Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

A Study of Phenylephrine versus Mephentermine during Subarachnoid Block for Cesarean Section

Sugatha Prakash[1], Xavier John[2]

[1]Professor, Department of Anaesthesia, Jubilee Mission Medical College and Research Institute, Thrissur, Kerala, India, [2]Junior Resident, Department of Anaesthesiology, Jubilee Mission Medical College and Research Institute, Thrissur, Kerala, India

Abstract

Introduction: Subarachnoid block for cesarean section can cause hypotension. In this study, we compared the effect of bolus dose of mephentermine and phenylephrine on maternal hemodynamics and neonatal outcome in patients undergoing cesarean section under subarachnoid block.

Materials and Methods: After approval from the Institutional Ethics Committee, 100 American Society of Anesthesiologists I and II patients, scheduled for elective cesarean section and who developed hypotension after subarachnoid block, were included in the study. The patients were randomized into two groups, Group M receiving inj. mephentermine 3 mg intravenously and Group P receiving inj. phenylephrine 50 mcg intravenously. Subarachnoid block was given using 2 ml of 0.5% heavy bupivacaine. Blood pressure was recorded every 2 min for 30 min, every 5 min for the next 30 min, and then every 15 min for the next 30 min. The time of hypotension was recorded and the vasopressor administered. Apgar scores at 1 min and 5 min and umbilical artery blood gas analysis were obtained after the delivery of the baby.

Results: The systolic blood pressure (SBP) at 2, 4, 6, 8, and 10 min after the administration of the drug was significant in both the groups ($P < 0.001$) when compared with the hypotensive value. The SBP was higher in phenylephrine group when compared to the mephentermine group up to 4 min after administration of the vasopressors ($P < 0.05$). The diastolic blood pressure was significantly higher in phenylephrine group occurring soon after the administration of the drug when compared to mephentermine group ($P < 0.05$). Apgar scores and umbilical arterial blood gas analysis of the newborn were comparable between the two groups.

Conclusion: Both phenylephrine and mephentermine maintained the SBP within 20% limit of baseline. Phenylephrine had a quicker peak effect. Neurobehavioral outcome in the neonate was comparable in both groups.

Key words: Cesarean section, Hypotension, Vasopressors

INTRODUCTION

With advancements in anesthetic techniques and better fetal monitoring systems, the anesthesiologists can now choose the best possible anesthetic technique for the parturient. Among the anesthetic techniques used for cesarean section, neuraxial anesthesia is preferred.[1] Subarachnoid block provides complete sensory and motor blockade, avoids the risk of pulmonary aspiration of gastric contents and the depressant effect of drugs on fetus associated with general anesthesia. However, there is a reported incidence of 76% of maternal hypotension.[2] This can have adverse effects both in the neonate and mother.

In the neonate fetal hypoxia, acidosis and neurological deficits due to decreased placental perfusion can occur. Hypotension can also result in maternal nausea, vomiting, and dizziness and, if severe, could result in loss of consciousness and sudden cardiac arrest.

Along with the left uterine displacement, Trendelenburg position, leg compression, and fluid coloading, administration of vasoconstrictors is used to offset maternal hypotension.[3-5] Phenylephrine has emerged a favorable vasopressor in recent times as it increases the maternal blood pressure by peripheral vasoconstriction. Phenylephrine has been associated with maternal bradycardia. Mephentermine has both direct and indirect sympathomimetic action and

Access this article online

www.ijss-sn.com

Month of Submission : 10-2021
Month of Peer Review : 11-2021
Month of Acceptance : 11-2021
Month of Publishing : 12-2021

Corresponding Author: Dr. Sugatha Prakash, AG 35. Alukkas Gardens, Nellikunnu, Thrissur, Kerala, India.

increases the maternal blood pressure by increasing the cardiac output. In our study, we compared the effects of bolus dosage of phenylephrine and mephentermine used to treat hypotension following spinal anesthesia in cesarean section patients. The effect of phenylephrine and mephentermine 3 mg on the maternal hemodynamics and neurobehavioral outcome in the newborn was studied.

