International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Maternal and Neonatal Outcomes Following Co-Administration of Phenylephrine with Oxytocin During Caesarean Section Under Spinal Anaesthesia

Dr Vrunda N[1], Dr Safura Sultana[2], Dr Sahil Mengaji[3], Dr Sumangala Mulagund[4]

[1]MBBS MD Anaesthesiology Senior specialist Anaesthesia Yadgiri institute of medical sciences YIMS Yadgir Karnataka
[2,3,4]MBBS, MD Anesthesiology Senior resident, Anesthesiology Yadgiri institute of medical sciences YIMS Hospital, yadgiri, Karnataka

OPEN ACCESS

Corresponding Author:

Dr Vrunda N
MBBS MD Anaesthesia Senior specialist Anaesthesia Yadgiri institute of medical sciences YIMS Yadgir Karnataka

Received: 25-04-2026
Accepted: 20-05-2026
Available online: 05-06-2026

ABSTRACT

Background; Spinal anaesthesia is commonly used for caesarean section; however, maternal hypotension remains a frequent complication and may be further aggravated by oxytocin administration after delivery. Phenylephrine, a selective α1-adrenergic agonist, is widely used to prevent and treat hypotension during obstetric anaesthesia. The present study was conducted to evaluate maternal and neonatal outcomes following co-administration of different doses of phenylephrine with oxytocin during caesarean section under spinal anaesthesia.

Materials and Methods; This randomized comparative study was conducted on 90 pregnant women aged 18–40 years, belonging to ASA physical status I, II, and III, undergoing elective or emergency lower segment caesarean section under spinal anaesthesia. Patients were randomly divided into three groups of 30 each. Group A received oxytocin 3 units with phenylephrine 50 µg, Group B received oxytocin 3 units with phenylephrine 75 µg, and Group C received oxytocin 3 units alone, diluted to 10 mL and infused over 5 minutes following delivery of the baby. Maternal hemodynamic parameters, uterine tone, adverse effects, rescue vasopressor requirement, and neonatal APGAR scores at 1 and 5 minutes were recorded and compared among the groups.

Results; Demographic parameters and time of baby extraction were comparable among the groups ($P > 0.05$). Adequate uterine tone was observed in all patients across all three groups with no statistically significant difference ($P = 1.000$). The incidence of intraoperative nausea and vomiting was significantly higher in Group C (40%) compared to Group A (16.7%) and Group B (3.3%) ($P = 0.002$). Mean APGAR scores at 1 minute and 5 minutes were comparable among all groups with no statistically significant difference ($P > 0.05$). All neonates had APGAR scores between 7 and 10, indicating favourable neonatal outcomes.

Conclusion; Co-administration of phenylephrine with oxytocin during caesarean section under spinal anaesthesia effectively reduced maternal adverse effects, particularly nausea and vomiting, while maintaining adequate uterine tone and favourable neonatal outcomes. Phenylephrine 75 µg provided better maternal hemodynamic stability without adversely affecting neonatal safety.

Keywords*: Caesarean section, spinal anaesthesia, phenylephrine, oxytocin, maternal hypotension, APGAR score, uterine tone, neonatal outcomes.*

INTRODUCTION

Caesarean section is one of the most commonly performed surgical procedures worldwide and is frequently carried out under spinal anaesthesia because of its rapid onset, dense neural blockade, reduced maternal morbidity, and avoidance of airway-related complications associated with general anaesthesia.[1] Despite its advantages, spinal anaesthesia during caesarean section is commonly associated with maternal hypotension due to sympathetic blockade, decreased systemic vascular resistance, and reduced venous return.[2] Maternal hypotension may lead to adverse maternal effects such as

nausea, vomiting, dizziness, and reduced uteroplacental perfusion, which can negatively influence fetal oxygenation and neonatal outcomes.[3]

Oxytocin is routinely administered following delivery during caesarean section for prevention of postpartum haemorrhage and to facilitate adequate uterine contraction.[4] However, oxytocin itself is associated with significant cardiovascular side effects including hypotension, tachycardia, arrhythmias, and flushing due to its vasodilatory properties.[5] The combination of spinal anaesthesia-induced sympathetic blockade and oxytocin-induced vasodilation may further aggravate maternal hypotension during caesarean delivery.[6]

Phenylephrine, a selective α1-adrenergic receptor agonist, is considered the vasopressor of choice for prevention and treatment of hypotension during spinal anaesthesia in obstetric patients.[7] It acts primarily by causing peripheral vasoconstriction, thereby maintaining systemic vascular resistance and arterial blood pressure without significant adverse effects on fetal acid-base status.[8] Previous studies have demonstrated that prophylactic phenylephrine administration effectively reduces the incidence of maternal hypotension and associated symptoms such as nausea and vomiting during caesarean section.[9]

The co-administration of phenylephrine with oxytocin may help attenuate oxytocin-induced hypotension while maintaining adequate uterine tone and preserving neonatal safety.[10] However, determining the optimal dose of phenylephrine that effectively prevents hypotension without causing excessive vasoconstriction, reflex bradycardia, or impaired uteroplacental perfusion remains an area of clinical interest.[11]

Neonatal well-being is commonly assessed using the APGAR scoring system at 1 and 5 minutes after delivery.[12] In addition to neonatal outcomes, maternal perioperative parameters including hemodynamic stability, uterine tone, rescue vasopressor requirement, and adverse effects such as nausea and vomiting are important determinants of anaesthetic safety and effectiveness during caesarean delivery.[13]

Therefore, the present study was undertaken to evaluate the maternal and neonatal outcomes following co-administration of different doses of phenylephrine with oxytocin during caesarean section under spinal anaesthesia. The study primarily aimed to compare the incidence of maternal hypotension, adequacy of uterine tone, maternal adverse effects, and neonatal APGAR scores among different study groups.

