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# PROPHYLACTIC ORAL EPHEDRINE REDUCES THE INCIDENCE OF HYPOTENSION AFTER SUBARACHNOID BLOCK

**Anaesthesiology**

**Dr. Prem Shankar Tiwary** Assistant Prof. Department of Anaesthesiology, A.N.M.M.C.H. Gaya.

**Dr. Manoj Kumar*** Assistant Prof. Department of Anaesthesiology, A.N.M.M.C.H. Gaya. *Corresponding Author

**Dr. P. K. Sinha** Associate Prof. Department of Anaesthesiology, A.N.M.M.C.H. Gaya.

## ABSTRACT

**Background:** Spinal anaesthesia remains one of basic techniques in arsenal of modern anaesthesiologist despite the waxing and waning of its popularity over the 90 years. Since its introduction into clinical practice. Although the spinal block offers several advantages, it is associated with significant adverse effect like hypotension. **Material and Methods:** This is a prospective randomized study conducted in the Department of Anaesthesiology, A.N.M. Medical College and Hospital, Gaya, Bihar. Hundred female patients belonging to ASA I/II grade, scheduled for lower abdominal and lower limb surgeries were randomly allocated into two groups. Group A (n=50) received prophylactic oral ephedrine 30mg and Group B (n=50) received placebo 30 minutes before spinal anaesthesia. **Conclusion:** Our study proves that prophylactic oral ephedrine 30mg when given 30-45 minutes before spinal anaesthsia is effective in reducing the incidence of hypotension after spinal anaesthesia without any adverse effects.

## KEYWORDS

Oral ephedrine, spinal anaesthesia, hypotension.

## INTRODUCTION

Spinal anesthesia is temporary interruption of nerve transmission following injection of local anesthetic solution into subarachnoid space. "Spinal anaesthesia has been both praised and condemned. Those who follow the correct technique in selected cases praise it, The decision step in development of regional anaesthesia was taken by C. Koller (1858-1944), a young Physician. But spinal anaesthesia was introduced into clinical practice by August Bier in 1898 by Kiel on August 16th even before the break- through of orotracheal intubation by Franz Kuhn in 1901. The only anaesthetic techniques to precede it were topical anaesthesia of the eye by Carl Koller and infiltration anaesthesia by Carl-Ludwig Schleich in 1892. Regional techniques are the preferred Anaesthetic procedure for surgeries involving abdomen and lower extremities. The various advantages include[7]:

*Blunting of stress response to surgery
*Avoidance of intubation
*Decrease in intraoperative blood loss
*Earlier return of gastrointestinal function
*Lower incidence of postoperative thromboembolic events.
*Anaesthesia limited to area of surgery
*Patient is awake to assess the clinical condition if required.

The unavoidable sequence of spinal anaesthesia is blockade of sympathetic preganglionic efferents leading to peripheral venous pooling causing hypotension. Therapies are primarily aimed at reducing the severity of hypotension, they include prophylactic leg elevation and wrapping, use of inflatable boots, preloading of the patient with crystalloids and colloids, lateral uterine displacement in Obstetric patients, and vasopressors used as last resort with varying results. Various vasopressor drugs have been studied phenylephrine, methoxamine metaraminol, angiotensin II, Mephentramine, dopamine, dobutamine. Among them, Ephedrine is most commonly used and is considered the vasopressor of choice. Its mixed α and β adrenergic activity helps maintaining arterial pressure, increased CO, heart rate thus preventing hypotension.

## OBJECTIVES

Our study is conducted to prove the safety and efficacy of prophylactic oral ephedrine (30mg, 30-45 minutes before spinal anaesthesia) in preventing the incidence of hypotension after spinal anaesthesia.

