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ORIGINAL RESEARCH

Efficacy of Mephentermine vs Phenylephrine for Preventing Maternal Hypotension undergoing Caesarean Section in Subarachnoid block

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ABSTRACT

Background: Maternal hypotension during caesarean section under the subarachnoid block (SAB) is a frequent and serious complication that can result in adverse maternal and fetal outcomes. Effective management of this condition is crucial to ensure the safety and well-being of both mother and baby.**Aim and objective:** To compare the efficacy of intravenous Mephentermine and Phenylephrine in preventing and managing maternal hypotension during caesarean sections performed under SAB.**Materials and Methods:** This prospective observational study was conducted at the Department of Anesthesiology, R.K.D.F Medical College Hospital and Research Centre, Bhopal, over 18 months. A total of 100 pregnant women undergoing elective or emergency cesarean sections under SAB were included. They were divided into Group M (Mephentermine, n=50) and Group P (Phenylephrine, n=50). Hemodynamic parameters, incidence of hypotension, total dose of vasopressor required, side effects, and neonatal outcomes (Apgar scores at 1 and 5 minutes) were recorded and analyzed.**Results:** The incidence of maternal hypotension was significantly lower in Group P (32%) compared to Group M (56%) (p=0.03). Phenylephrine maintained higher systolic and diastolic blood pressures at 1,3,5,and 10 minutes post-administration. The total dose of vasopressor required was significantly lower in Group P (9.6 ± 3.8 mg) compared to Group M (18.4 ± 5.2 mg) (p=0.01). Group M had a higher incidence of tachycardia (24% vs. 8%, p=0.02), while Group P had a higher incidence of bradycardia (18% vs. 6%, p=0.05). Neonatal Apgar scores were comparable between the two groups.**Conclusion:** Intravenous Phenylephrine is superior to Mephentermine for the prevention and management of maternal hypotension during cesarean section under SAB. It maintains better hemodynamic stability and is associated with fewer maternal side effects without compromising neonatal outcomes. Phenylephrine should be considered the preferred vasopressor in this clinical setting.

Keywords: Maternal hypotension, Caesarean section, Subarachnoid block, Mephentermine, Phenylephrine, Hemodynamic stability, Neonatal outcomes.

INTRODUCTION

Maternal hypotension is a frequent and severe complication during cesarean sections performed under the subarachnoid block (SAB).[1] The incidence of hypotension can be as high as 80%, and it poses significant risks to both the mother and the foetus.[1, 2] Hypotension during SAB can lead to symptoms such as nausea, vomiting, dizziness, and in severe cases, it can cause loss of consciousness in the mother. For the fetus, maternal hypotension can result in decreased placental perfusion, leading to fetal acidosis and distress.[3]

Managing maternal hypotension effectively is crucial to ensure the safety and well-being of both mother and child. Vasopressors are commonly used to prevent and treat hypotension during cesarean sections under SAB.[4, 5]Mephentermine and Phenylephrine are two such vasopressors widely used in clinical

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practice.[6]Mephentermine, a sympathomimetic amine, stimulates betaadrenergic receptors, increasing cardiac output and peripheral resistance. On the other hand, Phenylephrine is a selective alpha-1 adrenergic receptor agonist that primarily increases peripheral vascular resistance, raising blood pressure.[6, 7]

While both drugs are effective, their differing mechanisms of action and side effect profiles may influence maternal and fetal outcomes differently.[8]Mephentermine's beta-adrenergic activity can cause tachycardia, while phenylephrine's alpha-1 adrenergic stimulation may lead to reflex bradycardia.[9] Therefore, a comparative study of these two agents is necessary to determine which drug offers better hemodynamic stability and fewer complications.

This study aimed to compare the efficacy of intravenous Mephentermine and Phenylephrine in managing maternal hypotension during cesarean sections under SAB. It focused on maintaining maternal blood pressure and evaluating fetal outcomes. By understanding the advantages and limitations of each vasopressor, we hope to provide evidence-based recommendations for the optimal management of maternal hypotension in this clinical setting.

