

Comparison of Atropine with Ephedrine in Prevention of Spinal Anesthesia Induced Hypotension in Elderly Age Group

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Abstract

Background: Spinal anesthesia induced hypotension is common and dangerous especially in the elderly, as they have diminished physiological reserve and compromised blood supply to the vital organs. **Aim:** To compare the heart rate, systolic and diastolic blood pressure after spinal anesthesia with prophylactic use of atropine and ephedrine. **Materials and Methods:** This was a prospective study in which sixty ASA I and II patients undergoing urological surgeries were assigned to receive I.V. atropine 0.6 mg or I.V. ephedrine 12 mg one minute after spinal anesthesia induction. Heart Rate (HR), systolic and diastolic blood pressure, requirement of mephentermine and phenylephrine and side effects were studied. Hemodynamic parameters were compared with baseline values among the groups. **Results:** The patients with demographic data, baseline hemodynamic parameters and duration of surgery were comparable in both groups. Compared to baseline, trend of mean HR, systolic and diastolic BP were significantly less in Group E (ephedrine) than Group A (atropine). **Conclusion:** Administration of intravenous atropine 0.6 mg one min after induction of spinal anesthesia in elderly patients is safe and effective in the prevention of spinal anesthesia induced hypotension and bradycardia. Also, the requirement of vasopressors decreases without clinically significant side effects.

Keywords: Atropine; Ephedrine; Spinal anesthesia induced hypotension; Elderly age.

How to cite this article:

N Vanaja Lakshmi. Comparison of Atropine with Ephedrine in Prevention of Spinal Anesthesia Induced Hypotension in Elderly Age Group. Indian J Anesth Analg. 2019;6(6 Part -I):1973-1977.

Introduction

Spinal hypotension is common in women who receive Spinal Anesthesia (SA), with an incidence of up to 25–75%.¹ Spinal hypotension can occur precipitously and, if severe, can result in death related to regional anesthesia.^{2,3} Systemic vasodilation induced by sympathetic blockade after spinal anesthesia, results in venous pooling of blood and reduction in systemic vascular resistance. This is regarded as the predominant mechanism for hypotension. There is reflex tachycardia following

hypotension in elderly patients due to persistence of hypotension. This may be due to the blockade of cardioaccelerator sympathetic fibers at T1 to T4. It is also called atrial reflex, due to the distension of large systemic veins or the right atrium.

To prevent spinal hypotension, a number of approaches have been investigated, notably fluid loading, vasopressors, or both.⁴ Despite early enthusiasm, the efficacy of fluid loading for preventing spinal hypotension has been called into question. In contrast, the use of vasopressors has gained increasing prominence as the primary

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Received on 07.08.2019, **Accepted on** 04.09.2019



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technique for the prevention and treatment of spinal hypotension.^{5,6} The primary aim of the present study was to compare between the prophylactic use of atropine and ephedrine for the effect on mean heart rate and arterial pressure after spinal anesthesia.

Materials and Methods

This was a prospective study conducted over a period of fourteen months in the department of Anesthesia. A total of 60 elderly patients (age more than 60 years) posted for urological surgeries like transurethral resection for prostatic enlargement (BPH) or carcinoma of urinary bladder under spinal anesthesia were included in the study. The study was approved by the Ethics Committee and informed consent was obtained from all the patients.

Inclusion Criteria

Elderly patient (age more than 60 years) scheduled for urological surgery under spinal anesthesia, with an American Society of Anesthesiologist Physical Status (ASA PS) I and II.

Exclusion Criteria

The patients with known contraindications for SA including patient refusal, sepsis at the site of injection, indeterminate neurologic disease, coagulopathy, increased intracranial pressure, history of allergy to anesthetics, discopathy, arrhythmias such as atrial fibrillation, supraventricular tachycardia were excluded. Patients with present or past history of heart block greater than 1st degree, left bundle branch block, hypertension (systolic blood pressure more than 140 mm Hg or diastolic blood pressure more than 90 mm Hg), unstable angina or cardiomyopathy, taking β -adrenergic blockers or any drugs that may alter normal response to study drugs were excluded.

