Section: Anaesthesia

Original Research Article

A CLINICAL STUDY ON COMPARISON BETWEEN PHENYLEPHRINE AND MEPHENTERMINE FOR CORRECTING HYPOTENSION FOLLOWING SPINAL ANAESTHESIA IN LOWER SEGMENT CAESEREAN SECTION

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ABSTRACT

Background: The aim of the study is to compare the effectiveness of phenylephrine and mephentermine in treating hypotension following spinal anaesthesia.

Materials & Methods: This study was conducted at Government Medical College, Nandyala. The Study period was one year. Study population were 60 patients undergoing elective and emergency lower segment cesarean section. After obtaining Institutional Ethical Committee approval, written consent were obtained from all patients included in the study.

Results: In the present study, age between Groups by Unpaired t-test were t-value=1.272, p- value=0.208>0.05 which shows no statistical significant difference between Age and Groups. SLA between Groups by Pearson's chi-squared test. which shows no statistical significant association between SLA at 2 Mins and Groups. In comparison between APGAR at 1 Min with Groups were X2=3.068, p=0.080>0.05 which shows no statistical significant association. between APGR at 1 Min and Groups. Similarly, in comparison between APGAR at 5 Mins with Groups were X2=0.741, p=0.671>0.05 which shows no statistical significant association between APGAR at 5 Mins and Groups. Side effects between Groups by Pearson's chi-squared test were X2=1.019, p=0.797>0.05 which shows no statistical significant association between Side effects and Groups. Systolic Blood Pressure between Groups by Unpaired t -test were all the time durations of Systolic Blood Pressure with Groups shows no statistical significant difference at p > 0.05 level. Diastolic Blood Pressure between Groups by Unpaired t-test were all the time durations of Diastolic Blood Pressure with Groups shows no statistical significant difference at p > 0.05 level whereas in comparison of Diastolic Blood Pressure at Baseline with Groups were t-value=2.314, p-value=0.024<0.05 which shows statistical significant difference at p < 0.05 level. SPO2 between Groups by Unpaired t-test were all the time durations of SPO2 with Groups shows no statistical significant difference at p> 0.05 level whereas in comparison of SPO2 at 2 mins with Groups were t-value=2.408, p-value=0.023<0.05 which shows statistical significant difference at p < 0.05 level. Heart Rate between Groups by Unpaired t-test were all the time durations of Heart Rate with Groups shows no statistical significant difference at p > 0.05 level whereas in comparison of time durations of Heart Rate at 10 Mins (t-value=3.544, p-value=0.001<0.01), 15 Mins (t-value=3.469,p-value=0.001<0.01), 20 Mins (t-value=2.819,p- value=0.007<0.01), 30 Mins (t-value=3.273,p-value=0.002<0.01) with Groups shows highly statistical significant difference at p < 0.01 level.

Conclusion: In conclusion, we found that both vasopressors namely Mephentermine and Phenylephrine are effective in IV bolus form in maintenance of maternal arterial pressure within 20% limit of baseline values.
Keywords: Spinal Anesthesia, Mephentermine, Phenylephrine, MAP, APGAR, SPO^2.

INTRODUCTION

Karl August Bier in 1898 introduced spinal anaesthesia into clinical practice.[1]Today, Spinalanaesthesia is the most common mode of anaesthesia for caesarean section, as it avoids the most common risks associated with general anaesthesia such as aspiration, difficult intubationand negative effects of general anaesthesia on the foetus.[2]

Anaesthesia to a parturient is not only unique but also requires highest degree of care because the anesthesiologist has to look after two individuals, the mother and foetus. In elective caesarean section under spinal anaesthesia hypotension has been reported in as many as 85% of patients.

Hypotension during spinal anesthesia for caesarean delivery can have detrimental effects on both mother and neonate. Profound sustained hypotension may also lead to utero-placental insufficiency and may cause foetal complications like foetal hypoxia, acidosis, bradycardia and still birth.[3] Post spinal anaesthesia hypotension in caesarean section has been the topic of research for more than 50 years.[4]

These effects include decreased utero placental blood flow, impaired foetal oxygenation with asphyxial stress and foetal acidosis and maternal symptoms of low cardiac output such as nausea, vomiting, dizziness and decreased consciousness.[5-7]Therefore there has been much attention in the literature to methods of preventing and treating hypotension in obstetric anaesthesia. Careful positioning with left uterine displacement and volume preloading with crystalloids or colloids has been used to prevent it, but these are not complete measures and vasopressor is required to correct hypotension quickly. Vasopressor like Ephedrine, Mephentermine, Phenylephrine, Metaraminol and Methoxamine are used for treating the hypotension. In this study we compare the efficacy of Mephentermine and Phenylephrine in treating the hypotension for caesarean section and their undesirable side effects.