### Review Of Literature

Cerebrospinal fluid was first discovered by Domenico Cotugno in 1764 and its circulation was described by F. Magendie in 1825. First spinal analgesia was done by J. Leonard corning a New York neurologist in 1885. He accidently pierced the dura while experimenting with cocaine on spinal nerves of dog. Later he deliberately repeated the intradural injection, called it spinal anaesthesia and suggested it might be used in surgery. The term "Spinal anaesthesia" was introduced by Corning in 1885. The present day spinal anaesthesia and technique of lumbar puncture was described by Quincke in 1891 of Germany. The first two publications on spinal anaesthesia for surgical procedures were made in 1899 by Bier in the first paper later on by Tuffier. Bier had used it for surgeries on the lower limbs and Tuffier to relieve pain of sarcoma of the leg in a young man.

It is absolutely essential for any person undertaking the administrating of spinal anaesthesia to be thoroughly familiar with the anatomy of vertebral column. Spinal cord, the origin of various nerve roots from the spinal cord and distribution of the same as peripheral nerves in relation to surgical problems. Corning stated in 1900 that "I advise those who contemplate practicing spinal anaesthesia to take a look at the skeleton especially the relations of the lumbar vertebrae. An intelligent glance of this sort is worth many words". When the spine is fully flexed the cervical and lumbar curves are obliterated, in supine position the 3rd lumbar vertebrae marks the highest point of the lumbar curve, whereas the 5th thoracic is the lowest point of the dorsal curve. Thus hyperbaric solutions deposited at the third lumbar vertebrae will flow away, both cranially and caudally from it. The direction of spinous processes determines the direction in which the spinal needle should be inserted.

They form one fourth the length of vertebral column, thickest at cervical and lumbar regions. They are made up of outer collagenous annulus fibrous and inner gelatinous mucoidal mass nucleus pulposus. They mainly act as shock absorbers ensuring even distribution of compressive force and impart flexibility to the vertebral column. The spinal cord is the lower elongated, cylindrical part of Central nervous system. It occupies the upper two thirds of the vertebral canal. It is about 42- 45cm long. It extends from the level of the upper border of the atlas to the lower border of the first lumbar vertebra or upper border of the second lumbar vertebra. The lower border of the spinal cord is conical and is called the Conus medullaris. The apex of the conus is continued down as the filum terminale. The 31 spinal nerves emerge from the spinal cord in pairs-8cervical, 12 thoracic, 5 lumbar, 5 sacral and one pair of coccygeal nerves. The spinal nerves are comprised of anterior and posterior roots that unite in the intervertebral foramina to form the spinal nerve trunks. At the cervical level the nerves arise above their respective vertebra, but starting at first thoracic vertebra they exit below their vertebra. At the cervical and upper thoracic levels the roots emerge from the spinal cords and exit the vertebral foramina nearly at the same level. Once the diagnosis of hypotension is established, treatment should be instituted quickly. The aim is to re-establish normal tissue oxygenation at the earliest. This is accomplishes by increasing cardiac output, raising tissue perfusion pressure and flow and increasing blood oxygen content. Epinephrine was the vasopressor initially used, due its cardiac side effects it was replaced by Ephedrine on its introduction into clinical practice by

Ockerland and Dillon, and by Rudolf and Graham in 1927[4]. Since then it has remained the vasopressor of choice to combat spinal hypotension. **Datta et al in 1982**[2] assessed the effectiveness of intravenous Ephedrine in prevention of hypotension, nausea alone, or with vomiting. Forty six women scheduled to undergo elective caesarean section at term were allocated randomly to receive either Hartman solution preloading 20ml/kg (fluid group) or prophylactic intravenous Ephedrine 0.25mg/kg (ephedrine group). **Result:** There was lower incidence of severe hypotension in the Ephedrine group when compared to fluid group (35% vs. 65%, P=0.04). Mean umbilical venous pH was higher in the Ephedrine group than in fluid group (7.33 vs. 7.29, p=0.02) and the number of patients shivering was lower in the ephedrine group (2 vs. 9, P=0.02). They concluded that prophylactic Ephedrine infusion is a quick and simple technique which also confers the advantages of reducing the incidence of severe hypotension and neonatal acidosis. They further questioned the need for intravenous fluid preloading.

