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Original Research Paper

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A COMPARATIVE STUDY OF MEPHENTERMINE AND PHENYLEPHRINE IN THE TREATMENT OF HYPOTENSION DURING SPINAL ANAESTHESIA FOR CAESAREAN SECTION

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ABSTRACT

Purpose: To compare the effects of mephentermine and phenylephrine in maintaining arterial blood pressure in patients undergoing caesarean section under spinal anaesthesia who develop hypotension. **Materials and method-** This randomized study consisted of 42 parturient women who underwent elective caesarean section under spinal anaesthesia and developed hypotension during the operation. The patients were equally divided into 2 groups: Group I & Group II. Participants in Group I received intravenous bolus of Phenylephrine 100 mcg whereas participants in Group II received intravenous bolus of Mephentermine 6 mg. Mean heart rate, systolic blood pressure (SBP), diastolic (DBP) and mean arterial pressure (MAP) were measured at baseline and then at 2 minutes intervals till 10th minute and thereafter at every 5 minutes till 30th minute and then at 45th, 60th, 75th, 90th and 120th minute. **Results-** Mean heart rate, SBP, DBP and MAP were comparable at baseline in both the groups. The reduction in mean heart rate after administration of a vasopressor was statistically significant in Group I in comparison with Group II. Both Mephentermine & Phenylephrine were efficacious in maintaining the SBP, DBP and MAP within the normal range i.e., 20% of the baseline value and no statistically significant difference was observed between them. **Conclusion-** Both the vasopressors, Mephentermine and Phenylephrine have similar efficacy in maintaining post spinal maternal hypotension during caesarean section, although Phenylephrine causes reduction in heart rate which can be advantageous in patients with undesirable tachycardia. In addition to this, both the groups had no significant adverse effects.

KEYWORDS : Hypotension, Phenylephrine, Mephentermine, Spinal Anaesthesia, Caesarean Section

INTRODUCTION

Spinal anaesthesia is one of the most common regional block techniques used in clinical practice. The first subarachnoid block was given by August Bier in the year 1885, after that Adriani and his associates in the year 1940's developed a well-established and standardized safe technique of analgesia and became popular in the field of obstetrics(1). Nowadays, caesarean section is one of the most common surgical procedures and spinal anaesthesia is the most used technique(2),(3). Several studies have reported the increased risk for persistent hypotension in patients undergoing caesarean section surgery under spinal anaesthesia, which further causes complications like hypoperfusion of the placenta leading to foetal distress, acidosis and low (<7) Apgar score(4),(5),(6). Pregnant females receiving spinal anaesthesia experience sympathetic block which decreases venous return to the heart and results in hypotension. Several studies have reported that the use of intravenous vasopressors has been the main stay in treating hypotension caused by spinal anaesthesia(7)(8)(9).

The vasopressors used in practice include ephedrine, methoxamine, metaraminol, mephentermine, phenylephrine, and epinephrine. Mephentermine, is a sympathomimetic drug acting both on alpha and beta adrenergic receptors(4). Phenylephrine, a selective α1-adrenergic receptor agonist, is another drug that is commonly used for the treatment of hypotension(10)(11). However, there is paucity in studies comparing the efficacy of mephentermine and phenylephrine in controlling the hypotension caused by spinal anaesthesia during caesarean sections in western part of the Uttar Pradesh, India. Therefore, the present study was designed to study the efficacy of mephentermine and phenylephrine and compare the effects of these two drugs in regulating the blood pressure, heart rate, and monitoring of any adverse effect of the drugs in a tertiary care hospital in Ghaziabad, Uttar Pradesh.

MATERIAL AND METHODS

This was a prospective comparative study conducted in the Department of Anaesthesiology at Santosh Medical College, Ghaziabad, Uttar Pradesh and a total of 42 patients were enrolled.

42 ASA 2 parturient women admitted to Santosh Medical College scheduled to undergo elective caesarean section under spinal anaesthesia, were randomly divided into 2 groups (Group I and Group II) of 21 each, fulfilling the criteria of hypotension during the operation as defined. Hypotension after spinal anaesthesia was considered as a fall of >20% of blood pressure from baseline.

- **Group I-** Patients received IV bolus of Phenylephrine 100 mcg
- **Group II-** Patient received IV bolus of Mephentermine 6 mgPre-anaesthetic assessment was done a day prior. All patients were kept nil per oral for at least 6 hours, premedicated with oral Ranitidine 150 mg, and Metoclopramide 10 mg were given the night before surgery. As an intervention to treat hypotension as per the study design, each participant was allocated to receive either bolus IV injection of Phenylephrine 100 mcg (Group I) or Mephentermine 6 mg (Group II).