Aim of The Study

The aim of the study is to compare the effectiveness of phenylephrine and mephentermine in treating hypotension following spinal anaesthesia

Objectives

1. To assess the efficacy of vasopressor in treating hypotension
2. To evaluate the adverse effects like Nausea, Vomitings and other adverse effects.
3. To evaluate the neonatal outcome.

MATERIAL AND METHODS

This study was conducted at Government Medical College, Nandyal. The Study period was one year. Study population were 60 patients undergoing elective and emergency lower segment cesarean section. After obtaining Institutional Ethical Committee approval, written consent were obtained from all patients included in the study.

Study design

This study was a prospective double blinded Randomized clinical study.

Study Group

Patients involved in the study were divided into two groups of 30 each. Randomization was done by sealed envelope technique.

Group A - patients in this group received inj. Phenylephrine 100 Mcg IV

Group B - patients in this group received inj. Mephentermine 6mg IV

Selection of Cases

Inclusion Criteria

1. 18 to 35 yrs old Full term Singleton Parturient
2. American Society of Anaesthesiologists Physical Status I and II
3. Elective and emergency Caesarean Section
4. Patient who gave valid informed consent for the study

Exclusion Criteria

1. Age below 18 or above 35yrs, ASA – Grade III and Above.
2. Patient refusal
3. Patients with Cardiovascular, Respiratory, Hepatic, Renal, Endocrine, Neurological and Psychiatric disease
4. Patient with Coagulopathy and bleeding diathesis
5. Local infection at injection site
6. Allergy to Local Anaesthetics
7. Morbid obesity
8. Complicated Pregnancy
9. Intrauterine fetal compromise
10. Antepartum hemorrhage

Materials

Drugs

- Inj. Phenylephrine
- Inj. Mephentermine
- Inj. 0.5% Hyperbaric Bupivacaine
- Emergency drugs

Equipments

- 25G Quincke Babcock needle
- Sterile drapes and sterile bowl
- Sterile gauze pieces

- Sponge holding forceps
- Sterile 2ml and 5ml syringes

Monitors: NIBP, ECG, SPO2

Patient preparation

Elective cases: For elective LSCS, patients were assessed preoperatively. History regarding any comorbid conditions and previous surgery were noted.

Investigations done

1.Hb%, PCV, platelet
2.Bleeding time, clotting time
3.Blood urea, creatinine
4.Blood grouping, typing
5.Blood sugar

Premedication: given 2 hrs before surgery with sips of water Tab. Ranitidine 150 mg PO
Tab. Metaclopramide 10 mg PO
In case of emergency surgery, inj. Ranitidine 50 mg iv was given 30 mins prior to surgery

Methodology

After shifting the patient inside operation theater, monitor like non invasive blood pressure monitoring, electrocardiogram, pulse oximetry were connected. Preoperative checklist for anaesthesia machine was carried out and it was made sure that all the emergency drugs needed were available. Patient was made to lie in supine position with left uterine tilt with the help of a wedge under right pelvic bone. Intravenous access was secured with 18 G iv cannula. Patients were preloaded with Ringer lactate solution at 15ml/kg. Baseline variables like blood pressure, heart rate, saturation were noted down.

Under strict aseptic precautions after placing the patient in Sitting position leaning forward, parts painted and draped. After giving local infiltration with 2% plain lignocaine, L3-L4 intervertebral space is entered with 25G Quincke- Babcock spinal needle via midline approach. Drug was injected into subarachnoid space at 0.2ml/sec after confirming free flow of CSF. Patient was placed immediately in supine position and oxygen administered with the help of face mask at 6lit / min. Sensory block was assessed by pinprick method in midclavicular line using 27G needle until the block reached T6 dermatomal level.

RESULTS

Statistical Analysis

The collected data were analysed with IBM SPSS Statistics for Windows, Version 23.0. (Armonk, NY: IBM Corp).To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & Standard Deviation were used for continuous variables. To find the significant difference between the bivariate samples in Independent groups the Unpaired sample t-test was used. To find the significance in categorical data Chi-Square test was used. In both the above statistical tools the probability value .05 is considered as significant level. [Table 1]

The above table shows comparison of Age with Groups by Unpaired t - test were t-value=1.272, p-value=0.208>0.05 the difference of mean age in two groups was not statistically significant.