MATERIALS AND METHODS

This prospective observational study was conducted at the Department of Anesthesiology, R.K.D.F Medical College Hospital and Research Centre, Jatkhedi, Bhopal (M.P) 462026, over 18 months, from April to September. The study aimed to compare the effects of intravenous Mephentermine and Phenylephrine in preventing and managing maternal hypotension during cesarean section under the subarachnoid block (SAB).

Ethical Considerations

The study commenced after obtaining approval from the Institutional Ethics and Research Committee of R.K.D.F Medical College Hospital and Research Centre. Prior to inclusion in the study, written informed consent was obtained from all participants.

Study Population

The study population included pregnant women scheduled for elective or emergency cesarean section under SAB at R.K.D.F Medical College Hospital and Research Centre. One hundred patients were enrolled based on the inclusion and exclusion criteria.

Inclusion Criteria

- Pregnant women with term, uncomplicated, singleton pregnancy.
- Age between 18 to 40 years.
- ASA (American Society of Anesthesiologists) Grades I and II.
- They provided written informed consent.

Exclusion Criteria

- Patient refusal.
- Age below 18 years or above 40 years.
- ASA Grades III and above.
- Non-pregnant women.
- Local infection at the block site.
- History of allergy to study drugs.
- Uncontrolled diabetes, hypertension, cardiovascular disease, severe anemia, cerebrovascular disease, BMI > 30 kg/m².
- Obstetric complications (e.g., antepartum hemorrhage, pregnancy-induced hypertension, gestational diabetes mellitus, fetal malformation and malpresentation, cord prolapse).
- Autonomic neuropathy, spinal deformities, neurological diseases.
- Skin sepsis in the lumbar area.
- Coagulation abnormalities.
- Hypovolemia due to any cause.

Procedure

Patients were divided into two groups of 50 each. Group M received intravenous Mephentermine, while Group P received intravenous phenylephrine for the prevention and management of hypotension during the cesarean section under SAB.

- **Group M (Mephentermine)**: Patients in this group received an intravenous bolus of 6 mg of Mephentermine, administered as needed to maintain maternal blood pressure.
- **Group P (Phenylephrine)**: Patients in this group received an intravenous bolus of phenylephrine at a dose of 100 µg, administered as needed to maintain maternal blood pressure.

Data Collection

Data were recorded for each patient, including:

- Baseline maternal blood pressure and heart rate.
- Blood pressure and heart rate at intervals of 1, 3, 5, and 10 minutes after administration of the study drug.
- Incidence of maternal hypotension (a decrease in systolic blood pressure of more than 20% from baseline or systolic blood pressure of less than 90 mmHg).
- Total dose of vasopressor required.
- Incidence of side effects such as tachycardia, bradycardia, nausea, and vomiting.
- Neonatal outcomes, including Apgar scores at 1 and 5 minutes and any signs of fetal distress.

Statistical Analysis

The collected data were analyzed using appropriate statistical methods. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as percentages. Comparisons between groups were made using the Student's t-test for continuous variables and the chi-square test for

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categorical variables. A p-value of <0.05 was considered statistically significant.

There were no significant differences in age, weight, height, or baseline blood pressure (Table 1).

RESULTS

Demographic and Baseline Characteristics

The demographic and baseline characteristics of the patients in both groups were comparable.

Table 1: Demographic and Baseline Characteristics

Characteristic	Group M(Mephentermine)	Group P (Phenylephrine)	Pvalue
Age (years)	29.5 ± 4.2	28.8 ± 4.5	28.8 ± 4.5
Weight (kg)	68.2 ± 10.3	67.5 ± 9.8	67.5 ± 9.8
Height (cm)	158.5 ± 6.1	159.2 ± 5.8	159.2 ± 5.8
Baseline Systolic BP (mmHg)	122.8 ± 8.4	123.3 ± 8.2	123.3 ± 8.2
Baseline Diastolic BP (mmHg)	76.2 ± 5.7	76.5 ± 5.6	76.5 ± 5.6

Incidence of Maternal Hypotension

The incidence of maternal hypotension was significantly lower in Group P (Phenylephrine) compared to Group M (Mephentermine) (Table 2).

