATISTICAL ANALYSES:** Mean and standard deviation of the quantitative variables like age, weight and height, systolic blood pressure, diastolic blood pressure and heart rate for both groups, were determined. Independent sample t test was used to compare percentage changes in mean heart rate, systolic and diastolic blood pressures between groups. Chi square test was also applied to check proportion difference of hypotension between groups. $P<0.05$ was considered significant.

**RESULTS:** In this study, sixty patients were divided into two groups: Group I and group II. Group I (n=30) received Ringer's lactate solution 15 ml/kg as preload and group II (n=30) received Ringer's lactate solution 15 ml/kg as preload along with single prophylactic dose of ephedrine 10 mg intravenously. Out of 60 patients, 36 were males and 24 were females. 37 patients belonged to ASA-1 and 23 patients belonged to ASA-II. In group I, the average age of the patients was 26.24±6.4 years while in group II it was 24.12±3.2 years (table 1).

There were no significant statistical differences for age, weight and height between the two groups. The changes in heart rate, systolic and diastolic blood pressures were compared between the groups, after taking baseline readings, at 5 minutes interval starting immediately after spinal anesthesia till the end of surgery. The base line readings were not significantly different statistically (table 2). 24 (80.00%) patients in group I developed hypotension whereas only 7(23.33%) patients in group II developed hypotension.

The hypotension usually developed 10-15 minutes after spinal anesthesia was given. Only 6 (20.00%) patients in group I did not develop hypotension where as in group II 23 (76.66%) patients did not develop hypotension (table 3). The incidence of hypotension was significantly low in group II. So it can be concluded that incidence of hypotension was significantly reduced by single prophylactic dose of 10 mg ephedrine in addition to preload with Ringer's lactate as compared to patients who received only Ringers lactate solution as preload.

**DISCUSSION:** Regional anesthetic techniques particularly central blocks i.e. epidural and spinal anesthesia are safer anesthetic techniques and play an important role for decreasing the mortality and morbidity in patients. Hypotension and bradycardia occur commonly during this technique. Prevention and management of this hypotension is still a major issue. A number of strategies for preventing hypotension have been investigated including the use of vasopressors like ephedrine. In addition to ephedrine pretreatment, the contribution of small dose intrathecal anesthesia and rehydration play key roles.

In our study, ephedrine was used prophylactically as single 10 mg dose intravenously to observe its efficacy to prevent hypotension in patients during spinal anesthesia along with preloading them with crystalloid solution i.e. Ringer's lactate in dose of 15 ml/kg immediately after administration of spinal anesthesia and attainment of supine position. The results of our study are supported by other studies as well.

Gutsche, in his study, demonstrated that 25-50 mg ephedrine, given intramuscularly within 30 minutes of instituting a subarachnoid block, significantly decreased the incidence of hypotension[4].

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Kang et al, in their study, found that intravenous route for administering ephedrine, either as an incremental dose or by infusion, may be more effective and predictable than the intramuscular route.[9] Vercauteren et al, in their study observed that a small dose of ephedrine may significantly lower the incidence and limit the severity of hypotension during elective caesarean delivery under small dose spinal anesthesia.[10]

Dsalu and Kushimo concluded that prophylactic ephedrine given by standard infusion set was more effective than crystalloid prehydration in prevention of hypotension during spinal anesthesia.[11] Crystalloid prehydration is also important to prevent hypotension. Rout et al demonstrated that the incidence of hypotension decreased significantly from 71 % to 55 % for unpreloaded versus preloaded subjects, respectively. Increasing the crystalloid preload from 10 to 30ml/kg may further reduce the incidence of hypotension.[12]

In our study, all patients in group I and II were preloaded with Ringers lactate solution in dose of 15 ml/kg before giving injection of 0.5 % hyperbaric bupivacaine and patients in group II were given prophylactic 10mg dose of ephedrine intravenously. Hypotension developed in 24 patients in group I and in 7 patients in group II which was treated with additional 200 ml boluses of Ringers lactate solution.

**CONCLUSION:** Our study suggest that the prophylactic single 10 mg intravenous dose of ephedrine is effective in preventing hypotension during spinal anesthesia when given in addition to preload as compared to preload alone.

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| Variables | | Group I (n=30) Mean ± SD | Group II (n=30) Mean ± SD |
|---|---|---|---|
| Age (years) | | 26.24±6.4 | 24.12±3.2 |
| Weight (kilograms) | | 55.60±7.6 | 56.72±1.8 |
| Height (cm) | | 154.30±2.8 | 152±4.1 |
| Gender | Male | 15 | 17 |
| | Female | 15 | 13 |
| Male: Female Ratio | | 1:1 | 1.3:1 |
| ASA | I | 19 | 18 |
| | II | 11 | 12 |

Table 1: Demographic and clinical characteristics of the patients

| Haemodynamic Characteristics | Group I (n=30) Mean ± SD | Group II (n=30) Mean ± SD | P-Value |
|---|---|---|---|
| Systolic blood pressure (mm Hg) | 118.06±5.7 | 110.0±5.3 | 0.11 |
| Diastolic blood pressure (mm Hg) | 75.27±4.5 | 73.47±4.4 | 0.84 |
| Mean blood pressure (mm Hg) | 93.14±5.6 | 87.10±5.6 | 0.12 |
| Heart Rate (per min) | 94.43±10.1 | 93.33±18.2 | 0.73 |

Table 2: Comparison of base line hemodynamic characteristics

Values were considered significant when $p<0.05$.
Data presented in mean ± standard deviation.

| Hypotension | Group I (n=30) | Group II (n=30) | Total (n=60) |
|---|---|---|---|
| Yes | 24 (80.00%) | 7 (23.33%) | 31 (51.66%) |
| No | 6 (20.00%) | 23 (76.66%) | 29 (48.33%) |

Table 3: Comparison of frequency of hypotension between groups

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**AUTHORS:**

1. Madhu Tiwari
2. Pawan Tiwari
3. Krishan Lal Garg
4. Balbir Chhabra

**PARTICULARS OF CONTRIBUTORS:**

1. Associate Professor, Department of Anaesthesia, Faculty of Medicine and Health Sciences, SGT University, Budhera, Gurgaon, Haryana, India.
2. Associate Professor, Department of Surgery, Faculty of Medicine and Health Sciences, SGT University, Budhera, Gurgaon, Haryana, India.
3. Professor, Department of Anaesthesia, Faculty of Medicine and Health Sciences, SGT University, Budhera, Gurgaon, Haryana, India.
4. Professor, Department of Anaesthesia, Faculty of Medicine and Health Sciences, SGT University, Budhera, Gurgaon, Haryana, India.

**NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:**

Dr. Madhu Tiwari,
A-104, Medical Campus,
SGT University,
Budhera, Gurgaon. India.
Email: tiwaripawan58@gmail.com

Date of Submission: 11/09/2014.
Date of Peer Review: 12/09/2014.
Date of Acceptance: 22/09/2014.
Date of Publishing: 26/09/2014.