The above table shows comparison of Weight between Groups by Unpaired t-test were t-value=3.408, p-value=0.001<0.01 which shows highly statistical significant difference between Weight and Groups. [Table 2]

The above table shows comparison between SLA between Groups by Pearson's chi-squared test. In comparison between SLA at 2 Mins with Groups were □2=1.086, p=0.297>0.05 which shows no statistical significant association between SLA at 2 Mins between Groups. Similarly in comparison between SLA at 5 Mins between Groups were □2=1.971, p=0.373>0.05 which shows no statistical significant association between SLA at 5 Mins between Groups and in comparison between SLA at 10 Mins between Groups were □2=0.741, p=0.690>0.05 which shows no statistical significant association between SLA at 10 Mins between Groups. [Table 3]

The above table shows comparison between APGAR between Groups by Pearson's chi-squared test. In comparison between APGAR at 1 Min between Groups were □2=3.068, p=0.080>0.05 which shows no statistical significant association between APGR at 1 Min and Groups. Similarly in comparison between APGAR at 5 Mins between Groups were □2=0.741, p=0.671>0.05 which shows no statistical significant association between APGAR at 5 Mins between Groups. [Table 4]

The above table shows comparison between Side effects between Groups by Pearson's chi-squared test were □2=1.019, p=0.797>0.05 which shows no statistical significant association between Side effects and Groups. [Table 5]

The above table shows comparison of Systolic Blood Pressure between Groups by Unpaired t-test were all the time durations of Systolic Blood Pressure with Groups shows no statistical significant difference at p > 0.05 level. [Table 6]

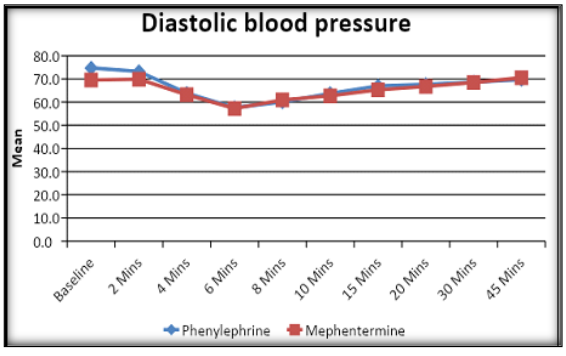

Figure 1: Diastolic Blood Pressure

The above table shows comparison of Mean Arterial Pressure between Groups by Unpaired t-test were all

the time durations of Mean Arterial Pressure with Groups shows no statistical significant difference at p > 0.05 level. [Table 8]

The above table shows comparison of SPO2 between Groups by Unpaired t-test were all the time durations of SPO2 with Groups shows no statistical significant difference at p > 0.05 level whereas in comparison of SPO2 at 2 Mins with Groups were t-value=2.408, p-value=0.023<0.05 which shows statistical significant difference at p < 0.05 level. [Table 9]

The above table shows comparison of Heart Rate between Groups by Unpaired t-test were all the time durations of Heart Rate with Groups shows no statistical significant difference at p > 0.05 level whereas in comparison of time durations of Heart Rate at 10 Mins (t-value=3.544, p-value=0.001<0.01), 15 Mins (t-value=3.469, p-value=0.001<0.01), 20 Mins (t- value=2.819, p-value=0.007<0.01), 30 Mins (t-value=3.273, p-value=0.002 <0.01) with Groups shows highly statistical significant difference at p < 0.01 level. Similarly in comparison of Heart Rate at 8 Mins (t-value=2.496, p-value= 0.015<0.05), 45 Mins (t-value= 2.600, p-value= 0.012<0.05) which shows statistical significant difference at p < 0.05 level. [Table 10]

Table 1: Comparison of Age between Groups by Unpaired t-test

Variable	Groups	N	Mean	SD	t-value	p-value
Age	Phenylephrine	30	27.2	3.8	1.272	0.208#
	Mephentermine	30	26.0	3.7		
#NoStatisticalSignificanceatp>0.05level						

Table 2: Comparison of Weight between Groups by Unpaired t-test

Variable	Groups	N	Mean	SD	t-value	p-value
Weight	Phenylephrine	30	65.5	3.8	3.408	0.001**
	Mephentermine	30	61.9	4.4		
**HighlyStatisticalSignificanceatp<0.01level						