Table 2: Incidence of Maternal Hypotension

Group	Incidence of Hypotension (%)	p-value
Group M (Mephentermine)	28 (56%)	0.03
Group P (Phenylephrine)	16 (32%)	

Hemodynamic Parameters

The hemodynamic parameters, including systolic and diastolic blood pressure and heart rate, were recorded at baseline and 1, 3, 5, and 10 minutes after administration of the study drugs. Group P maintained significantly more stable blood pressure than Group M (Table 3).

Table 3: Hemodynamic Parameters

TimeInterval	Parameter	Group M (Mephentermine)	Group P (Phenylephrine)	Pvalue
Baseline	Systolic BP (mmHg)	122.8 ± 8.4	123.3 ± 8.2	0.80
	Diastolic BP (mmHg)	76.2 ± 5.7	76.5 ± 5.6	0.85
	Heart Rate (bpm)	82.4 ± 7.5	81.8 ± 7.2	0.75
1 minute	Systolic BP (mmHg)	115.2 ± 10.2	121.5 ± 9.6	0.02
	Diastolic BP (mmHg)	72.4 ± 6.1	75.8 ± 5.8	0.04
	Heart Rate (bpm)	84.5 ± 8.1	80.2 ± 7.4	0.03
3 minute	Systolic BP (mmHg)	118.4 ± 9.8	123.2 ± 8.5	0.05
	Diastolic BP (mmHg)	73.8 ± 6.0	75.2 ± 5.7	0.25
	Heart Rate (bpm)	85.2 ± 7.8	79.5 ± 7.3	0.01
5 minute	Systolic BP (mmHg)	119.6 ± 9.4	122.8 ± 8.1	0.10
	Diastolic BP (mmHg)	74.1 ± 5.9	75.0 ± 5.5	0.40
	Heart Rate (bpm)	83.5 ± 7.7	80.5 ± 7.1	0.15
10 minute	Systolic BP (mmHg)	120.4 ± 9.2	123.0 ± 8.0	0.25
	Diastolic BP (mmHg)	74.8 ± 5.8	75.5 ± 5.4	0.55
	Heart Rate (bpm)	82.8 ± 7.6	80.8 ± 7.2	0.30

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Total Dose of Vasopressor Required

The total dose of vasopressor required was significantly higher in Group M compared to Group P (Table 4).

Table 4: Total Dose of Vasopressor Required

Group	Total Dose of Vasopressor (mg)	p-value
Group M (Mephentermine)	18.4 ± 5.2	0.01
Group P (Phenylephrine)	9.6 ± 3.8	

Incidence of Side Effects

The incidence of side effects, such as tachycardia and bradycardia, was recorded. Group M had a higher incidence of tachycardia, while Group P had a higher incidence of bradycardia (Table 5).