## MATERIAL AND METHODS

This is a randomized, prospective study performed over a period of one year. The study was carried out in one hundred patients between the age group of 20-60 years female patients belonging to American society of Anesthesiologist (ASA) grade I and II who were scheduled for elective surgery being performed over the lower abdomen or the lower limbs under spinal anaesthesia. After institutional Ethical committee approval and informed consent from each patient, the study was conducted at A.N.M.Medical College and Hospital, Gaya, Bihar.

### Inclusion Criteria

Patients belonging to ASA grade I and II posted for elective surgery on the lower abdomen or lower limbs under spinal anaesthesia. Female Patients between the age group 20-60 years. Baseline blood pressure between 100-140 and diastolic between 50-90mmHg.

### Exclusion Criteria

ASA grade III & IV, Patient refusal, Emergency surgeries, Patients having systemic cardiovascular, respiratory, hepatic, renal or central nervous system disorders.

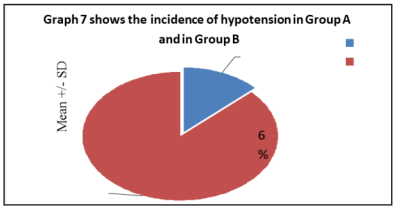
All patients were pre-medicated with Tab. Ranitidine 150mg Po the night before surgery and 2 hours before surgery. Tab. Diazepam 10mg Po was administered the night before surgery. All patients were kept nil orally before surgery. The baseline Heart rates (HR), Systolic blood pressure (SBP), Diastolic blood pressure (DBP) were recorded for all patients. After that patient will randomly allocated into two groups. Group A (n=50) were given Tab. Ephedrine 30mg orally with a sip of water 30 minutes before surgery. Group B (n=50) were given a placebo to be taken orally with a sip of water 30 minute before surgery. Hypotension was defined as a decrease in systolic blood pressure (SBP) more than 20% from the base line. If hypotension occurred in any of the patients they were treated first with foot end elevation, then infusion of ringer lactate was increased. If hypotension continued following these measures finally they were treated with Inj. Ephedrine administered intravenously in 6mg boluses at 2 minute interval until the SBP returned to within 20% of the base line values. Inj. Atropine 0.6mg was administered intravenously to any patient if the heart rate decreased below 60 beats/minute.

## RESULTS

### Age Distribution of the Patients Patient's Pre-Operative Data

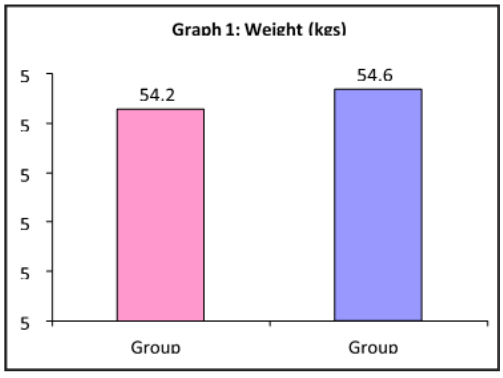
| Variable | With (n=50) Group A | Without Group B (n=50) | p-value |
|---|---|---|---|
| Age (years) | 33.4 ± 8.5 | 34.8 ± 8.9 | 0.44, NS |
| Pre-Operative Heart Rate | 91.16±6.02 | 90.62±5.83 | 0.65, NS |
| Pre-Operative SBP | 111.5 ± 8.6 | 116.3 ± 9.2 | 0.66, NS |
| Pre-Operative DBP | 75.1 ± 18.0 | 66.1 ± 4.5 | 0.08, NS |
| Weight | 54.28±3.48 | 54.68±4.32 | 0.61, NS |
| Height | 152.66±4.32 | 150.96±4.67 | 0.06, NS |

| | |
|---|---|
| Group A | 6% |
| Group B | 40% |




There were only 3 cases of hypotension in Group A and 20 cases in Group B. This difference is statistically highly significant, The results of the graph proves the efficacy of prophylactic oral ephedrine in presenting hypotension after SA.