On arrival of the patients in operation theatre, IV line was secured with 18-G cannula; all patients received 20 ml/kg of Ringer's lactate solution intravascularly before spinal anaesthesia, thereafter this was continued at a rate of approximately 10-15 ml/min throughout the study period. Heart rate, NIBP, respiratory rate, ECG and SpO_2 were monitored. Spinal anaesthesia was administered using the midline approach and maintaining standard aseptic precautions using a 25 Gauge Quincke spinal needle. Bupivacaine 12.5 mg (2.5 mL of 0.5% bupivacaine with dextrose 8% solution) was used at a rate of approximately 0.2 mL/sec for spinal anaesthesia. The following parameters were monitored during the study period: Systolic and diastolic blood pressure every 2 minutes after administration of spinal anaesthesia for next 20 minutes; thereafter every 15 minutes till the completion of caesarean section or at least 45 minutes and subsequently every 30 minutes for rest of the study period. Nausea, vomiting and other undesirable maternal effects were also monitored.

Hypotension during the study period was treated with one unit of the drug which was unknown to the interventionist and was

repeated according to the requirement. Inj. oxytocin 20U in 5% dextrose was administered after cord clamping. During the study, shivering was treated with IV Tramadol 0.5mg/kg body weight and nausea/vomiting were treated with IV Ondansetron 4mg per episode. Bolus IV injection of Atropine 0.3 mg was administered as a treatment for bradycardia.

RESULTS

Table No. 1 Comparison Of Age

Age (years)	Group I		Group II	
	N	%	N	%
19-25	10	47.62	7	33.33
26-30	8	38.10	12	57.14
31-35	2	9.52	2	9.52
≥36	1	4.76	0	0.00
Median	27		27	
Range	21-44		19-33	
Mean±SD	27.4±5.0		26.8±3.5	
p value	0.649			

The women in both groups were between 19-44 years of age, and were classified into four subgroups, namely, 19-25 years, 26-30 years, 31-35 years and more than 35 years. Majority of the patients in Group I belonged to 19-25 years age group while in Group II the majority of patients belonged to 26-30 years age group. The difference in mean age between the two groups was statistically insignificant (p=0.649).

Table No. 2 Comparison Of Weight

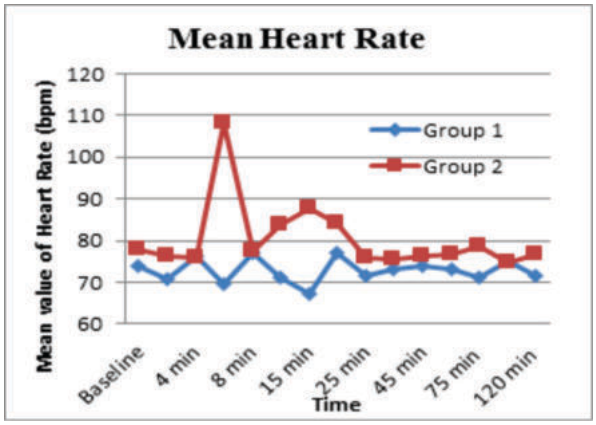
Weight (kg)	Group I		Group II	
	N	%	N	%
51-65	5	23.81	6	28.57
66-75	2	9.52	7	33.33
76-85	10	47.62	4	19.05
≥86	4	19.05	4	19.05
Median	78		76	
Range	55-92		51-89	
Mean±SD	76.1±10.6		73.7±12.0	
P value	0.500			

The weight of the subjects in the study ranged from 51 to 92 kgs. Maximum patients were from the weight group of 76-85 kgs. In intergroup comparison, the mean weight of Group I was 76.1±10.6 kgs whereas the mean weight of Group II was 73.7±12.0 kgs. No significant difference was found between Group I and Group II with respect to weight (P=0.500).