MATERIALS AND METHODS

This randomized prospective study was carried out at Jubilee Mission Medical College, Thrissur, Kerala, India, between June 2014 and January 2016. After obtaining approval from the Institution Ethical Committee, singleton full-term pregnant women, aged 20–35 years, scheduled for elective cesarean section under spinal anesthesia and who developed hypotension after subarachnoid block, were taken for the study. Inclusion criteria were American Society of Anesthesiologists physical status 1 and 2, baseline systolic blood pressure (SBP) between 100 and 140 mmHg, diastolic blood pressure (DBP) between 70–89 mmHg, and a sensory block at T6 level. Patients with pre-term and post-term pregnancies, multiple pregnancies, diagnosed placental abnormalities, preeclampsia and eclampsia, hemoglobinopathies, coexisting neurologic, cardiopulmonary, cerebrovascular, renal, metabolic, and psychiatric disorders were excluded from the study. Pre-anesthetic evaluation was done and informed consent was taken. Hundred patients were allotted to two groups by consecutive sampling. Group M ($n = 50$) received injection mephentermine 3 mg intravenously and Group P ($n = 50$) received injection phenylephrine 50 mcg intravenously. Hypotension was defined as fall in SBP >20% from the baseline value or a value <90 mmHg. Bradycardia was defined as heart rate (HR) between 50 and 60 beats/min for fall in SBP >20% from baseline value, HR between 45 and 50 beats/min when SBP is above baseline value or HR <45 beats/min whatever be the SBP.

The patients were given oral ranitidine 150 mg the night before and the morning of the surgery. An 18G IV cannula was placed in the forearm under aseptic precautions. Pulse oximeter probe, electrocardiogram electrodes, and automated non-invasive blood pressure cuff were attached and all readings were taken before starting surgery. Subarachnoid block was given in the left lateral position using a fixed volume 2 ml of 0.5% heavy bupivacaine at L3-L4 or L2-L3 interspinous space using a 25G Quincke needle. The patient was coloaded with the recommended dose of 20 ml/kg of intravenous crystalloids over 10 min. A 15° wedge was placed under the right flank to provide left uterine displacement. Oxygen was administered at 3 L/min by a face mask. The level of sensory block was assessed by loss of cold sensation 5 min after spinal anesthesia. SBP and DBP were noted every 2 min after administration of spinal anesthesia till 30 min, every 5 min for the next 30 min, and then every 15 min for the next 30 min. HR and any cardiac rhythm disorders were monitored using Lead II. When the patient developed hypotension, she was given phenylephrine 50 mcg or mephentermine 3 mg, depending on the group, she was allotted. Time from intrathecal administration of bupivacaine to the development of hypotension (t_0) was noted. Time to delivery of baby after intrathecal bupivacaine and duration of surgery were also noted. Time of first dose of the vasopressor and number of subsequent doses were recorded. Bradycardia was treated with bolus IV atropine 0.6 mg. Nausea and vomiting was assessed by nausea vomiting score. Episodes of nausea and vomiting were noted and treated with IV ondansetron 4 mg. Neonatal cord blood from umbilical artery was obtained for analysis at the time of cutting of the cord. The cord was double clamped and umbilical artery blood gas analysis was done immediately. Apgar score for neurobehavioral assessment was noted at 1 min and 5 min of delivery.

The results on continuous measurements were presented on Mean ± standard deviation (min-max) and results on categorical measurements were presented in number (%). Significance was assessed at 5% level of significance ($P < 0.05$).

Student's *t*-test (two tailed, unpaired) had been used to find the significance of study parameters between the two groups and Student's *t*-test (two tailed, paired) was used within each group. For all statistical tests, $P < 0.05$ was taken as statistically significant. For statistical analysis, SPSS version 22, Med Calc 9.0.1, Systat 12.0, and R environment ver. 3.2.2 had been used.

RESULTS

Both the groups were comparable in their mean age, body weight, height, and body mass index (BMI). The baseline parameters recorded were SBP, DBP, HR, mean arterial pressure (MAP), respiratory rate (RR), and SpO_2. These were comparable between the two groups with the difference in mean values being statistically not significant ($P > 0.05$) as analyzed by Student's unpaired *t*-test [Table 1].

The mean time in minutes of subarachnoid block to onset of hypotension (t_0) in Group M and Group P was 6.51 ± 2.32 and 5.92 ± 1.94, respectively ($P > 0.05$). There was no significant difference between the two groups. The SBP, DBP, and HR, at the time of hypotension, were not statistically different between the two groups ($P > 0.05$) as analyzed by Student's unpaired *t*-test [Table 2].