The SA technique

At first, the patients were visited by anesthetic residents on the evening before surgery. After clinical examination, the patients received explanation about the study procedure. After pre-anesthetic evaluation, the subjects were randomly allocated to one of the 2 Groups as atropine 0.6 mg (Group A) and ephedrine 12 mg (Group E). Each Group had 30 individuals. All drugs were made in a volume of 2.5 ml in a similar looking syringe and the patient received the drugs one minute

after the induction of spinal anesthesia as per the Group allocation.

Under strict aseptic pre-caution, SA was performed in sitting position by injection of a local anesthetic (2 ml bupivacaine 0.5% with or without opioid) into the subarachnoid space (L3 - L4, L4 - L5 or L5 - S1) through a fine Quincke type spinal needle, with lateral bevel direction and at a rate of 0.2 ml per second. Immediately after the intrathecal injection, the patient was kept in supine left lateral tilt position, and 5 L/min supplemental oxygen was administered through a face mask. Sensory block height was measured by loss of cold sensation to alcohol swabs 10 min after induction of SA. After ensuring the appropriate level of blockade (T4-T6), surgery was started. Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Heart Rate (HR) were monitored and recorded sequentially. Episodes of hypotension were attributed to SA only in the first 30 minutes period after SA induction so as to eliminate surgery-related causes for hypotension. Due to the fact that all the patients were not normotensive, considering an absolute value for SBP as a cut-off point for hypotension was not applicable to all patients. Three degrees of hypotension were determined according to reduction in initial SBP: Mild, moderate and severe. Mild hypotension defined as a drop of $\geq 10\%$ and $\leq 20\%$ in baseline SBP, moderate hypotension defined as a drop of $> 20\%$ and $\leq 30\%$ in baseline SBP and severe hypotension defined as a drop of $> 30\%$ in baseline SBP. A reduction of SBP to $< 10\%$ of the baseline SBP was defined as 'no hypotension'. Any drop $> 20\%$ in baseline SBP was treated with a bolus of 5 mg ephedrine.

After one minute of spinal anesthesia, one of the study drugs (either atropine 0.6 mg or ephedrine 12.5 mg or placebo (normal saline) was injected intravenously. MAP and HR were recorded at 0 (baseline), 1, 5, 10, 20, 30, 40, 50 and 60 minutes following the administration of study drugs. Amount of vasopressor (mephentermine or phenylephrine) required, sensory level achieved at 15 min of spinal anesthesia, presence of intra-operative angina and intra/post-operative confusion and other side effects were recorded till 6 hours post-operative. For the analysis of the data, Statistical Package for the Social Sciences (SPSS) 17 was used. For statistical analysis, *p* values < 0.05 were considered as statistically significant.

Results

All sixty patients enrolled completed the study. Demographic data (Age, Weight, ASA PS and

Diagnosis) in both the groups were comparable. There were no differences regarding demographics, type of surgeries and duration of surgery in both the groups. The types of surgeries were transurethral resection of prostate under spinal anesthesia for prostatic enlargement (BPH) or TURBT (Transurethral resection for bladder tumor), shows in **Table 1**.

Table 1: Demographic distribution in study

Variables	Group A (n = 30) Mean ± SD	Group E (n = 30) Mean ± SD	p value
Age (in yrs)	68.45 ± 8.21	69.78 ± 8.22	0.81
Weight (in kgs)	60.32 ± 5.67	59.89 ± 6.12	0.76
Baseline HR	73.31 ± 8.89	72.87 ± 7.56	0.67
Baseline Mean arterial blood pressure	93.45 ± 10.23	93.55 ± 10.21	0.12
Duration of Surgery	69.77 ± 9.67	73.88 ± 6.66	0.44

There is no significant difference between the groups for demographic data, displays as in (**Fig. 1**).

As compared to the baseline, mean heart rate significantly decreased in Group A at 5, 10, 15, 20, 30, 40, 50 and 60 minutes, ($p = 0.01$), displays in **Fig. 2**.

Systolic blood pressure significantly decreased in Group A when compared to Group E at all the periods of time in minutes, displays as in **Fig. 3**.

Diastolic blood pressure significantly decreased in Group A when compared to Group E at 5,10,15, 20 minutes, shows in **Table 2**.

Table 2: Intra-operative events in study

Events	Group A	Group E
Mephentermine used	1 (3.3%)	16 (53%)
Bradycardia	0	10 (33%)
Tachycardia	0	0
Other adverse effects	0	0

Intra-operatively, 53% patients developed hypotension and 33% developed bradycardia in Group E, which was statistically significant when compared to Group A. None of the patients in any group developed side effects like intra-operative angina and/or giddiness till 6 hours post-operatively. No other side effects were detected in either Group.

