Original Research Article

Clinical evaluation of preloading alone, vasoconstrictors alone and combined prophylaxis for hypotension during subarachnoid block

R. Sri Bindu Mounika[1], R. Rajeshwar Reddy[2], Prattipati Swathi[3*]

[1]Postgraduate, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India
[2]Assistant Professor, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India
[3]Assistant Professor, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India

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Abstract

Background: The most common serious problem associated with spinal anaesthesia remains rapid onset of profound hypotension. Even a mild drop in blood pressure must be avoided in high-risk patients in whom the autoregulatory mechanism may be abnormal. The present study was undertaken to clinically evaluate the efficacy of pre-loading vasoconstrictors (Ephedrine) and combined preloading and vasoconstrictors prophylaxis for hypotension during sub arachnoid block. **Aim:** The clinical evaluation of preloading alone, vasoconstrictors alone and combined Prophylaxis for hypotension during subarachnoid block. **Materials and methods:** This is an observational study, approved by the institutional ethical committee. An individual informed consent was taken from all patients selected for the study. All patients belonging to ASA grade 1 and 2, between the age group of 18 to 50 years posted for elective surgeries with SUB ARACHNOID BLOCKS. Patients having coagulation disorders, Cardiac diseases, Patients refusal are excluded. Total 150 patients undergoing elective surgeries with sub arachnoid blocks are included. They were divided into Crystalloid group(50 Patients),Vasoconstrictor group(50 Patients),Combination group(50 Patients). **Discussion:** Hypotension during subarachnoid block is common. Pre-block crystalloid administration has been recommended by some to reduce the incidence of hypotension. Use of Ephedrine may be an alternative approach. The present study is based on effect of crystalloid preloading and use of vasopressor (Ephedrine) for the prevention of spinal hypotension. **Conclusion: C**ombined use of crystalloid preloading and vasoconstrictor (Ephedrine) is effective in reducing incidence, severity and duration of hypotension due to SAB.

Key words: Subarachnoid block, Hypotension, Crystalloid, Ephedrine.

Introduction

Spinal anaesthesia was introduced into clinical practice by a general surgeon Karl August Bier in 1898. More than a century has passed and even today, it is one of the most popular techniques for both elective and emergency surgical procedures particularly Caesarean Sections, lower abdominal surgeries, orthopedic and urological surgeries.

The most common serious problem associated with spinal anaesthesia remains the rapid onset of profound hypotension and it can cause significant mortality and morbidity. Various studies indicate an incidence of hypotension varying from20% to 92%

Spinal induced hypotension is undesirable in obstetrics because it may adversely affect both maternal and neonatal outcome owing to a significant fall inuteroplacental blood flow. Even a mild drop in blood pressure must be avoided in high-risk patients such as the elderly and in those with underlying organ dysfunction in whom the auto regulatory mechanism may be abnormal.

Considering all this, the prevention of hypotension during sub-arachnoid block is important subject and there is no perfect method to prevent it. The corner stones of prevention of hypotension due to SAB for caesarean section are the use of a left lateral tilt and volume pre loading.

Mechanical methods like left lateral tilt, leg wrapping with esmarch

*Correspondence
Dr. Prattipati Swathi
Assistant Professor, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India.
E-mail: asramlibrary@gmail.com

bandages and thrombo-embolic stockings, volume pre loading and vasopressors have been tried from time to time with variable results.

Most of the studies are centered around the effects of preloading vasopressors.

Several studies have shown that an adequate preload of atleast 1Lof crystalloid before spinal anaesthesia reduces the incidence of hypotension to some extent. Other studies have shown that an infusion of Ephedrine may be an effective alternative for pre block crystalloid administration for prevention of hypotension due to SAB. Prophylactic infusion of ephedrine not only may be more effective against hypertensive episodes, but may also reduce the volume requirements of colloid. Keeping all this in mind, the present study was undertaken to clinically evaluate the efficacy of pre-loading (with Ringer's Lactate) and vasoconstrictors(Ephedrine) as a combined prophylaxis for hypotension during sub arachnoid block.

Materials and methods

The present clinical observative, analytical study entitled ―clinical evaluation of preloading alone, vasoconstrictors alone and combined prophylaxis for hypotension during subarachnoid block was conducted on 150 patients posted for elective surgeries selected randomly.