Table 1: Baseline HR (beats per min), SBP, DBP, MAP (mmHg), RR (rate/min), and SpO_2 (%)

Group	*n*	Mean	Std. deviation	Std. error mean	*t*-value	*P* value
HR (baseline)						
M	50	82.78	7.68	1.08	1.68	0.095
P	50	80.22	7.50	1.06		
SBP (baseline)						
M	50	118.64	10.06	1.42	-0.17	0.872
P	50	118.96	9.66	1.36		
DBP (baseline)						
M	50	74.66	4.21	0.59	-1.92	0.058
P	50	76.38	4.73	0.67		
MAP (baseline)						
M	50	89.32	5.49	0.77	-1.13	0.261
P	50	90.58	5.65	0.799		
RR (baseline)						
M	50	20.44	1.71	0.24	0.61	0.548
P	50	20.24	1.59	0.22		
SpO_2 (baseline)						
M	50	100.0	0.0	0.0		
P	50	100.0	0.0	0.0		

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, MAP: Mean arterial pressure, RR: Respiratory rate

Table 2: Variables at the time of hypotension (t_0)

Variable	Group	*n*	Mean	SD	Min	Max	*P* value
SAB to t_0	M	50	6.51	2.32	2	16	0.167
	P	50	5.92	1.94	2	6	
HR at t_0	M	50	91.68	8.78	78	112	0.057
	P	50	88.60	7.09	68	106	
SBP at t_0	M	50	92.36	7.45	80	110	0.876
	P	50	92.58	6.57	84	104	
DBP at t_0	M	50	59.32	4.99	50	69	0.120
	P	50	61.01	5.69	40	72	
MAP at t_0	M	50	69.83	5.21	60	80	0.103
	P	50	71.53	5.13	55	79	

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, MAP: Mean arterial pressure, RR: Respiratory rate

Intraoperative SBP (mmHg) in Groups M and P

Basal SBP in mephentermine group was 118.64 ± 10.06 and that in phenylephrine group was 118.96 ± 9.66. Similarly, SBP during hypotension was 92.36 ± 7.45 and 92.58 ± 6.57 in mephentermine group and phenylephrine group, respectively, which was found to be statistically comparable in both the groups ($P > 0.05$). In our study, both the vasopressors maintained the SBP within 20% limit of baseline value. The mean SBP at 2 min in mephentermine and phenylephrine group was 97.24 ± 7.81 and 102.90 ± 5.84, respectively, which was significant ($P < 0.05$). The mean SBP at 4 min in mephentermine and phenylephrine group was 97.42 ± 6.79 and 104 ± 6.97, respectively, which was significant ($P < 0.05$).

There was a significant difference in SBP between the two groups till 4 min after administration of the vasopressors ($P < 0.05$) with the SBP being higher in phenylephrine group when compared to the mephentermine group. From 6 min onwards, the SBP was comparable between the two groups ($P > 0.05$) as analyzed by Student's unpaired *t*-test.

Statistical analysis of difference in mean SBP at different time points within the group was done by Student's paired *t*-test. The SBP after the administration of the drug at 2, 4, 6, 8, and 10 min was compared with the hypotensive value (t_0) and was significant in both the groups ($P < 0.001$). Within Group M, the SBP at 2 min was not statistically significant to SBP at 4 min ($P > 0.05$). However, the SBP at 2 min was statistically significant to the SBP at 6 min ($P < 0.05$). Within Group P, the SBP at 2 min was statistically significant to SBP at 4 min and 6 min ($P < 0.05$) [Figure 1].

Intraoperative DBP (mmHg) in Groups M and P

The difference in mean DBP between the two groups was analyzed by Student's unpaired *t*-test. The mean DBP at the time of hypotension was statistically not significant between the two groups at 59.32 ± 4.99 and 61.00 ± 5.69 in mephentermine and phenylephrine group, respectively ($P > 005$). There was a significant difference between the two groups in mean DBP till 35 min after the administration of the drug ($P < 0.05$). The mean DBP was significantly higher in phenylephrine group compared to mephentermine group till 35 min after the administration of the vasopressor [Figure 2].

Intraoperative MAP (mmHg) in Groups M and P

The difference in mean MAP between the two groups was analyzed by Student's unpaired *t*-test and the mean MAP at the time of hypotension was statistically not significant between the two groups. The mean MAP at time of hypotension was 69.83 ± 5.21 and 71.53 ± 5.13 in mephentermine and phenylephrine group, respectively

($P > 0.05$). There was a significant difference between the two groups in mean MAP after the administration of the drug ($P < 0.05$). The mean MAP was significantly higher in the phenylephrine group compared to mephentermine group up to 28 min after the administration of the vasopressor [Figure 3].

