

Comparing effect of Phenylephrine and ephedrine in patients undergoing lower segment caesarean section under spinal anaesthesia

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Abstract

Background: Spinal anaesthesia, a frequently used technique for caesarean delivery may be associated with maternal hypotension in as many 85% of patients. Various vasopressor have been studied for the treatment. **Aim:** The study was undertaken to compare the effect of phenylephrine and ephedrine in prophylactic intravenous infusion given to prevent and control intraoperative hypotension in patients undergoing lower segment caesarean section under spinal anaesthesia for ASA –PS 2014 I and II. **Materials and Methods:** Fifty patients were taken for this present study and distributed randomly to two groups with consent. Group A included 25 patients who were administered inj. Phenylephrine 100ugm/min infusion soon after giving spinal anaesthesia. In group B 25 patients were administered inj. Ephedrine 1mg/min as an infusion after giving spinal anaesthesia. Parameters observed were maternal heart rate, blood pressure, O2 saturation, level of block. **Results:** Maximum cases were in the age group of 21-25years, 56% in group A and 52% in group B belong to this age group. Maximum cases were in between the 51-55kgs group 40% in group A and 48% in group B. Spinal anaesthesia with 2ml (10mg) of 0.5% of inj. Bupivacaine was given and the level of block checked at 2 min and 5 mins. The level of anaesthesia achieved was T4 in group A (44%) and group B (56%). Inj. Phenylephrine 100ugm/min infusion was found to be superior in preventing and controlling the hypotension, as 96% of cases the fall of blood pressure was prevented and it was brought back to normal preoperative levels within 2-4minutes after giving spinal anaesthesia. In group B with inj.ephedrine 1mg/min it took a 8-10minutes for the control of blood pressure. Bradycardia was not a significant finding in ephedrine group. **Conclusions:** Titrated prophylactic phenylephrine infusion is preferred over ephedrine group in controlling fall of blood pressure with careful monitoring of pulse rate.

Key Words: Hypotension, Bradycardia, Phenylephrine, Ephedrine.

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Received Date: 14/05/2017 Revised Date: 28/06/2017 Accepted Date: 20/07/2017

DOI: <https://doi.org/10.26611/1015319>

Access this article online

Quick Response Code:



Website:

www.medpulse.in

Accessed Date:
25 July 2017

INTRODUCTION

The type of anaesthesia for caesarean section depends on the indication for the operation, the degree of urgency, the desires of the patient and the judgment of anaesthesia or regional anaesthesia; each of the technique having its own

merits and demerits. Recently regional anaesthesia is gaining popularity due to absence of minimal biochemical and metabolic changes. In spinal anaesthesia, the onset of anaesthesia is more rapid, allowing the surgical incision to be made sooner and producing a shorter total operation room time.¹ The rapid onset of anaesthesia with subarachnoid anaesthetics allows spinal anaesthesia to be used for all but the most spinal anaesthesia produces a more profound block. Because the dose of local anaesthetics used with spinal anaesthesia is small, there is little chance of maternal toxicity and very minimal placental transfer of drug to fetus. Spinal anaesthesia, a frequently used technique for caesarean delivery may be associated with maternal hypotension in as many 85% of patients.³ Prolonged and marked maternal hypotension may result in fetal acidemia due to decreased utero-placental blood flow. Common preventing measures

How to cite this article: P Savanth Kumar, G S Nikilesh Kumar. Comparing effect of Phenylephrine and ephedrine in patients undergoing lower segment caesarean section under spinal anaesthesia. *MedPulse International Journal of Anesthesiology*. July 2017; 3(1): 43-47.

<http://medpulse.in/Anesthesiology/index.php>

include fluid preload, lateral tilt and use of vasopressor.^{2,3} Various vasopressor have been studied for this purpose, e.g., ephedrine, phenylephrine, metaraminol, methoxamine, and dopamine. Our aim of study was comparison of phenylephrine and ephedrine in prophylactic intravenous infusion given to prevent and control intra operative hypotension in patients undergoing lower segment caesarean section under spinal anaesthesia.