- The study was conducted between December 2020 - October 2021 at Alluri Sitarama Raju Academy of Medical Sciences, Eluru, after getting approved by the institutional ethical committee. An individual informed consent was taken from all the patients selected for the study from GENERAL SURGERY and OBG departments posted for elective surgeries.

Inclusion criteria

- Patients aged 18 – 50 years of either sex
- ASA grade I and II
- Undergoing elective surgeries with SUB ARACHNOID BLOCK

Exclusion criteria

- Patients having bleeding and coagulation disorder
- Unwilling patients

Total 150 patients are included in the study. Preanaesthetic evaluation was done a day prior to the elective surgery. History of present complaints, history of allergy to study drugs and any other drugs, any co-existing disease, medication, previous surgery, hospitalization etc were noted. A thorough physical and systemic examination (including weight of the patient, height of the patient, vital signs, spine, air way assessment, etc) was done.

On the day of surgery, on arrival at operation theatre two IV lines were secured. An 18-gauge IV cannula with threeway, kept open with Ringers Lactate solution was used for pre-loading, and for giving additional boluses of I.V. fluids during an event of hypotension. Another 20 gauge IV cannula with triway was used for injecting ephedrine and for infusion of fluids during anaesthesia.

150 patients of both genders were randomly allocated into three equal groups of 50 each.

Group I:-(Crystalloid group)Patients received preloading with 15 ml/ KgRinger's Lactate over 20 minutes period preceding the subarachnoid block.

Group II:-(Vasoconstrictor group) Patients received intravenous bolus of 5 mg Ephedrine in the first and second minute, followed by 1 mg Ephedrine at the end of each minute for the next 18 minutes following the subarachnoid block.

Group III:- (Combined group) Patients received pre loading with 7.5 ml/kg Ringer Lactate over 10 minutes period preceding the subarachnoid block followed by intravenous bolus of 2.5 mg Ephedrine in the first and second minute and 0.5mg Ephedrine at the end of each minute for the next 18 minutes after the subarachnoid block.

Procedure

All the Patients were examined the day before surgery, and preanaesthetic counseling was done. All patients received Alprazolam 0.5mg orally on the night before surgery. Inj. Ondansetron 0.1mg/kg i.v. and Inj. Ranitidine 1mg/kg i.v. given on day of surgery.

After pre-loading the patient, ie. Group I and Group III, (without preloading in Group II) patient was put in left lateral position. The back was painted and draped. After identifying L_{2-3}or L_{3-4}intervertebral space, local infiltration was given with 2%lignocaine 1.5 to 2ml. Then with 23 G lumbar puncture needle, lumbar puncture was done. After confirming clarity and free flow of cerebrospinal fluid, subarachnoid block was given with 3ml of inj. Bupivacaine 0.5% (heavy). Patients were turned to supine position and level of sensory block and analgesia was checked with loss of pinprick sensation. When the level reached to T8, the surgeon was asked to proceed with the surgery. An infusion of Lactated Ringer's solution at the rate of 2ml/kg was administered during anaesthesia, and the rate was not altered during the study period.

In each patient, a baseline recording of the arterial blood pressure and pulse rate was made before preloading the patients in-group I and III, and before positioning the patients for subarachnoid block in group II. Subsequently recording was done at 5,10, 15, 20, 25 and 30 minutes after the subarachnoid injection of the drug. However minute to minute monitoring was done to assess any hemodynamic changes and institution of corrective therapy.

A sphygmomanometer was cuffed around the upper arm and brachial artery pressure was recorded in the form of Systolic Arterial Pressure (SAP). Hypotension was defined as a decrease of SAP more than 30% of the baseline or less than 90 mmHg. During an episode of hypotension, an additional bolus of 2ml $Kg^{-1}$of lactated Ringer's solution was given. A maximum of three boluses were given. However if supplementation of IV fluids failed to reverse hypotension, a bolus dose of Ephedrine 6mg was given intravenously and solution repeated if necessary. Pulse Oxymeter was used to record the pulse rate. The patients were monitored for any reactive hypertension (SAP more than 30% of the base line values), nausea and vomiting. The results were tabulated and statistical tests of significance were applied. Analysis of variance (ANOVA) test was used to compare the age, weight and height among the three groups. Changes in Blood pressure and pulse rate within the groups were analysed using paired student t-test & inter group by unpaired student't' test episodes and its management were analyzed using student 't' test. The incidence of hypertension, nausea and vomiting and the sex of the patients were compared for their significance of difference using chi-square test. A 'P' value of less than 0.05 was considered as statistically significant.