Intraoperative HR (Beats/Min) in Groups M and P

The difference in mean HR between the two groups was analyzed by Student's unpaired *t*-test. The mean HR at the time of hypotension was statistically not significant between the two groups at 88.80 ± 8.42 and 85.64 ± 7.74 in mephentermine and phenylephrine group, respectively ($P > 0.05$). There was a significant difference between the two groups in mean HR after the administration of the drug. The mean HR was significantly higher in mephentermine group compared to phenylephrine group at all the time points after the administration of the vasopressor ($P < 0.05$) [Figure 4].

In Group P, 4 patients (8%) experienced bradycardia after administration of vasopressor and was given IV atropine 0.6 mg. Bradycardia was not associated with hypotension. In Group M, none of the patients had bradycardia.

Intraoperative RR (Rate/Min) in Groups M and P

There was no significant difference between the mean RR between the two groups after the administration of the vasopressor ($P > 0.05$) as analyzed by Student's unpaired *t*-test.

Number of boluses of drug in Groups M and P

The number of boluses of vasopressors required in the two groups was analyzed by Student's unpaired *t*-test. The mean number of boluses in Group M and Group P was 2.54 ± 0.813 and 2.08 ± 0.528, respectively ($P < 0.05$), showing a significant difference between the number of boluses of vasopressors required in the two groups, with Group M receiving more than Group P [Table 3].

In Group M, four patients developed nausea as per the nausea vomiting score [Table 4]. None of the patients in Group P developed nausea.

The subarachnoid block to baby delivery time in Group M and Group P was 14.02 ± 3.30 and 15.02 ± 2.13,