Table No. 3 Mean Heart Rate

Time	HEART RATE (Beats per minute/BPM)		P value
	Group I (Mean±SD)	Group II (Mean±SD)	
Baseline	73.86±10.34	77.9±10.2	0.208
2 min	70.95±12.36	76.29±11.08	0.148
4 min	76.38±10.64	75.81±12.37	0.873
6 min	69.62±13.76	108.71±16.9	<0.0001
8 min	77.29±10.37	77.42±13.40	0.969
10 min	71.24±12.39	83.66±14.08	0.004
15 min	67.14±13.42	87.76±15.6	<0.0001
20 min	77.29±10.37	84.19±18.31	0.140
25 min	71.71±12.09	75.76±13.15	0.305
30 min	73.24±10.65	75.62±10.11	0.461
45 min	74.05±10.03	76.38±8.85	0.428
60 min	73.00±9.13	76.57±10.53	0.247
75 min	71.39±10.61	78.78±13.06	0.087
90 min	75.22±9.3	74.75±13.89	0.943
120 min	71.5±8.06	76.5±19.09	0.651

At baseline, the mean heart rate in Group 1 and Group 2 was 73.86±10.34 BPM and 77.9±10.2 BPM respectively (P=0.208). On comparison at baseline, no statistically significant difference was found between both the groups (p=0.208). The mean heart rate in both the groups measured at various time intervals after administration of the vasopressors was analysed and it was found that the heart rate was significantly higher in Group 2 in comparison to Group 1 at 6th minute (p=<0.0001), 10th minute (p=0.004) and at 15th minute (p=<0.0001). (Table 3, Graph 1)

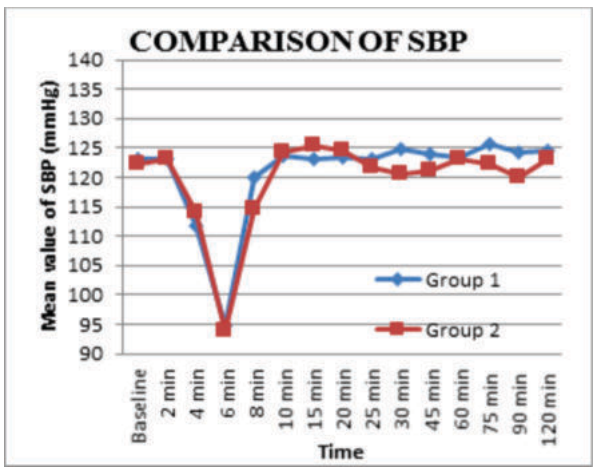


Graph 1

Table No. 4 Systolic Blood Pressure

Time (minutes)	SBP (mmHg)		P value
	Group I (Mean±SD)	Group II (Mean±SD)	
Baseline	123±8.74	122.48±9.61	0.854
2	123.24±9.93	123.14±10.31	0.975
4	111.9±18.15	114.1±15.61	0.677
6	94.71±11.43	94±8.53	0.819
8	119.9±16.03	114.67±13.82	0.263
10	123.81±5.51	124.38±6.89	0.768
15	123.14±6.34	125.52±7.18	0.261
20	123.52±4.69	124.67±7.47	0.555
25	123.23±5.19	121.81±6.78	0.447
30	124.95±7.71	120.52±8.64	0.087
45	124.14±6.78	121.05±6.68	0.144
60	123.43±8.08	123.05±7.74	0.876
75	125.67±6.94	122.29±7.64	0.200
90	124.22±5.61	120±12.33	0.399
120	124.5±2.52	123±1.41	0.491

The mean SBP in Group I at baseline was 123±8.74 mmHg and in Group II it was 122.48±9.61 mmHg (P=0.854). After administration of vasopressors, no statistically significant difference was found (P>0.05) in terms of SBP between both the groups at all the time intervals. In addition to this, both the drugs maintained the SBP within 20% of the baseline value. (Table 4, Graph 2)