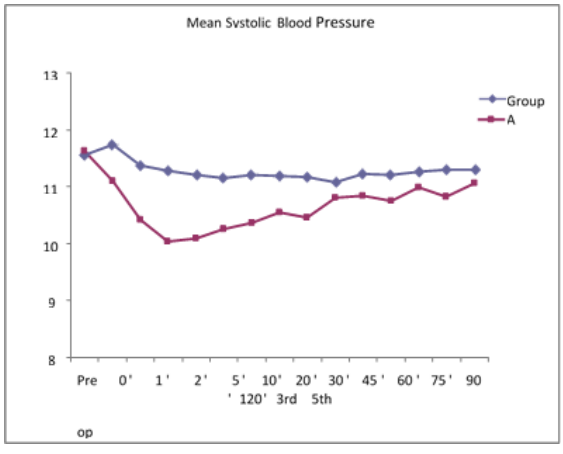
There is no difference between in Group A and B in Weight, height and age.



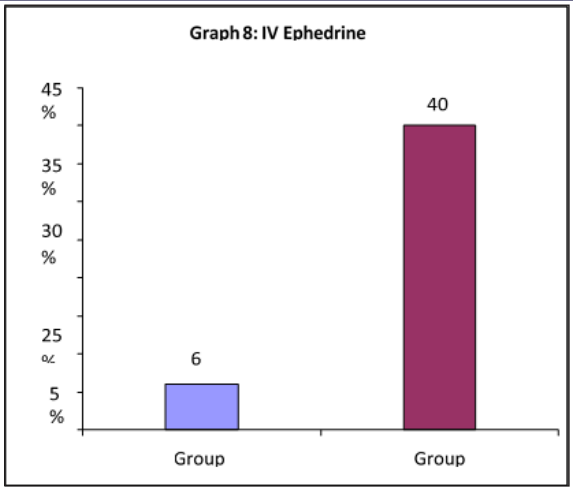

### Type of Surgery

| | Group A | | Group B | | Total | |
|---|---|---|---|---|---|---|
| | No | % | No. | % | No. | % |
| BB lower limb fracture | 4 | 8 | 0 | 0 | 4 | 4 |
| NOF fracture | 2 | 3 | 0 | 0 | 2 | 3 |
| Tibia fracture | 2 | 4 | 2 | 4 | 4 | 4 |
| Abd. Hysterectomy | 5 | 10 | 6 | 12 | 11 | 11 |
| Appendicectomy | 14 | 28 | 9 | 18 | 23 | 23 |
| Cervical encirclage | 0 | 0 | 1 | 2 | 1 | 1 |
| Cervicopexy | 0 | 0 | 1 | 2 | 1 | 1 |
| elective LSCS | 0 | 0 | 1 | 2 | 1 | 1 |
| Elective LSCS + CPD | 0 | 0 | 1 | 2 | 1 | 1 |
| Ex-fix ankle | 1 | 2 | 0 | 0 | 1 | 1 |
| Haemorrhoids | 4 | 8 | 3 | 6 | 7 | 7 |
| Laparotomy | 1 | 2 | 2 | 4 | 3 | 3 |
| MVA+Tubectomy | 5 | 10 | 4 | 8 | 9 | 9 |
| Ovarian cyst removal | 1 | 2 | 1 | 2 | 1 | 1 |
| Ovarian tumour | 0 | 0 | 2 | 4 | 2 | 2 |
| Ovariectomy | 4 | 8 | 0 | 0 | 4 | 4 |
| Perineal tear repair | 0 | 0 | 1 | 2 | 1 | 1 |
| prev LSCS for tubectomy | 0 | 0 | 1 | 2 | 1 | 1 |
| Screw removal hip | 0 | 0 | 1 | 2 | 1 | 1 |
| Skin grafting | 3 | 6 | 6 | 12 | 9 | 9 |
| Stripping of varicose veins | 1 | 2 | 0 | 0 | 1 | 1 |
| Tendo-Achilles repair | 0 | 0 | 1 | 2 | 1 | 1 |
| Tubectomy+MVA | 0 | 0 | 1 | 2 | 1 | 1 |
| Umbilical hernia repair | 3 | 6 | 1 | 2 | 4 | 4 |
| Vaginal hysterectomy | 1 | 2 | 5 | 10 | 6 | 6 |

Systolic Blood Pressure of the patients of Group A and Group B at different time interval. The difference are highly significant except at base line.