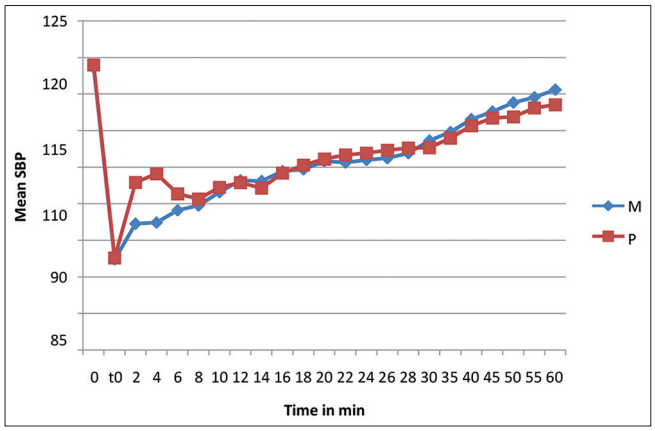

Figure 1: Intraoperative systolic blood pressure (mmHg) in Groups M and P

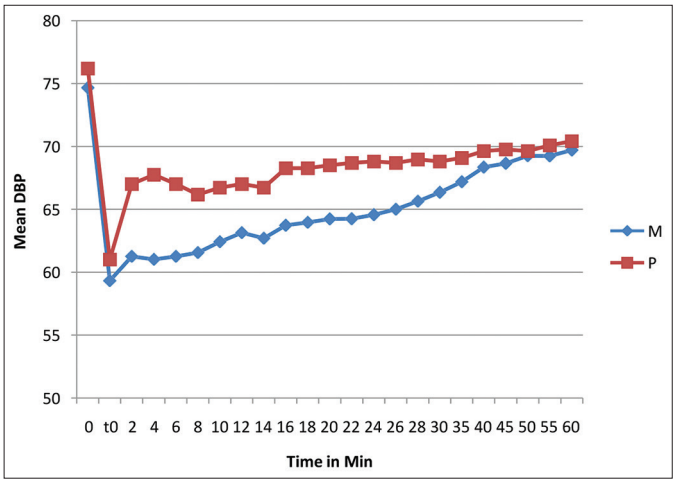

Figure 2: Intraoperative in diastolic blood pressure (mmHg) in Groups M and P

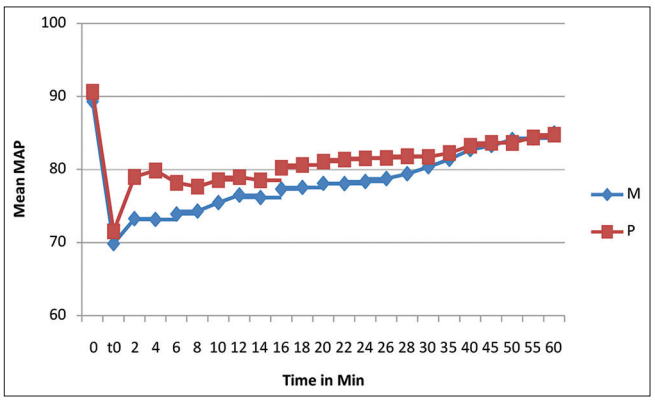

Figure 3: Intraoperative mean arterial pressure in Groups M and P

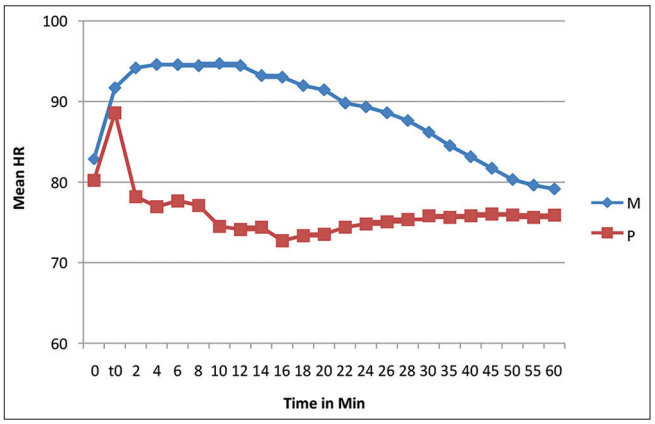

Figure 4: Intraoperative heart rate (beats per min) in Groups M and P

respectively ($P > 0.05$), which was comparable between the two groups as analyzed by Student's unpaired *t*-test.

Apgar score at 1 min and 5 min

The neonatal Apgar scores at 1 min and 5 min after delivery were comparable between the two groups ($P > 0.05$) by Student's unpaired *t*-test. The Apgar score was more than 8 in both groups at 1 min and 5 min after delivery of the baby [Figure 5].

Umbilical artery blood gas analysis

The umbilical artery blood gas analysis by Student's unpaired t-test showed comparable values of pH, PO_2, PCO_2, and HCO_3 [Table 5].

DISCUSSION

The incidence of hypotension has been shown to be higher in cesarean section done under spinal anesthesia.[6] Aortocaval compression and sympathetic blockade by the local anesthetic are the factors contributing to the higher incidence of hypotension in spinal anesthesia.[7] Sustained hypotension is deleterious for maternal and fetal well-being. Spinal anesthesia-induced sympathetic blockade will reduce the venous return to the heart and will affect the cardiac output producing hypotension. Severe hypotension will affect the uteroplacental blood flow. The umbilical artery blood pH and Apgar scores are good indicators of uteroplacental blood flow.

Various techniques have been adopted to counteract the effect of hypotension in the past. Early studies comparing preloading versus coloading by intravenous crystalloids have shown no significant advantage.[8-10] Lower limbs compression bandages were found to be of limited benefit. Hypotension has shown good response to vasopressors.[11]

The current study was conducted to compare the vasopressors, mephentermine and phenylephrine, for their efficacy to maintain maternal arterial blood pressure.

We compared the effect of bolus dosage of mephentermine and phenylephrine on maternal hemodynamics and fetal outcome. In this study, various demographic criteria and various parameters such as HR, SBP, DBP, MAP, SpO_2, RR, subarachnoid block to baby delivery time, Apgar scoring, and umbilical artery pH were compared among the two groups.

Demographic Data

In the present study, both the groups were comparable with respect to mean age (Group M 25.34 ± 3.11 and Group P 25.58 ± 2.84), mean height (Group M 156.82 ± 4.29 and Group P 157.88 ± 4.42), mean weight (Group M 61.34 ±3.98 and Group P 61.66 ± 4.26), and mean BMI (Group M 24.98 ± 1.95 and Group P 24.80 ± 2.28).

Baseline Parameters

The baseline HR, SBP, DBP, mean arterial blood pressure, RR, and peripheral oxygen saturation were comparable between the two groups ($P > 0.05$).

