

ORIGINAL RESEARCH

Study Comparing Bolus Intravenous Ephedrine and Phenylephrine for Maintenance of Arterial Blood Pressure in Cesarean Section During Spinal Anesthesia

T. Mohan Singh¹, J. Rajkumar²

ABSTRACT

Introduction: Presently the mainstay in management of hypotension is the use of Vasopressor agents, but those currently available are not ideal and there has been an ongoing search for ideal vasopressor. Ephedrine is supposed to be most widely used agent for this purpose, but causes maternal tachycardia due to its non selective action on both alpha and beta adrenergic receptors. It is difficult to titrate and also exhibits the phenomena of tachyphylaxis due to its indirectly acting nature. Hence there is a need to find an alternative drug for the treatment of hypotension, which lacks the forementioned maternal side effects and also does not cause any detrimental effect on the fetus. Objective of the study was to compare the efficacy of intravenous bolus dose of Phenylephrine (40 mcg) with Ephedrine (6mg) to maintain arterial blood pressure during spinal anaesthesia for Caesarean section.

Material and Methods: The present randomized controlled study of 100 patients undergoing surgery under spinal anaesthesia for elective and emergency caesarean section was conducted in the Department of Anaesthesiology, MediCiti Institute of Medical Sciences, Ghanpur village, Medchal Mandal, Ranga Reddy District, Telangana state during the period of Dec 2012 – June 2014. 100 patients were randomly divided into two groups of 50 each, Group P (Phenylephrine group) and Group E (Ephedrine group). APGAR score of every neonate was noted at 1 min and 5 mins after delivery.

Results: The data of subarachnoid block to hypotension time and duration of surgery were compared. There was no statistically significant difference found in the two groups. Group P required average of 1.20 boluses whereas Group E required 1.40 as boluses. Mean dose of 48 mcg was required in Group P and 8.4 mg was required in Group E. It was observed that mean value of APGAR score at 1 min in Group P was 9.66 ± 0.478 and that of Group E was 9.58 ± 0.49 . The APGAR 1 min Score difference between the two groups is not statistically significant as indicated by p value of greater than 0.05. It was observed that mean value of APGAR score at 1 min in Group P was 9.78 ± 0.418 and that of Group E was 9.78 ± 0.41 . The APGAR 5 min Score difference between the two groups is not statistically significant as indicated by p value of greater than 0.05.

Conclusion: Phenylephrine in a dose of 40 microgram is more efficacious in comparison to Ephedrine 6 milligrams in maintaining arterial blood pressure following hypotension after spinal anaesthesia in Caesarean section.

Keywords: Ephedrine, phenylephrine, spinal anesthesia

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INTRODUCTION

Presently the mainstay in management of hypotension is the use of Vasopressor agents, but those currently available are not ideal and there has been an Ongoing search for ideal vasopressor.¹

Ephedrine is supposed to be most widely used agent for this purpose, but causes maternal tachycardia due to its non selective action on both alpha and beta adrenergic receptors.²

It is difficult to titrate and also exhibits the phenomena of tachyphylaxis due to its indirectly acting nature. Hence there is a need to find an alternative drug for the treatment of hypotension, which lacks the forementioned maternal side effects and also does not cause any detrimental effect on the fetus.³

Phenylephrine is one such drug, which is a directly acting sympathomimetic agent with selective alpha 1 adrenergic activity. It is easy to titrate and maintain maternal blood pressure without producing undue tachycardia. Moreover, the administration of Phenylephrine is reported to be associated with lower incidence of fetal acidosis than is Ephedrine.⁴

Numerous studies⁵⁻⁸ have been carried out to evaluate the various doses of Phenylephrine, from 20 to 100 micrograms and a dose of 20 mcg has been found to be ineffective but dose as high as 100 mcg has caused maternal bradycardia.

Hence, an attempt has been made to compare the efficacy of

intravenous Phenylephrine 40 micrograms and Ephedrine 6 milligram as a vasopressor therapy in case of hypotension associated with spinal anaesthesia in patients undergoing Caesarean section. A good control of maternal blood pressure is one of the mainstay requirements for ensuring safety during spinal anaesthesia in Caesarean section.⁹

MATERIALS AND METHODS

Study design

A randomized controlled study of patients undergoing surgery under spinal anaesthesia for elective and emergency caesarean section

Sample size

A total sample size of 100 cases

Inclusion Criteria

Uncomplicated pregnancy

- Weight: 0 to 70kg's
- Aged between 24 to 30 years
- ASA class I & II
- Baseline systolic blood pressure between 100 to 140 mm Hg
- Baseline diastolic blood pressure between 70 to 89 mm Hg and developed hypotension during the surgery

Hypotension is defined as fall in systolic pressure greater than 20% from baseline value or value less than 90 mm Hg