Table 3: Comparison between SLA between Groups by Pearson's Chi- Square t-test

SLA			Groups		Total	□2-value	p-value
			Phenylephrine	Mephen-termine			
2Mins	T10	Count	19	15	34	1.086	0.297#
		%	63.3%	50.0%	56.7%		
	T8	Count	11	15	26		
		%	36.7%	50.0%	43.3%		
Total		Count	30	30	60		
		%	100.0%	100.0%	100.0%		
5Mins	T10	Count	1	0	1	1.971	0.373#
		%	3.3%	0.0%	1.7%		
	T6	Count	9	13	22		
		%	30.0%	43.3%	36.7%		
	T8	Count	20	17	37		
		%	66.7%	56.7%	61.7%		
Total		Count	30	30	60		
		%	100.0%	100.0%	100.0%		
10Mins	T4	Count	2	1	3	0.741	0.690#
		%	6.7%	3.3%	5.0%		
	T6	Count	26	28	54		
		%	86.7%	93.3%	90.0%		
	T8	Count	2	1	3		
		%	6.7%	3.3%	5.0%		
Total		Count	30	30	60		
		%	100.0%	100.0%	100.0%		
#NoStatisticalSignificanceatp>0.05level							

Table 4: Comparison between APGAR between Groups by Pearson'sChi- Square t-test

APGAR			Groups		Total	□2 - value	p-value
			Phenylephrine	Mephentermine			
1Min	6	Count	11	5	16	3.068	0.080#
		%	36.7%	16.7%	26.7 %		
	7	Count	19	25	44		
		%	63.3%	83.3%	73.3 %		
		Cou	30	30	60		

Total		nt					
		%	100.0%	100.0%	100.0 %		
5 Mins	8	Count	4	2	6	0.741	0.671 #
		%	13.3%	6.7%	10.0 %		
	9	Count	26	28	54		
		%	86.7%	93.3%	90.0 %		
Total		Count	30	30	60		
		%	100.0%	100.0%	100.0 %		
#NoStatisticalSignificanceatp>0.05level							

Table 5: Comparison between Side effects between Groups by Pearson'sChi- Square t-test

			Groups		Total	□2 - value	p-value
			Phenylephrine	Mephentermine			
Sideeffects	Absent	Count	26	27	53	1.019	0.797 #
		%	86.7%	90.0%	88.3%		
	Headache	Count	2	2	4		
		%	6.7%	6.7%	6.7%		
	Nausea	Count	1	0	1		
		%	3.3%	0.0%	1.7%		
	Vomiting	Count	1	1	2		
		%	3.3%	3.3%	3.3%		
Total		Count	30	30	60		
		%	100.0%	100.0%	100.0 %		
#NoStatisticalSignificanceatp>0.05level							

Table 6: Comparison of Systolic Blood Pressure between Groups by Unpaired t-test

SBP	Groups	N	Mean	SD	t-value	p-value
Baseline	Phenylephrine	30	117.1	10.0	0.228	0.821#
	Mephentermine	30	116.5	10.4		
2Mins	Phenylephrine	30	117.1	10.3	0.454	0.651#
	Mephentermine	30	115.9	10.8		
4Mins	Phenylephrine	30	104.9	9.9	1.324	0.191#
	Mephentermine	30	101.5	10.4		
6Mins	Phenylephrine	30	94.9	8.9	0.706	0.483#
	Mephentermine	30	93.4	7.1		
8Mins	Phenylephrine	30	98.9	7.2	0.338	0.737#
	Mephentermine	30	98.2	7.4		
10Mins	Phenylephrine	30	105.2	5.4	1.361	0.179#
	Mephentermine	30	103.3	5.2		
15Mins	Phenylephrine	30	107.7	4.8	0.230	0.819#
	Mephentermine	30	107.3	6.3		
20Mins	Phenylephrine	30	110.7	5.5	1.084	0.283#
	Mephentermine	30	109.2	5.7		
30Mins	Phenylephrine	30	111.1	4.9	0.728	0.469#

Table 7: Comparison of Diastolic Blood Pressure between Groups by Unpaired t-test