Subarachnoid block to baby delivery time was comparable between the two groups. The mean value of baby delivery time in Group M and Group P was 14.02 ± 3.30 and

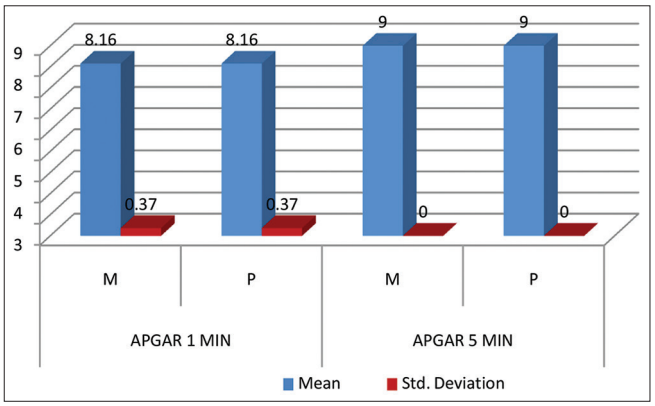

Figure 5: Apgar score at 1 min and 5 min in Groups M and P

Table 3: Number of boluses given in Groups M and P

Groups	*n*	Mean	Std. deviation	*t*-value	*P* value
No. of bolus					
M	50	2.54	0.813	3.35	0.0001
P	50	2.08	0.528		

Table 4: Nausea-vomiting score

Nausea-vomiting score			
Score 0	**Score 1**	**Score 2**	**Score 3**
No Nausea	Nausea	Retching or mild vomiting	Two or more vomiting episodes

Table 5: Umbilical artery blood gas analysis

Group	*n*	Mean	Std. deviation	*t*-value	*P* value
pH					
M	50	7.26	0.027		
P	50	7.26	0.021	-0.12	0.90
PO2					
M	50	17.37	2.085		
P	50	17.7	2.386	-0.72	0.47
HCO3					
M	50	20.84	1.351		
P	50	20.992	1.1248	-0.62	0.54
PCO2					
M	50	50.724	1.9910		
P	50	50.240	1.7207	1.30	0.20

15.02 ± 2.13, respectively ($P > 0.05$). The mean value of subarachnoid block to baby delivery time was comparable between the two groups.

Sensory block was at T6 level for all patients. The time of onset of hypotension after subarachnoid block was comparable between the two groups ($P > 0.05$). The SBP, DBP, mean arterial blood pressure, and HR at the time of onset of hypotension were comparable between the two groups ($P > 0.05$).

Study Parameters

SBP

In our study, both the vasopressors maintained the SBP within 20% limit of baseline value. There was a significant difference in SBP between the two groups at 2 min and 4 min after administration of the vasopressors. The SBP was high in phenylephrine group when compared to the Mephentermine group at 2 min–4 min after administration of vasopressors ($P < 0.05$). This may be due to quicker onset of action of phenylephrine when compared to mephentermine. From 6 min onwards, the SBP was comparable between the two drugs ($P > 0.05$). Within Groups M and P, the mean SBP at 2, 4, 6, 8, and 10 min, compared to the hypotensive value (t_0), was significant in both the groups ($P < 0.05$).

Sahu *et al.*[11] compared the effect of phenylephrine, mephentermine, and ephedrine on maternal blood pressure and showed that the SBP was significantly high in phenylephrine group at 2 min after bolus of the drugs. From 4 min onwards, the SBPs were comparable between the drugs in their study.

Sharma *et al.*[12] compared mephentermine and phenylephrine and found that SBP was significantly higher with phenylephrine at 6 min after administration compared to mephentermine. Within the groups, the mean SBP at 2, 4, 6, 12, and 30 min, compared to the hypotensive value (t_0), were significant in both the groups ($P < 0.05$).

DBP

The DBP was significantly high in phenylephrine group immediately after the administration of the drug when compared to mephentermine group and there was a statistical difference between the two groups up to 35 min ($P < 0.05$), with phenylephrine group having higher DBP. This may be due to the predominant α_1 action of phenylephrine, which increases the systemic vascular resistance (SVR). The DBPs were comparable between the two groups after 35 min.

Sharma *et al.*[12] in their study observed that at all intervals of time the DBPs were significantly higher in phenylephrine group compared to mephentermine group ($P < 0.05$).

Mean arterial blood pressure

The mean arterial blood pressure was significantly high in phenylephrine group when compared to the mephentermine group. The MAP was significantly higher in phenylephrine group up to 28 min after the administration of the vasopressor ($P < 0.05$) beyond which the values were comparable between both the two groups.