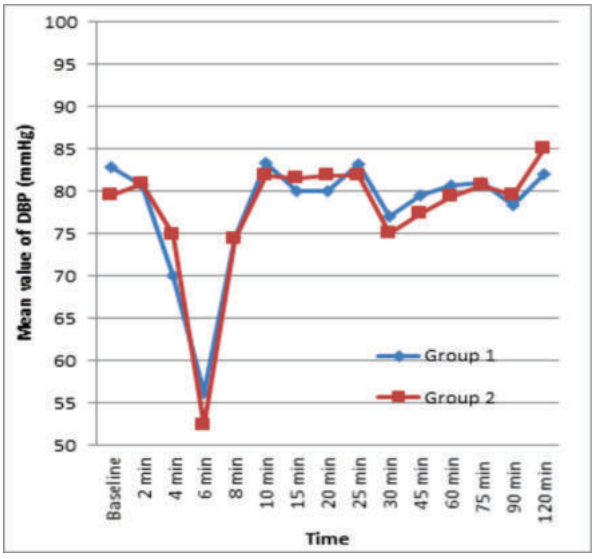


Graph 2

Table No. 5 Diastolic Blood Pressure

Time (minutes)	DBP (mmHg)		P value
	Group I (Mean±SD)	Group II (Mean±SD)	
Baseline	82.95±4.32	79.62±7.81	0.094
2	80.76±7.2	80.86±7.09	0.965
4	70.19±15.46	74.86±14.6	0.320
6	56.19±12.96	52.48±7.01	0.254
8	74.67±15.95	74.38±16.07	0.954
10	83.33±5.03	81.81±6.06	0.380
15	80.1±5.46	81.52±5.65	0.409
20	80.19±5.17	81.9±6.08	0.331
25	83.24±3.92	81.9±5.35	0.362
30	77.14±6.74	75.14±5.08	0.284
45	79.62±5.71	77.33±5.42	0.190
60	80.76±5.04	79.43±6.76	0.472
75	81.00±6.48	80.71±6.45	0.902
90	78.44±7.33	79.5±10.38	0.350
120	82.00±1.63	85.00±1.41	0.093

The mean value of DBP at baseline was greater in Group I (82.95±4.32 mmHg) than Group II (79.62±7.81), but the difference was not significant (P=0.094). Following the administration of both the drugs, the DBP was maintained within 20% of baseline value till the end of surgery, although on statistical analysis no significant difference was observed at all the time intervals (P>0.05). (Table 5, Graph 3)

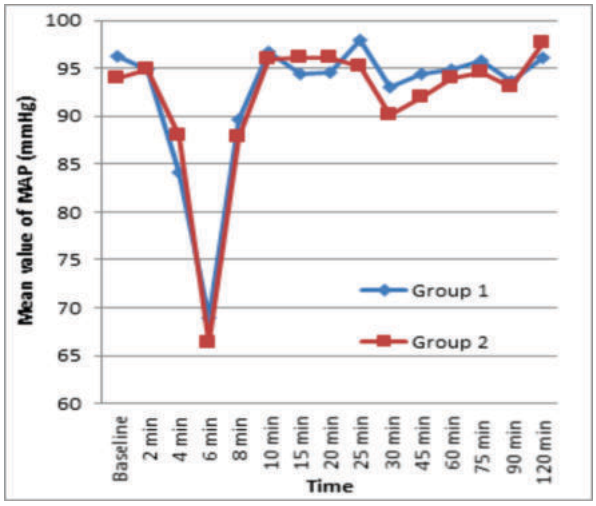


Graph 3

Table No. 6 Comparison Of Mean Arterial Pressure

Time (minutes)	MAP (mmHg)		P value
	Group I (Mean±SD)	Group II (Mean±SD)	
Baseline	96.3±5.11	93.9±7.22	0.227
2	94.92±7.14	94.95±7.9	0.983
4	84.1±15.78	87.94±14.57	0.410
6	69.03±11.55	66.32±6.88	0.367
8	89.75±15.77	87.81±15.1	0.699
10	96.83±4.93	96±5.14	0.624
15	94.44±5.13	96.19±5.51	0.277
20	94.63±4.36	96.16±5.72	0.327
25	97.9±3.63	95.21±5.63	0.656
30	93.08±6.07	90.19±5.35	0.108
45	94.46±5	91.9±5.05	0.099
60	94.97±5.16	93.97±6.28	0.542
75	95.89±6.11	94.57±6.44	0.543
90	93.7±5.64	93±10.59	0.883
120	96.17±1.14	97.67±1.41	0.137

At baseline, the mean value of MAP in Group I was 96.3±5.11 mmHg whereas in Group II was 93.9±7.22 mmHg (P=0.227). During the intraoperative period in both groups, the MAP was maintained within the haemodynamic range after administration of Mephentermine & Phenylephrine at all the time intervals. When the changes were compared between Group I and Group II statistically insignificant difference was found (P>0.05). (Table 6, Graph 4)



Graph 4

Summary

This comparative randomised study demonstrated that phenylephrine and mephentermine have equal efficacy in management of post spinal anaesthesia related hypotension occurring in patients undergoing caesarean section surgery. Both the drugs maintained the blood pressure within 20% of baseline values. The effect on SBP, mean DBP, and MAP was comparable in both the groups at different time intervals with a statistically insignificant difference. Furthermore, the subjects who received bolus of phenylephrine developed bradycardia which did not go below 50beats/min, and the lower heart rate was proved beneficial to counter the undesirable tachycardia. Both the treatments were well tolerated by the patients and no serious adverse drug reaction was observed.

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