Number of patient receiving IV ephedrine bolus in Group A is very less than Group B.




## DISCUSSION

Spinal anaesthesia is widely practiced regional anaesthesia technique for many lower abdomen and lower limb surgery. Advantages of spinal anaesthesia lies in its simplicity of administration, more efficient block and fewer side effects. Among few, hypotension and bradycardia are potential hazards following spinal anaesthesia. The most common serious side effects from spinal anaesthesia are hypotension and bradycardia. Large surveillance studies typically observed incidence of hypotension around 33% and bradycardia around 13% in non-obstetric patient group Spinal anaesthesia induced hypotension is treated physiologically by improving the venous return so as to increase the preload thereby restoring the cardiac output. Head down or leg elevation (10-15º) or leg wrapping with elastocrit bandages and splints do not abolish the incidence of hypotension.

Few preloading studies have proved beyond doubt that colloids are no better than crystalloids in preventing the incidence of hypotension. Crystalloids on the other hand are required in great volumes (>15ml/kg) to decrease the incidence of hypotension. These huge volumes have detrimental effects like: Increased central venous pressure. Blood dilution leading to decrease in oxygen carrying capacity. Release of atrial natriuretic peptide initiating diuresis, thereby attenuating the effect of volume load on blood pressure. The use of prophylactic bolus or infusions of I.V. Ephedrine have proved their efficacy in preventing the episodes of hypotension without unwanted side effects. Studies relating to Oral route of prophylactic Ephedrine are sparse. So we conducted this study to determine the safety and efficacy of prophylactic Oral Ephedrine in reducing the incidence of hypotension after subarachnoid block.

incidence of hypotension is 6% in Group A patients and 40% in patients of Group B. All these patients who developed hypotension showed a fall in SAP was more than 20% in patient whoever develops hypotension and was observed with in 5-20 minutes of intrathecal block.The incidence of hypotension is greater in Group B when compared to Group A which is statistically highly significant ($p < 0.01$). **Sanjay Datta et al 1982**[2] conducted a study on Sixty healthy parturients scheduled for caesarean section and assessed the effectiveness of intravenous Ephedrine in prevention of hypotension, nausea alone, or with vomiting. They concluded that prompt intravenous administration of Ephedrine as soon as fall in base line blood pressure was detected prevents further fall in blood pressure and markedly reduces the incidence of nausea alone or with vomiting. Kang et al 1982[3] **Rothenberg et al 1991** designed a study to determine the antiemetic effect of ephedrine in a prospective, randomized, and double blind fashion in patients under going outpatient gynecologic laparoscopy. Before reversal of neuromuscular blockade patients either received placebo (0.9% saline I.M.), 0.04mg/kg I.M. Droperidol, or 0.5mg/kg I.M. Ephedrine. They concluded that Ephedrine is an effective prophylactic antiemetic agent in patients having general anaesthesia for outpatient laparoscopy. Gajraj et al 1993[17]. **Vercauteren et al 2000** in there study have shown lower incidence of nausea in patients who received prophylactic 5mg Inj. Ephedrine I.M. this is consistent with my study. In the present study prophylactic administration of Oral Ephedrine 30mg 30 minutes before spinal anaesthesia not only reduced the incidence of hypotension effectively in patients undergoing various elective lower abdomen / lower limb surgeries involving blood loss <10% but also reduces the incidence of Intraoperative nausea and vomiting considerably without any unwanted side effects like central nervous system stimulation, tachycardia or arrhythmias.

## CONCLUSION

Spinal anaesthesia has come to play a major role in surgery and hypotension is the major drawback associated with it. The prophylactic administration of oral Ephedrine in ASA Grade I & II patients 30-45 minutes before undergoing elective surgery under spinal anaesthesia is an effective measure in preventing hypotension without causing untoward side effects like central nervous system stimulation, tachycardia or arrhythmias.

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