HR

In our study, phenylephrine group had significant fall in HR immediately after bolus dosage of the drug was administered, when compared to the baseline value. Bradycardia in phenylephrine group was probably a baroreceptor mediated reflex mechanism due to increased SVR after the drug bolus. In the mephentermine group, there was increase in HR after the bolus dosage of the drug which could be due to the beta-agonist action of mephentermine. There was a significant difference between the two groups in mean HR after the administration of the drug. The mean HR was significantly high in mephentermine group at all the time intervals after the administration of the vasopressor and stayed elevated till 40 min after the bolus administration of mephentermine.

Sahu *et al.*[11] in their study found significant decrease in HR in the phenylephrine group. In mephentermine group, the post-drug administration value of HR was high and remained statistically non-significant with values of onset of hypotension till the end of the surgery ($p>0.05$).

Sharma *et al.*[12] in their study found that after the administration of the drug, HR was significantly high in mephentermine group compared to phenylephrine group ($P < 0.05$). Within Group P, HR was significantly less at all time points after administration of the vasopressor ($P < 0.01$) compared to the value at the time of hypotension and even the baseline value, while in Group M, the mean HR at all time points was significantly higher after the administration of the vasopressor when compared to baseline value ($P < 0.05$).

Bradycardia

In our study, 4 patients (8%) in phenylephrine group had one episode of bradycardia, while none of the patients in mephentermine group had bradycardia. The four patients in the phenylephrine group were treated with atropine 0.6 mg IV. Bradycardia was not associated with hypotension in phenylephrine group and may have been caused by baroreceptor-mediated reflex to increased SVR. Hall *et al.*[13] had observed 20% incidence of bradycardia in patients who received bolus of phenylephrine 20 mcg and infusion of 10 mcg/min when compared to patients who received bolus of ephedrine 6 mg and infusion of 1 mg/min in his study.

Number of bolus of drugs

There was a significant difference between the number of boluses of vasopressors required in the two groups, with mephentermine group receiving more when compared to phenylephrine group. Sharma *et al.*[12] in their study observed that the mean number of doses was significantly more in mephentermine group when compared to phenylephrine group, 1.667± 0.83 and 1.289 ± 0.589, respectively ($P < 0.05$).

Nausea-vomiting score

In our study, none in the phenylephrine group experienced nausea and vomiting while four patients in the mephentermine group developed nausea. The nausea-vomiting score was one for each of these patients. The nausea was not associated with hypotension.

Sharma *et al.*[12] found the incidence of nausea and vomiting comparable between the mephentermine and phenylephrine groups ($P > 0.05$).

Neonatal outcome Apgar scores

The neonatal Apgar scores at 1 min and 5 min were comparable in both the groups in our study and never <8 in both groups at 1 min and 5 min. Mohta *et al.*[14] in their study had compared the Apgar score of the newborn at 1 min and 5 min, and found similar results in both the phenylephrine and mephentermine groups. Sharma *et al.*[12] in their study between phenylephrine and mephentermine for hypotension during spinal anesthesia for cesarean section, showed similar values for neonatal Apgar score in both the groups.

Neonatal umbilical artery blood gas analysis

In our study, the mean umbilical artery pH was comparable in Group M and P at 7.26 ± 0.027 and 7.26 ± 0.021, respectively. Mohta *et al.*[14] found similar umbilical artery blood gas analysis between the phenylephrine and mephentermine groups. Ngan *et al.*[15] studied the placental transfer and fetal metabolic effects of phenylephrine and ephedrine during spinal anesthesia for cesarean section and found a significant difference in the two groups. Ephedrine being more lipid soluble, stimulates fetal beta-adrenergic receptors increasing the metabolic activity with fetal oxygen demand exceeding fetal oxygen supply, resulting in anaerobic metabolism and a low umbilical artery pH. Mephentermine has not been reported to affect the umbilical artery pH.

Lee *et al.*[16] studied the effect of phenylephrine and ephedrine on maternal and neonatal outcome and concluded that phenylephrine may maintain the uterine blood flow better than ephedrine.

In our study, the umbilical artery blood gas analysis showed comparable values of mean PO_2, mean HCO_3, and mean PCO_2 values between the M and P groups.

The limitation in the study was that the hemodynamic variables were assessed at 2 min intervals, so the peak effect of the drugs may not be accurate.