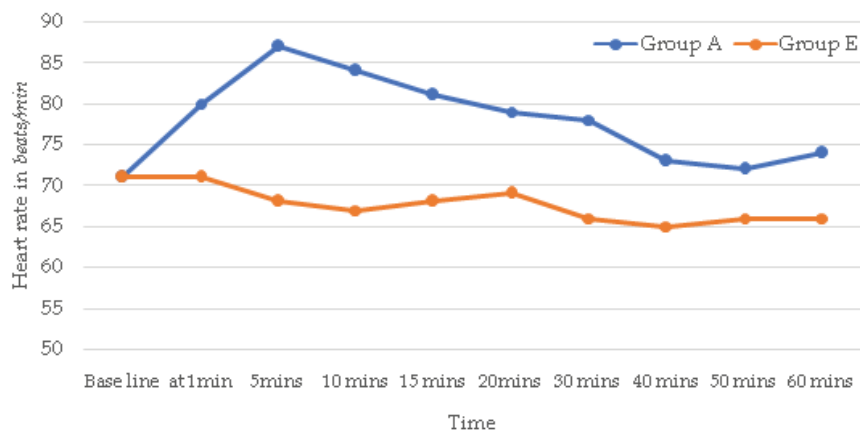


Fig. 1: Comparison of heart rate in both groups

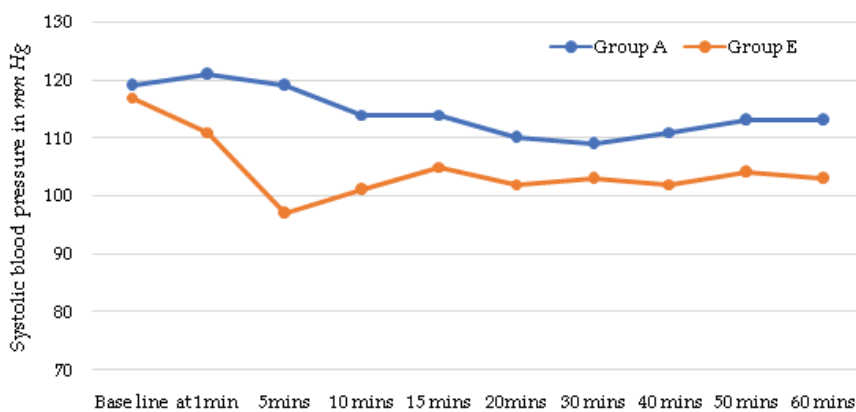


Fig. 2: Comparison of systolic blood pressure in both groups

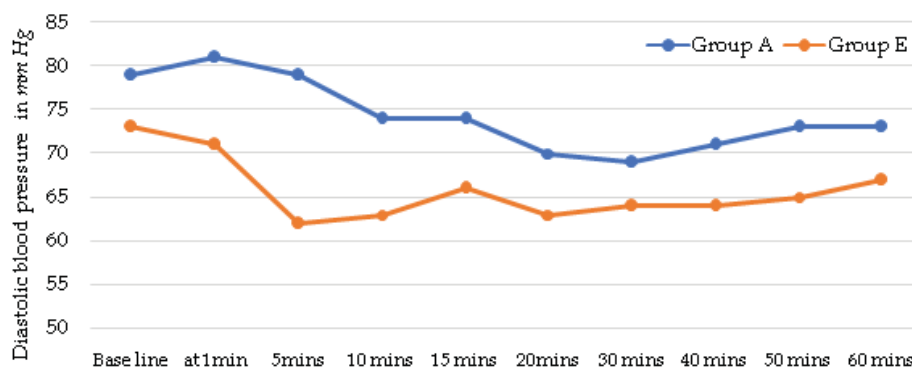


Fig. 3: Comparison of Diastolic blood pressure in both groups

Discussion

The types of surgeries done in the study were transurethral resection of prostate under spinal anesthesia either for prosthetic enlargement or for carcinoma of urinary bladder. Urosurgery interventions need peri-operative anesthetic management and are more complicated in elderly population.