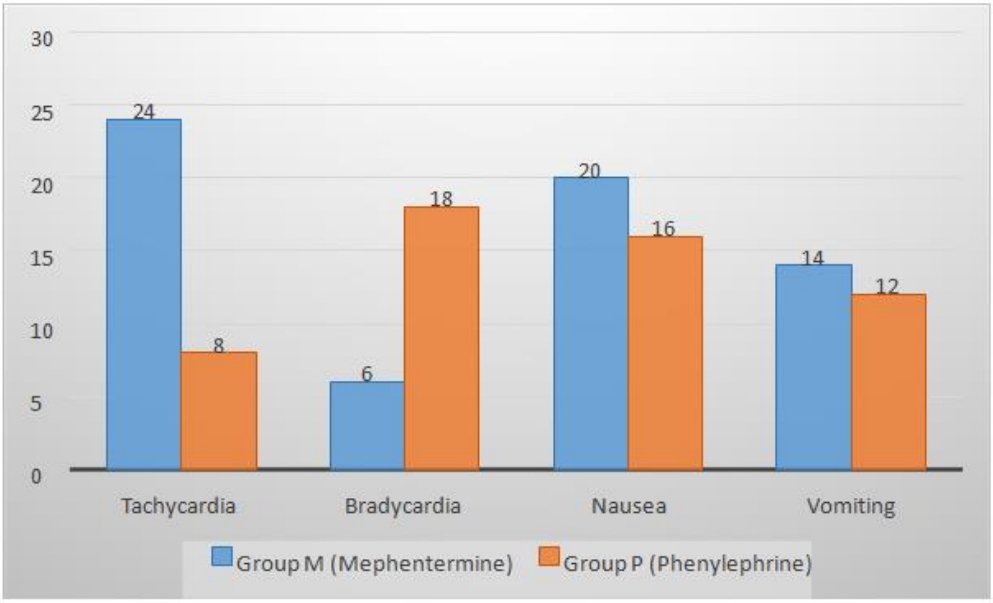

Figure 1: Incidence of Side Effects

Neonatal Outcomes

Neonatal outcomes were evaluated based on Apgar scores at 1 and 5 minutes. The two groups had no significant differences in Apgar scores (Table 6).

Table 5: Neonatal Outcomes

Apgar Score	Group M (Mephentermine)	Group P (Phenylephrine)	p-value
1 minute	8.2 ± 1.0	8.4 ± 0.8	0.30
5 minutes	9.1 ± 0.6	9.2 ± 0.5	0.40

DISCUSSION

Maternal hypotension during cesarean section under the subarachnoid block (SAB) is a wellrecognized complication that can lead to adverse maternal and fetal outcomes.[6-8] The present study aimed to compare the efficacy of intravenous Mephentermine and Phenylephrine in preventing and managing maternal hypotension in this clinical setting. Our findings indicate phenylephrine is more effective in maintaining maternal blood pressure with fewer complications than Mephentermine.

In our study, the incidence of maternal hypotension was significantly lower in the Phenylephrine group (32%) compared to the Mephentermine group (56%). This aligns with previous studies that have demonstrated the superior efficacy of phenylephrine in preventing hypotension during SAB. Ngan Kee et al. (2004) [10] found phenylephrine was more effective than Ephedrine in maintaining arterial blood pressure during SAB for cesarean delivery. Similarly, Lee et al. (2002)[11] reported that phenylephrine was better at preventing hypotension than Mephentermine, further supporting our findings.

The hemodynamic stability provided by phenylephrine was evident in our study, where it maintained higher systolic and diastolic blood pressures at 1, 3, 5, and 10 minutes after administration. This stability is crucial as maternal hypotension can lead to decreased uteroplacental perfusion, potentially causing fetal acidosis and distress. Our results are consistent with the study by Allen et al. (2002)[12], which reported that

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phenylephrine maintained maternal blood pressure more effectively than Mephentermine, thereby ensuring better fetal outcomes.

The total dose of vasopressor required was significantly lower in the Phenylephrine group compared to the Mephentermine group. This finding is supported by the work of Dyer et al. (2009)[13], who found that phenylephrine requires fewer doses to achieve the desired hemodynamic effect compared to other vasopressors. Additionally, side effects, such as tachycardia, were higher in the Mephentermine group, while phenylephrine was associated with a higher incidence of bradycardia. The reflex bradycardia observed with phenylephrine is a welldocumented effect due to its alpha-adrenergic solid activity, leading to vasoconstriction and increased blood pressure, which triggers the baroreceptor reflex.

As assessed by Apgar scores at 1 and 5 minutes, Neonatal outcomes were comparable between the two groups. This is consistent with the findings of Cooper et al. (2002)[14], who reported no significant differences in neonatal Apgar scores between Phenylephrine and Ephedrine groups. Our study thus supports the safety of phenylephrine in terms of neonatal outcomes.

The current study adds to the growing body of evidence favoring Phenylephrine over

Mephentermine for the management of maternal hypotension during cesarean sections under SAB. While Mephentermine remains a viable option, its higher incidence of tachycardia and the more significant total dose required to make it less desirable compared to phenylephrine.

CONCLUSION

Intravenous Phenylephrine is superior to Mephentermine for preventing and managing maternal hypotension during cesarean section under subarachnoid block. It maintains better hemodynamic stability and is associated with fewer maternal side effects without compromising neonatal outcomes. These findings suggest phenylephrine should be the preferred vasopressor in this clinical setting.

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