DBP	Groups	N	Mean	SD	t-value	p-value
Baseline	Phenylephrine	30	74.7	7.9	2.314	0.024*
	Mephentermine	30	69.5	9.4		
2Mins	Phenylephrine	30	73.2	8.1	1.388	0.170#
	Mephentermine	30	69.9	10.3		
4Mins	Phenylephrine	30	63.8	7.6	0.318	0.751#
	Mephentermine	30	63.2	7.8		
	Phenylephrine	30	57.6	6.2		

6Mins	Mephentermine	30	57.2	3.3	0.340	0.735#
8Mins	Phenylephrine	30	60.0	5.9	0.707	0.482#
	Mephentermine	30	61.0	4.1		
10Mins	Phenylephrine	30	63.8	5.6	0.844	0.402#
	Mephentermine	30	62.7	4.1		
15Mins	Phenylephrine	30	67.0	5.4	1.329	0.189#
	Mephentermine	30	65.3	4.2		
20Mins	Phenylephrine	30	67.7	4.6	0.739	0.465#
	Mephentermine	30	66.8	4.9		
30Mins	Phenylephrine	30	68.6	4.7	0.151	0.880#
	Mephentermine	30	68.5	3.7		
45Mins	Phenylephrine	30	69.7	5.1	0.563	0.575#
	Mephentermine	30	70.5	5.9		
*Significantatp<0.05and#NoStatisticalSignificanceatp>0.05						

Table 8: Comparison of Mean Arterial Pressure between Groups by Unpaired t-test

MAP	Groups	N	Mean	SD	t-value	p-value
Baseline	Phenylephrine	30	88.8	7.8	1.678	0.099#
	Mephentermine	30	85.2	9.0		
2Mins	Phenylephrine	30	87.8	8.0	1.129	0.263#
	Mephentermine	30	85.2	9.9		
4Mins	Phenylephrine	30	77.5	7.9	0.773	0.443#
	Mephentermine	30	76.0	7.9		
6Mins	Phenylephrine	30	70.1	6.6	0.546	0.588#
	Mephentermine	30	69.3	4.2		
8Mins	Phenylephrine	30	73.0	5.9	0.297	0.768#
	Mephentermine	30	73.4	4.7		
10Mins	Phenylephrine	30	77.6	5.1	1.128	0.264#
	Mephentermine	30	76.2	3.9		
15Mins	Phenylephrine	30	80.5	4.9	1.029	0.308#
	Mephentermine	30	79.3	4.3		
20Mins	Phenylephrine	30	82.0	4.5	0.929	0.357#
	Mephentermine	30	80.9	4.8		
30Mins	Phenylephrine	30	82.8	4.2	0.439	0.662#
	Mephentermine	30	82.3	4.0		

Table 9: Comparison of SPO2 between Groups by Unpaired t-test

SPO2	Groups	N	Mean	SD	t-value	p-value
Baseline	Phenylephrine	30	99.9	0.3	0.000	1.000#
	Mephentermine	30	99.9	0.3		
2Mins	Phenylephrine	30	100.0	0.0	2.408	0.023*
	Mephentermine	30	99.8	0.4		
4Mins	Phenylephrine	30	99.6	0.7	0.200	0.842#
	Mephentermine	30	99.6	0.6		
6Mins	Phenylephrine	30	99.3	0.7	0.664	0.509#
	Mephentermine	30	99.4	0.8		
8Mins	Phenylephrine	30	99.6	0.6	0.887	0.379#
	Mephentermine	30	99.7	0.6		
10Mins	Phenylephrine	30	99.9	0.3	0.000	1.000#
	Mephentermine	30	99.9	0.3		
15Mins	Phenylephrine	30	99.9	0.3	0.584	0.561#
	Mephentermine	30	100.0	0.2		
20Mins	Phenylephrine	30	100.0	0.0	1.000	0.326#
	Mephentermine	30	100.0	0.2		
30Mins	Phenylephrine	30	100.0	0.0	1.439	0.161#
	Mephentermine	30	99.9	0.3		

Table 10: Comparison of Heart Rate between Groups by Unpaired t-test

Heart Rate	Groups	N	Mean	SD	t-value	p-value
Baseline	Phenylephrine	30	82.2	6.1	0.518	0.607#
	Mephentermine	30	83.0	6.4		
2Mins	Phenylephrine	30	84.8	7.0	1.055	0.296#
	Mephentermine	30	82.9	7.0		
4Mins	Phenylephrine	30	88.1	5.9	1.922	0.060#
	Mephentermine	30	84.7	7.5		
6Mins	Phenylephrine	30	89.9	6.4	0.808	0.422#
	Mephentermine	30	88.4	7.6		
8Mins	Phenylephrine	30	85.8	6.5	2.496	0.015*
	Mephentermine	30	89.9	6.4		