MATERIALS AND METHODS

The present study of comparison of phenylephrine with ephedrine in intravenous infusion to prevent and control intra operative hypotension for lower segment caesarean section was undertaken at Govt. maternity hospital, Nayapool, Hyderabad, during the period April 2014 to October 2015. After approval from hospital ethical committee and written informed consent. We have selected 50 patients randomly who are undergoing elective, emergency caesarean section were included in this study. Pregnancy induced hypertension, severe anaemia, eclamptic patients, patients with coagulation abnormalities, maternal haemorrhage and those with foetal distress were excluded from the study. The patients were randomly assigned to 2 groups

Group A: Phenylephrine 100µg/minute in infusion

Group B: Ephedrine 1 mg/minute in infusion

In pediatrics burette with 100ml of normal saline 10mg of inj. Phenylephrine added to prepare 100µgs/ml solution). In pediatric burette with 90ml normal saline 90mg of ephedrine (3amp) added to prepare 1mg/ml solution). 2ml (10mg of 0.5%) bupivacaine, Inj. Phenylephrine 100µgs as infusion Inj. Ephedrine 1mg/minute as infusion

Procedure: Lumber puncture was done in left lateral position under full aseptic precaution at L3, L4 interspace. Once free flow of cerebrospinal fluid is obtained 2ml (10mg) of 0.5% bupivacaine is administered over 10-15sce. Patients were truned supine with a left wedge kept to accomplish a left uterine displacement. Soon after the spinal was given and patient made supine, the drip of phenylephrine 100ug/minute in group A and ephedrine 1mg/minute in group B in intravenous was started. Blood pressure/ pulse and oxygen saturation was monitored. Standard monitoring included heart rate, non invasive blood pressure, respiratory rate, oxygen saturation, oxygen was administered throughout the procedure by face mask. Parameters observed were maternal heart rate, blood pressure, O2 saturation, level of block. Maternal pulse rate blood pressure were monitored every 2 minutes for 1st 10minutes, every 5 minutes for 30 minutes, every 10 mins after 30 mins till the procedure was over, approximately it was between 30 to 40 minutes. In both the group the drip was discontinued after the surgical procedure was over i.e., 30 mins and the blood

pressure was found to be stable. The patient was shifted to the postoperative ward and was monitored until 2 segment regression was noticed. The data obtained was analyzed using Microsoft excel Appropriate statistical tests were used to assess the outcome of instrument assisted delivery. Descriptive results are expressed as percentages, mean and SD of various parameters.

RESULTS

The group were demographically and haemodynamically similar in all respects.

Table 1: Demographic distribution in study

Age in years	Group A	Group B
15-20years	6(24%)	5(20%)
21-25years	14(56%)	13(52%)
26-30years	5(20%)	5(20%)
31-35years	0(0%)	2(8%)
Mean±SD	24±4	25±5
P-Value	0.89	
Weight in Kgs	Group A	Group B
45-50	4 (16%)	5(20%)
51-55	10(40%)	12(48%)
56-60	8(32%)	5(20%)
Above 61 kgs	3(12%)	3(12%)
Mean±SD	53±9	53±8
P-Value	0.99	

Maximum cases were in the age group of 21-25years, least in 31-35years, more than 50% (56% in group A and 52% in group B) belong to the age group of 21-25 years. Maximum cases were in between the 51-55kgs group (40% in group A and 48% in group B), least were above 61kgs (12% in group A and B). both groups are not significant.

Table 2: Level of blocks and Preoperative mean arterial pressure

Level of blocks	Group A	Group B
T4	11(44%)	14(56%)
T5	12(48%)	9(36%)
T6	2(8%)	2(8%)
Mean arterial pressure in mmHg	Group A	Group B
80-90	6(24%)	11(44%)
90-100	13(52%)	8(32%)
100-110	5(20%)	6(24%)
Above110	1(4%)	0(0%)
Mean±SD	94±12	91±11
P-Value	0.73	

Spinal anaesthesia with 2ml (10mg) of 0.5% of inj. Bupivacaine was given and the level of block checked at 2min and 5 mins. The level of anaesthesia achieved was T4 in group A (44%) and group B (56%). Before taking up for caesarean section the preoperative mean arterial pressure were recorded in group A 52% of cases recorded

mean arterial pressure at 90-100mmhg. In group B 44% of cases recorded mean arterial pressure of 80-90mmhg. There is no significance of mean arterial pressure before surgery in two groups.

Table 3: Mean \pm SD value of systolic,diastolic and pulse rate in group A and group B.