Results

The incidence and severity of hypotension was maximum (16%) in the crystalloid group, followed by the vasoconstrictor group (8%) and least (2%) in the combination group. The difference in incidence of hypotension among three groups was statistically significant (P<0.05). The incidence of reactive hypertension was more in vasoconstrictor group (16%) than the other two groups. The incidence of nausea and vomiting was not significant in any group.

Hypotension and its management

	Crystalloid Gr. n=50	Vasoconstrictor Gr. n=50	Combination Gr. N=50	'P' value
No. of Hypotensive patients	8	4	1	< 0.05
No. of Episodes of Hypotension	10	6	1	<0.05
% of patients managed byIVF	6 (75%)	4 (100%)	1 (100%)	-
No. of boluses of IVF	13	7	0	-
% Patientsrequired6mg of Ephedrine	2 (25%)	0	0	-
No. of boluses of 6 mg Ephedrine given	2	0	0	-

'P' value<0.05 is significant

Eight patients (16%) in-group I, four patients (8%) in-group II and one patient (2%) in group III had hypotension following subarachnoid block, and the difference, among the groups was statistically significant.(Table8)

IV fluids alone could reverse hypotension in 6 patients of group I,4 of group II & single hypotensive patient of group III.2 patients in group I could not be managed with IV fluids alone and had to be treated with 6 mgbolus of Ephedrine for reversal of hypotension. The total number of hypotensive episodes and the use of additional boluses of IV fluids and 6mg ephedrine were maximum in the crystalloid group, whereas all the four cases in vasoconstrictor group were managed only with I.V. fluids with few additional boluses of IV fluids. But in the combination group, only one IV fluid bolus was needed to rescue the single episode of hypotension ,in one patient additional ephedrine was not required in vasoconstrictor & combination groups.

Discussion

Hypotension during subarachnoid block is common and can cause significant morbidity and mortality.Pre-block crystalloid administration has been recommended by some to reduce the incidence of hypotension.The use of Ephedrine may be an alternative approach.Most of the studies for prevention of spinal hypotension are centred around the effect of preloading or vasopressors. The present study is also based on the effect of crystalloid preloading and use of the vasopressor (Ephedrine) for the prevention of spinal hypotension.

In the present study, the use of crystalloids was preferred over colloids for preloading,because

(i) Colloids are more expensive.

(ii) Some colloids confer a small, but significant risk of anaphylaxis.

However, large volumes of IV fluids may be frankly dangerous in elderly patients whom there is a risk of pulmonary edema.

As Ephedrine has both alpha and beta actions[6]., it was used in this study. But Ephedrine may cause tachycardia and hypertension and should be used cautiously in patients with ischaemic heart disease.

Inorder to take the advantage of both factors i.e.1) preloading(with crystalloids) and 2) use of vasoconstrictors(Ephedrine) in preventing hypotension due to subarachnoid block and at the same time avoiding their undesirable effects, the combinationofbothfactorswasusedingroupIII(withhalfvolumeofgroupI and halfdose of group II).

Severity of spinal hypotension in the present study was assessed using the following indicators

a) The total number of hypotensive episodes,
b) The percentage of hypotensive patients who were managed by IV fluids alone and
c) The percentage of patients who required 6mg Ephedrine intravenously besides IV fluids for the management of hypotension.

Using this methodology in the present study and comparing the three groups, the severity of hypotension was found to be maximum in crystalloid group less in Ephedrine group and least in combination group.

Conclusion

With regard to the prevention of post spinal hypotension, the present study concludes that:

1. Preloading with crystalloids alone does not prevent the incidence of hypotension.
2. The use of vasoconstrictors like Ephedrine alone is associated with hypotension after SAB but to a lesser extent than with the use of crystalloid preload alone, thus showing that vasoconstrictor use can prevent post spinal hypotension better than crystalloid preloading alone.
3. The combined use of both the above techniques i.e.crystalloid preloading and vasoconstrictor(Ephedrine) is effective in reducing the incidence, severity and durationof hypotension due to SAB.
4. The combination of decreased volume of preload with crystalloid and reduced dose of vasoconstrictor provides better haemodynamic stability when compared to preloading or vasoconstrictors alone.
5. This study was done with crystalloids and vasoconstrictor Ephedrine.

Further studies could be done using colloid preloading combination with or in comparison with vasoconstrictor

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