10Mins	Phenylephrine	30	83.0	5.9	3.544	0.001**
	Mephentermine	30	88.4	5.9		
15Mins	Phenylephrine	30	81.3	5.5	3.469	0.001**
	Mephentermine	30	86.1	5.1		
20Mins	Phenylephrine	30	80.4	5.0	2.819	0.007**
	Mephentermine	30	84.0	5.0		
30Mins	Phenylephrine	30	79.4	5.0	3.273	0.002**
	Mephentermine	30	83.5	4.7		
45Mins	Phenylephrine	30	79.1	4.4	2.600	0.012*
	Mephentermine	30	82.0	4.4		
**Highly Statistical Significance atp<0.01*Significant atp<0.05and #NoStatisticalSignificanceatp>0.05						

DISCUSSION

Blood Pressure

The baseline systolic, diastolic and mean arterial pressure were comparable in both the groups. Spinal hypotension was considered to be >20% of fall from baseline systolic blood pressure. There was a significant rise in pressures after administering bolus doses of injection Mephentermine and Phenylephrine. The rise in systolic blood pressure in the phenylephrine group was found to be significant in the first 5 minutes of administration of bolus dose. Hypotensive events were noted in phenylephrine group after first bolus dose requiring additional dose.

Klohr et al,[8] compared the effects of bolus Ephedrine, Mephentermine, Phenylephrine for the maintenance of arterial pressure during spinal anesthesia for LSCS. In their study all the three vasopressor were effective in maintaining arterial pressure though Phenylephrine has a quicker peak effect. Similar peak effect of phenylephrine was found in our study.

Burns et al,[9] found that Mephentermine when used in pregnancy with hypotension after SAB and had significant increase in Systolic and diastolic blood pressure due to increase in stroke volume. There was no significant changes occurred in heart rate in contrast to our findings which showed significant increase in HR when administered as a bolus dose.

Heart Rate

Hypotensive episodes caused by the spinal anaesthesia resulted in reflex tachycardia. On administration of phenylephrine there was decrease in HR due to increase in systemic vascular resistance. mephentermine has both direct and indirect effects on beta receptors which significantly raised HR.

Burns et al,[9] found that maternal bradycardia was more likely to occur with Phenylephrine than with Ephedrine. Thomas DG et al on comparing the efficacy of bolus Ephedrine and Phenylephrine, they found that mean maximum percentage change in maternal HR was larger in Phenylephrine group than in the ephedrine group. As a consequence atropine was required in eleven out of eighteen women in the Phenylephrine group compared with two out of eighteen women in the Ephedrine group. In our study though phenylephrine caused decrease in heart rate there was no significant bradycardia requiring atropine administration.

Ngan et al,[10] in his study found that Phenylephrine may decrease maternal heart rate and cardiac output.

Adverse Effects

The common side effects of phenylephrine are bradycardia, nausea and vomiting. On the other hand mephentermine causes excitatory symptoms like anxiety, hallucination, euphoria. Mephentermine can also cause arrhythmia and seizure.

Klohr et al,[8] study, 10% patients in Ephedrine and Phenylephrine group and 15% patients in Mephentermine group developed nausea and vomiting. Moran DH et al also found that there were no significant differences between the Ephedrine, Phenylephrine groups in the frequency of maternal nausea and vomiting. In Our study headache was noted in 6.7% of patients in both groups, nausea was found in 3.3% of patients in phenylephrine group.

Neonatal Outcome

Kinsella et al,[11] on their retrospective analysis found that Apgar score is comparable to umbilical artery pH in predicting the neonatal outcome. On assessing the Apgar score in our study there was no statistical significant association between APGR at 1 Minute and 5 minutes. Similar outcome was found in Kestein et al,[12] Salinas et al.[13]

CONCLUSION

In conclusion, we found that both vasopressors namely Mephentermine and Phenylephrine are effective in IV bolus form in maintenance of maternal arterial pressure within 20% limit of baseline values, though Phenylephrine has quicker peak effect, in comparison to Mephentermine and it causes reduction in heart rate, which may be advantageous in patients in whom tachycardia is undesirable. Both vasopressor had no significant adverse effects and no adverse neonatal outcome.

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