Exclusion Criteria

- Patient refusal
- Patient with medical complications like Diabetes mellitus, cardiovascular diseases, severe anemia
- Patient with obstetrical complications like Ante Partum hemorrhage, Pregnancy induced hypertension.
- Contraindications to spinal anaesthesia

Methodology

Approval from institutional ethical committee was obtained prior to study. After explaining the anaesthetic procedure, written informed consent for participation in the study was obtained from the patient. 100 patients were randomly divided into two groups of 50 each, Group P (Phenylephrine group) and Group E (Ephedrine group) using computer generated randomization table. Study drugs were prepared and dispensed in syringes labelled "Study Vasopressor" by an anaesthesiologist not involved in the study. In the operating room SpO₂, ECG, NIBP, HR monitored. The baseline heart rate, systolic, diastolic and mean blood pressures were measured. Intravenous preloading was done with 10ml / kg of Ringer lactate solution. Preloading was given over 15 minutes. Following this, all patients received intrathecal 2 ml of 0.5% hyperbaric Bupivacaine through 23 G Quincke needle at L3-L4 subarachnoid space in left lateral position. Immediately following the injection, patient was turned to supine position

and received oxygen at the rate of 5 Litre / min by face mask. Level of sensory block was assessed by pinprick method from below upwards 5 minutes after SAB. Heart rate, systolic diastolic and mean arterial pressures were recorded every 2 minutes for 20 minutes and thereafter every 5 minutes for 1 hour or till the end of the surgery.

Whenever Hypotension (fall in BP >20% of baseline or less than 90 mm of Hg) occurred, Group P received Phenylephrine 40 mcg and Group E received 6 mg

Ephedrine as intravenous bolus. Time taken to develop hypotension and the number of boluses administered were noted. APGAR score of every neonate was noted at 1 min and 5 mins after delivery.

Statistical analysis

Statistical analysis was done using Student's t test and Mann-Whitney test. 'p' value of less than 0.05 was considered to be statistically significant.

RESULTS

The objective of the present study is to compare the efficacy of intravenous bolus dose of Phenylephrine (40 mcg) and Ephedrine (6mg) to treat hypotension following spinal anaesthesia for Caesarean section.

A total of 100 patients were grouped into two groups, Group P (Phenylephrine group, n = 50) and Group E (Ephedrine group, n=50) by a computer generated randomization table. After collecting data in both the groups the observations and analysis of the data are presented in tabular form.

The data of subarachnoid block to hypotension time and duration of surgery were compared. There was no statistically significant difference found in the two groups (p >0.05).

Group P required average of 1.20 boluses whereas Group E required 1.40 as boluses. Mean dose of 48 mcg was required in Group P and 8.4 mg was required in Group E.

It was observed that mean value of APGAR score at 1 min in Group P was 9.66 ± 0.478 and that of Group E was 9.58 ± 0.49. The APGAR 1 min Score difference between the two groups is not statistically significant as indicated by p value of greater than 0.05. It was observed that mean value of APGAR score at 1 min in Group P was 9.78 ± 0.418 and that of Group E was 9.78 ± 0.41. The APGAR 5 min Score difference between the two groups is not statistically significant as indicated by p value of greater than 0.05.

DISCUSSION

Since sympathetic blockade resulting in vasodilatation is the primary cause of fall in arterial pressure, use of vasopressors in conjunction with fluid preloading appears to be a more logical approach to correct it. It has been shown that the percentage decrease in placental circulation is related to percent of reduction in maternal arterial pressure but not absolute reduction in pressure.

Incidence of hypotension clearly depends on its definition. Hypotension in most of the studies has been defined as values ranging from 20 to 30 percent reduction from baseline systolic arterial pressure.⁵ In the present study hypotension was defined as decrease in systolic arterial pressure 20 percent from the baseline systolic pressure.

Bradycardia was defined as fall in heart rate of 20 percent or more from then baseline value.

The role of intravenous vasoconstrictors has been well established in case of postspinal hypotension during Caesarean section. Ephedrine acts directly as well as indirectly on alpha and beta adrenergic receptors. Phenylephrine has selective alpha adrenergic activity due to which it was considered to cause reduction in uterine bloodflow, but it has been mentioned that Phenylephrine causes less fetal acidosis than Ephedrine in a review by Ngan et al.¹⁰

The present study is compared only with the studies in which Phenylephrine and Ephedrine was given as IV bolus to treat hypotension following spinal anaesthesia in caesarean section and the studies that have used prophylactic IM and IV doses of the drug as well as those studies which have given the drug as infusions are not taken into consideration.