Time after giving drug	Group-A			Group B		
	Systolic BP	Diastolic BP	Pulse rate	Systolic BP	Diastolic BP	Pulse rate
0 min	121 \pm 8.27	80.12 \pm 7.15	93 \pm 23	117.9 \pm 8.29	78.24 \pm 7.46	83 \pm 8.6
2 min	117 \pm 7.155	77.76 \pm 10.33	91 \pm 22	114 \pm 11.92	76.24 \pm 8.06	85 \pm 9.2
4 min	105.1 \pm 18.78	70.04 \pm 9.4	93.6 \pm 16	103.2 \pm 14.55	71.84 \pm 6.45	89 \pm 11.1
6 min	108.8 \pm 15.96	72.2 \pm 6.13	87 \pm 12	104.7 \pm 14.28	73.92 \pm 6.94	93 \pm 11
8 min	117.32 \pm 17.13	76.28 \pm 9.82	84.8 \pm 15.3	107.24 \pm 10.35	72.32 \pm 6.94	97 \pm 9.22
10min	118.24 \pm 17.13	75.72 \pm 12	80.48 \pm 11.57	110.76 \pm 9.15	73.72 \pm 6.46	96.08 \pm 6.65
15 min	119.92 \pm 13.13	76.84 \pm 10.22	77.1 \pm 12.3	112.12 \pm 9.42	73.2 \pm 5.72	73.72 \pm 6.46
20min	124.8 \pm 10.04	81.72 \pm 12.02	71.6 \pm 12	116.12 \pm 12.09	74.48 \pm 7.35	98.2 \pm 5.97
25 min	127.24 \pm 11.38	86.08 \pm 8.5	68.36 \pm 11.09	115.96 \pm 10.81	75.8 \pm 9.39	99.6 \pm 9.9
30 min	129 \pm 10.4	86.56 \pm 8.19	69 \pm 10.88	115.84 \pm 9.66	76.44 \pm 9.11	96.44 \pm 11
40 min	128 \pm 8.66	86.4 \pm 8.19	74 \pm 6.61	117.08 \pm 8.66	79.6 \pm 7.43	94.2 \pm 20.14

It was observed that phenylephrine infusion had faster onset of action than inj. Ephedrine. In group A with inj. Phenylephrine as infusion of 100ug/min, the blood pressure after 2-4 min was stable at the preoperative levels in 92% of cases the systolic pressure were 120mmhg. The diastolic blood pressure remained constant in 96% of cases without any initial fall. In 88% of cases the pulse rate in group A was stable throughout in 3 (12%) cases bradycardia was noticed, in one case drip was discontinued and in 2(8%) cases atropine had to be administered. In group B with inj. Ephedrine 1mg/minute infusion soon after the spinal anesthesia the fall in blood pressure was noticed initially and after 8-10min it was stabilized that the onset of action of ephedrine was slower at the given infusion rates. The systolic blood pressure in group B 80% of cases was brought back to preoperative levels. The diastolic pressure remained constant without gross deviation in 80% of cases. The pulse rate remains little on the higher side with 92% of cases the pulse rate remained between 93-99 beats/min. there was no incidence of bradycardia as seen in group A.

DISCUSSION

Maternal hypotension is the most frequent complication of spinal anaesthesia for caesarean section.⁴ Prompt effective treatment is considered essential to prevent serious risks to mother and baby. The results of our study indicate that prophylactic intravenous infusion of ephedrine and phenylephrine was effective in controlling maternal hypotension, though the patients in the phenylephrine group had significantly higher BP throughout the study period in comparison to patients in

the ephedrine group. In group A with inj. Phynylephrine infusion of 100ugs/min the control and prevention of fall of blood pressure in 96% of cases was immediate i.e., within 2-4min as the onset of action of phenylephrine was quicker than inj.ephedrine. Hypotension, defined as a decrease in systolic blood pressure greater than 20% from the baseline value, or a systolic blood pressure less than 100mmhg was observed at two minutes after spinal anaesthesia in ephedrine group.⁵ The offset of hypotension was achieved earlier in the ephedrine group after continuation of ephedrine infusion for additional two minutes. Sahu *et al*⁶ compared ephedrine 6mg, mephentermine 6mg and phenylephrine 100mcg 4 boluses given after the fall of SBH>20% during spinal anaesthesia in 60 health parturients undergoing caesarean section. They showed that all the three drugs were able to maintain systolic blood pressure with a better intial response with phenylephrine group as compared to ephedrine and mephentermine. They attributed this to the fact that phenylepfrime has a peak effect within one minutes, whereas ephedrine at 2-5minutes and mephentermine at 5 minutes. The results of the present study vary from the present study because sahu *et al* used 4 boluses of vasopressors after the onset of hypotension and not prophylactic infusion of vasopressors as in the present study Similarly, Kansal *et al*⁷ compared the efficacy of 4 infusion in a different dosage regimen i.e., ephedrine 2.5mg/min and mephentermine 2.5mg/min after an intial bolus of 5mg in each group, for the treatment of hypotension and reported that both these drugs are safe and equally efficacious for the management of maternal hypotension as in the present study. In the present study, phenylepherine group shows