CONCLUSION

Phenylephrine and mephentermine effectively maintained blood pressure during spinal anesthesia for cesarean section. Phenylephrine had a quicker peak effect after administration in comparison to mephentermine. Phenylephrine caused a reduction in HR while mephentermine increased HR. Phenylephrine increased DBP and the MAP**.** Repeat bolus doses of phenylephrine needed were significantly less. The effect of phenylephrine and mephentermine on umbilical artery pH and Apgar scores of the neonate were comparable.

We conclude from the study that phenylephrine and mephentermine maintained SBP above hypotensive range and that the effect on neonatal outcome was minimal and comparable, phenylephrine might be a better choice because number of repeat doses needed was less and it maintained the maternal DBP and mean arterial blood pressure better. Mephentermine increases the HR and so may be avoided in patients where the effect may be detrimental.

REFERENCES

1. Hughes SC, Levinson G, Rosen MA. Anaesthesia for caesarean section. In: Anaesthesia for Obstetrics. 4th ed. Philadelphia, PA: Lippincott, Williams and Wilkins; 1993. p. 201-36.
2. Chumpathong S, Chinachoti T, Visalyaputra S, Himmunngan T. Incidence and risk factors of hypotension during spinal anesthesia for cesarean section at Siriraj hospital. J Med Assoc Thai 2006;89:1127-32.
3. Kundra P, Khanna S, Habeebullah S, Ravishankar M. Manual displacement of the uterus during caesarean section. Anaesthesia 2007;62:460-5.
4. Rout CC, Rocke DA, Gouws E. Leg elevation and wrapping in the prevention of hypotension following spinal anaesthesia for elective caesarean section. Anaesthesia 1993;48:304-8.
5. Ayorinde BT, Buczkowski P, Brown J, Shah J, Buggy J. Evaluation of pre-emptive intramuscular phenylephrine and ephedrine for reduction of spinal anaesthesia-induced hypotension during caesarean section. Br J Anaesth 2001;86:371-6.
6. Rout CC, Rocke DA. Prevention of hypotension following spinal anaesthesia for caesaren section. Int Anaesthesiol Clin 1994;11:117-35 .
7. Marx GF. Aortocaval compression: Incidence and prevention. Bull NY Acad Med 1974;50:443.
8. Banerjee A, Stocche RM, Angle P, Halpern SH. Preload or coload for spinal anesthesia for elective cesarean delivery: A meta-analysis. Can J Anaesth 2010;57:24-31.
9. Nishikawa K, Yokoyama N, Saito S, Goto F. Comparison of effects of rapid colloid loading before and after spinal anesthesia on maternal hemodynamics and neonatal outcomes in cesarean section. J Clin Monit Comput 2007;21:125-9.

10. Teoh WH, Sia AT. Colloid preload versus coload for spinal anesthesia for cesarean delivery: The effects on maternal cardiac output. Anesth Analg 2009;108:1592-8.
11. Sahu D, Kothari D, Mehrotra A. Comparison of bolus phenylephrine, ephedrine, and mephentermine for maintenance of arterial pressure during spinal anesthesia in caesarian section-a clinical study. Indian J Anesth 2003;47:125-8.
12. Sharma R, Maitra N, Niyogi M. A comparative study of bolus phenylephrine and mephentermine for treatment of hypotension during spinal anesthesia for cesarean section. Internet J Anesthesiol 2009;19:1-10.
13. Hall PA, Bennett A, Wilkes MP, Lewis M. Spinal anaesthesia for caesarean section: Comparison of infusions of phenylephrine and ephedrine. Br J Anaesth 1994;73:471-4.
14. Mohta M, Janani SS, Sethi AK, Agarwal D, Tyagi A. Comparison of phenylephrine hydrochloride and mephentermine sulphate for prevention of post spinal hypotension. Anaesthesia 2010;65:1200-5.
15. Kee WD, Lee A, Khaw KS, Ng FF, Karmakar MK, Gin T. A randomized double-blinded comparison of phenylephrine and ephedrine infusion combinations to maintain blood pressure during spinal anesthesia for cesarean delivery: The effects on fetal acid-base status and hemodynamic control. Anesth Analg 2008;107:1295-302.
16. Lee A, Kee WD, Gin T. A quantitative, systematic review of randomized controlled trials of ephedrine versus phenylephrine for the management of hypotension during spinal hypotension. Anesth Analg 2002;94:920-6.

How to cite this article: Prakash S, John X. A Study of Phenylephrine versus Mephentermine during Subarachnoid Block for Cesarean Section. Int J Sci Stud 2021;9(9):34-41.

Source of Support: Nil, **Conflicts of Interest:** None declared.