Dinesh Sahu¹¹ et al studied 60 patients undergoing elective as well as emergency caesarean section under spinal anaes-

thesia who developed hypotension after subarachnoid block. They were randomly allocated to one of three groups to receive an IV bolus of the following Group P Phenylephrine 100mg (n=20), Group E Ephedrine 6mg (n=20) or Group M Mephentermine 6mg (n=20). Hypotension was defined as a decrease in systolic arterial pressure > 20% of baseline values or < 90mmHg, whichever was greater. They concluded that elevation of systolic arterial pressure in Phenylephrine group was significantly high for first 6min of bolus dose as compared to Ephedrine & Mephentermine groups. There was significant reduction in heart rate in Phenylephrine group. Neonatal Apgar score were >7 in all three groups.

Bhattarai et al¹², study compares three vasoconstrictors-Phenylephrine, Ephedrine, Mephentermine. Study included 90 patients undergoing elective and emergency caesarean section who developed hypotension following sub-arachnoid-block. They were randomly divided into 3 groups, each group of 30 each. Group P received bolus of Phenylephrine 25mcg, Group E 5mg of Ephedrine, Group M 6mg of Mephentermine. It was found that rise of BP was significantly higher in case of Phenylephrine group in first 6 minutes, after the bolus, there was significant reduction in heart rate in Phenylephrine group, but there was tachycardia following administration of bolus Ephedrine and Mephentermine. Neonatal APGAR scores were similar in all the groups.

The median value of level of anaesthesia in Sahu et al study in Group P is 8 whereas in Group E is 6. The mean value of level of anaesthesia in present study in Group P is 6.96 ± 0.85 whereas in Group E is 7.16 ± 0.738. The values of the present study are comparable with Sahu et al study. The mean value of Sub-arachnoid block (SAB) to hypotension time in Sahu et al study in Group P is 4.3 whereas in Group E is 3.4. The mean value of Sub-arachnoid block (SAB) to hypotension time in Bhattarai et al study in Group P is 3.63 ± 3.33 whereas in Group E is 4.55 ± 0.42. The mean value of Sub-arachnoid block (SAB) to hypotension time in Present study in Group P is 3.36 ± 0.81 whereas in Group E is 3.52 ± 0.81. The mean value of the Sub-arachnoid block (SAB) to hypotension time in present study are comparable with the study of Bhattarai et al & Sahu et al.

The mean value of APGAR Score 1 minute in Bhattarai et al study in Group P is 7.40 ± 0.814 whereas in Group E is 7.31

Time (minutes)	Group P	Group E	P value
SAB to hypotension	3.36±0.81	3.52±0.81	0.3256
Duration of surgery	68.28±8.46	69.40±8.18	0.5027

Table-1: Sub arachnoid block (SAB) to hypotension time and duration of surgery

	Mean number of bolus	Standard deviation	Mean dose
Group P	1.2	0.45	48 mcg
Group E	1.4	0.64	8.4 mg

Table-2: Number of bolus and mean drug dose required in each group

	Group P	Group E	P value
APGAR at 1 min.	9.66±0.478	9.58±0.49	0.41
APGAR at 5 min.	0.78±0.418	0.78±0.41	0.99

Table-3: Comparison of APGAR Scores in both the Groups

	SAB to hypotension		Level of anaesthesia	
	Group P	Group E	Group P	Group E
Sahu et al ¹¹	4.3	3.4	8	6
Bhattarai et al ¹²	3.63±3.33	4.55±0.42	-	-
Present study	3.36±0.81	3.52±0.81	6.96±0.85	7.16±0.738

Table-4: Comparison of SAB to hypotension time & Level of Anaesthesia with other studies

	APGAR at 1 min.		APGAR at 5 min.	
	Group P	Group E	Group P	Group E
Bhattarai et al ¹²	7.40±0.814	7.31±0.806	9	9
Present study	9.66±0.478	9.58±0.49	9.78±0.418	9.78±0.41

Table-5: Comparison of APGAR Score with other studies

± 0.806 . The median value of APGAR Score 5 minutes in Bhattarai et al study in Group P is 9 whereas in Group E is 9. The mean value of APGAR score 1 minute in Present study in Group P is 9.66 ± 0.478 whereas in Group E is 9.58 ± 0.49 . The mean value of APGAR Score 5 minutes in Present study in Group P is 9.78 ± 0.418 whereas in Group E is 9.78 ± 0.41 . Other studies have compared neonatal outcome based on umbilical cord blood pH for both the drugs.

In Present study only APGAR score was compared, and there was no significant effect on the APGAR score of neonate at 1 and 5 minutes in both the groups, which correlated well with study by Sahu et al. The mean value of APGAR Score 5 minutes in Present study is comparable with that of Bhattarai study in both groups.

CONCLUSION

Phenylephrine in a dose of 40 microgram is more efficacious in comparison to Ephedrine 6 milligrams in maintaining arterial blood pressure following hypotension after spinal anaesthesia in Caesarean section.

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