significant reduction in the heart rate when compared with ephedrine groups and responded to atropine boluses without any other significant. The increased incidence of bradycardia in phenylephrine group may be explained due to its lack of action on the beta receptors. No episode of bradycardia was noted in ephedrine and bradycardia (HR < 60 beats/min) that was associated with systolic blood pressure greater than or equal to the baseline was treated by stopping the vasopressor infusion and with bolus of 4 atropine 0.6mg, and bradycardia associated with systolic blood pressure less than the baseline with 1.5 atropine 0.6mg along with vasopressor infusion. Cooper *et al*⁸ compared the 4 infusion of phenylephrine 100ug/ml ephedrine 3mg/ml and combination of phenylephrine 50ug/ml+ephedrine 1.5mg/ml during spinal anesthesia for elective caesarean section and showed that heart rate was significantly lower in the phenylephrine group. Though the dosage of drugs and their time of administration differed from our study, but similar decrease in heart rate in phenylephrine group as compared to ephedrine was noted in the present study. Our findings also and in comparison with other dose finding studies highlight the difficulties in comparing potencies of drugs that differ in speed of onset and duration of action. Phenylephrine is a selective alpha 1 agonist activates beta receptors only at a much higher dose. Hence, it can restore arterial pressure without causing tachycardia which is associated with the action on the beta receptors. Ephedrine stimulates both alpha and beta receptors and cause cardiac stimulation with little change in peripheral resistance. Nagan kee *et al*⁹ in a randomized double blind study compared the phenylephrine and ephedrine infusion combinations in different ratios in the five groups contained the proportional potency equivalent of 100%, 75%, 50%, 25%, or 0% of phenylephrine and 0% 25%, 50%, 75%, or 100% respectively of ephedrine to compare the effects on umbilical cord blood gases, maternal blood pressure and HR and concluded as the proportion of phenylephrine decreased and the proportion of ephedrine increased, haemodynamic control was reduced and fetal acid base status was less favourable. Despite the ongoing research, hypotension during spinal anaesthesia for caesarean delivery remains a common problem that is associated with maternal and fetal morbidity. The effective mode of treatment remains controversial and large multicentric studies should be done in future to consider the timing of crystalloid administration and establish role of prehydration vs cohydration. The choice of vasopressor, timing and mode of administration and dose of vasopressor should be evidence based so as to clearly define efficacy, maternal and fetal effects and its ease of use. Lakshmi mahajan *et al*¹⁰ studied a randomized

double blinded comparison of ephedrine, phenylephrine and mephentermine infusions to maintain blood pressure during spinal anaesthesia for caesarean delivery: the effects on fetal acid base status and haemodynamic control, this randomized and double blind, study compared the prophylactic intravenous infusions of ephedrine, mephentermine and phenylephrine to control maternal hypotension induced by spinal anaesthesia and its effects on fetal acidosis. Prophylactic intravenous infusion of ephedrine, mephentermine and phenylephrine was effective in controlling maternal hypotension; phenylephrine more closely meets the criteria for its use as a vasopressor in patients undergoing caesarean section under spinal anaesthesia.

CONCLUSION

In group A Inj. Phenylephrine 100ug/min infusion was found to be superior in preventing and controlling the hypotension, as 96% of cases the fall of blood pressure was prevented and it was brought back to normal preoperative levels within 2-4 minutes after giving spinal anaesthesia. In group B with inj. ephedrine 1mg/min it took 8-10 minutes for the control of blood pressure clearly indicating that phenylephrine has faster onset of action and better control. Further phenylephrine because of lack of action on beta receptors it has been observed that in 3 cases (12%) bradycardia was observed forcing to use atropine or discontinuing the drip. Bradycardia was not a significant finding in ephedrine group. Because of these findings which conclude titrated prophylactic phenylephrine infusion is preferred over ephedrine group in controlling fall of blood pressure with careful monitoring of pulse rate.

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Source of Support: None Declared
Conflict of Interest: None Declared