Regional anesthesia as spinal anesthesia provides good operating conditions with reduced blood loss, lower incidence of deep vein thrombosis and pulmonary embolism, better post-operative analgesia and above all the maintenance of mental functions.⁷ Reduced physiological reserve and chronic diseases pre-dispose the elderly to long-term complications after hypotension particularly to coronary artery disease and cognitive behavioural dysfunction.⁸

Currently various techniques are being used for the prevention of hypotension and bradycardia which include pre or co-loading of intravenous fluids, vasopressors, and physical methods such as Table tilt, leg binders, and compression devices.⁹ However, a Cochrane review concluded that none of these techniques alone are effective and suggested that the future research be directed towards a combination of interventions.⁹ This study attempted to prevent the spinal anesthesia induced hypotension with combination of pre-loading with normal saline 10 ml/kg and pre-treatment with either I.V. atropine or ephedrine.

Atropine is an aromatic acid combined with organic base. It competitively blocks acetylcholine receptor by binding to it and prevents receptor activation thus cellular effects of acetylcholine are inhibited. In general, atropine lowers the parasympathetic activity of all muscles and glands regulated by the parasympathetic nervous system

and increases heart rate via abolishing the vagal tone acting on M2 receptors at heart.

The present study, showed that the incidence of bradycardia was significantly high at various time frames displayed as in (Fig. 1) in placebo group and required treatment with atropine ($p=0.01$) compared to atropine groups. Compared to baseline, heart rate was high in atropine group at 5 minutes, which corresponds to the peak effect of the I.V. atropine. The HR is increased significantly but only one patient needed treatment for tachycardia. Similarly, MAP was also lower in placebo group at most of the time compared to atropine group. In present study, 3.3% patients in atropine group required mephentermine for the treatment of hypotension and use of mephentermine was significant ($p = 0.01$) when compared to ephedrine group. This indicates that both incidence and severity of hypotension are greater in Group E as compared to the atropine group, as displayed in (Figs. 1-3). The findings are similar to various other studies. After a crystalloid infusion I.V. atropine given to patients undergoing spinal anesthesia could increase HR very quickly in a dose-dependent manner and decreases the incidence of hypotension significant in a dose-related manner.¹⁰

PUN Nze¹¹ observed that the incidence and severity of hypotension were less in pregnant women undergoing section under spinal anesthesia with precautionary use of intravenous bolus of atropine. Thus, intravenous atropine may be a useful supplement to the existing methods in preventing hypotension induced by spinal anesthesia. Nevertheless, IM atropine when used, as observed by Hirabayashi *et al.*¹² did not show any beneficial effect in hemodynamic stability during SA because the absorption of IM atropine may be incalculable, and the onset may have been too slow in comparison to initiation of hypotension after SA. Sternlo *et al.*¹³ studied about efficacy of IM ephedrine

and initiation in elderly patients undergoing hip arthroplasty under spinal anesthesia and concluded that ephedrine dispensed in the paravertebral muscles immediately after spinal anesthesia was a simple and effective means of reducing the occurrence of hypotensive experience in the elderly patients. Katie *et al.*¹⁴ conducted study on 200 women, ASA physical status I or II undergoing lower abdominal surgery and reported that pre-medication with oral ephedrine (30 minutes before spinal anesthesia) was an adequate and capable way of reducing the incidence of hypotension compared to control group ($p < 0.01$). Kohki *et al.*¹⁵ studied precautionary use of IM phenylephrine on hyperbaric tetracaine spinal anesthesia-induced hypotension in 90 elderly patients (age > 65 years) undergoing surgery for hip fractures. They found that the incidence of hypotension was significantly lower in the patients who received phenylephrine 1.5 mg or 3 mg than in the controls, both in the normotensive and hypertensive groups ($p = 0.01$). In a quantitative, systematic review of seven randomized controlled trials analysed by Lee *et al.*¹⁶ comparing phenylephrine with ephedrine for the counteracting maternal hypotension during cesarean delivery with spinal anesthesia there was no significant difference between ephedrine and phenylephrine.

Conclusion

The use of prophylactic I.V. atropine after one minute of induction of spinal anesthesia reduces the incidence and severity of the spinal anesthesia induced hypotension and bradycardia in elderly patients without clinically significant side effects. The study also concluded that atropine has better profile than ephedrine in maintaining hemodynamic stability in elderly patients.

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