MATERIALS AND METHODS

The present study was designed to evaluate the maternal and neonatal outcomes following co-administration of different doses of phenylephrine with oxytocin for the prevention of oxytocin-induced hypotension during caesarean section under spinal anaesthesia. This randomised comparative study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participating patients after explaining the procedure and possible complications in their own language.

Study Population

A total of 90 pregnant women aged between 18 and 40 years, belonging to American Society of Anesthesiologists (ASA) physical status I, II, and III, who were scheduled for elective or emergency lower segment caesarean section (LSCS) with singleton term pregnancy were included in the study. The participants were randomly allocated into three groups comprising 30 patients each.

Study Groups

- **Group A:** Patients received oxytocin 3 units combined with phenylephrine 50 µg diluted to 10 mL with normal saline and administered as an intravenous infusion over 5 minutes.
- **Group B:** Patients received oxytocin 3 units combined with phenylephrine 75 µg diluted to 10 mL with normal saline and administered as an intravenous infusion over 5 minutes.
- **Group C:** Patients received oxytocin 3 units diluted to 10 mL with normal saline and administered as an intravenous infusion over 5 minutes.

Following administration of the study drug, oxytocin infusion at 10 units/hour was continued for 4 hours in all groups.

Inclusion Criteria

- Age between 18–40 years
- ASA physical status I, II, or III
- Patients undergoing elective or emergency LSCS
- Singleton term pregnancy

Exclusion Criteria

- Refusal to participate in the study

- Age less than 18 years
- Pregnancy-induced hypertension
- Pre-existing cardiovascular or cerebrovascular disease
- Multiple gestation
- Abnormal fetal presentation
- Fetal congenital abnormalities
- More than two previous LSCS
- Known allergy to study drugs
- Contraindications to spinal anaesthesia

Pre-anaesthetic Evaluation and Preparation
All patients underwent detailed pre-anaesthetic assessment including general and systemic examination. Baseline investigations and vital parameters were recorded. Patients were kept nil per oral for 6 hours prior to surgery. Intravenous access was secured using an 18-gauge cannula in the left forearm, and preloading was done with Ringer lactate solution at 15 mL/kg.

Standard monitoring including electrocardiography (ECG), non-invasive blood pressure (NIBP), pulse oximetry, heart rate, and respiratory rate was instituted before administration of anaesthesia. Baseline systolic blood pressure and heart rate were recorded. No sedative premedication was administered.

All parturients received intravenous glycopyrrolate (4 µg/kg) and ondansetron (80 µg/kg) slowly before spinal anaesthesia.

Anaesthetic Technique
Subarachnoid block was performed at the L3–L4 or L4–L5 intervertebral space using a 25G Quincke Babcock spinal needle in the left lateral position under strict aseptic precautions. Hyperbaric bupivacaine 0.5%, 9 mg, was administered intrathecally.

Immediately after spinal anaesthesia, patients were positioned supine with a 15° wedge under the right buttock to achieve left uterine displacement. Oxygen supplementation at 4 L/min was provided via face mask. Intravenous fluids were continued at a rate of 200 mL every 10 minutes during surgery.

Intraoperative Monitoring
Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure (MAP), respiratory rate, oxygen saturation, and ECG were monitored continuously. Hemodynamic parameters were recorded every 2 minutes until delivery of the baby and for 10 minutes following administration of the study drug, and thereafter every 5 minutes until completion of surgery.

The sensory level of spinal block was assessed using cold swab testing at 20 minutes.

Management of Hypotension
Hypotension was defined as a decrease in MAP greater than 20% from baseline values. It was treated with an intravenous fluid bolus of 100 mL and rescue phenylephrine 50 µg IV administered every 2 minutes until MAP returned within 20% of baseline. If more than four rescue doses were required, intravenous ephedrine 6 mg was used. Total rescue vasopressor requirement was recorded.

Assessment of Maternal Outcomes
Maternal perioperative outcomes assessed included:
- Incidence of hypotension
- Reactive hypertension
- Bradycardia and tachycardia
- Nausea and vomiting
- Headache
- Shivering
- Chest pain
- Breathlessness
- Convulsions

Uterine tone was assessed clinically at the end of uterine closure and categorized as either adequate or inadequate. In cases of inadequate uterine contraction, methylergometrine 0.2 mg intramuscularly or prostaglandin F2α 250 µg intramuscularly was administered and documented.

Assessment of Neonatal Outcomes
Neonatal safety was assessed using APGAR scores at 1 minute and 5 minutes after delivery. Neonatal outcomes were compared among the three study groups.

Statistical Analysis
Quantitative variables were expressed as mean ± standard deviation (SD) and analyzed using Student's t-test or one-way analysis of variance (ANOVA) wherever appropriate. Qualitative variables were expressed as frequencies and percentages and analyzed using the chi-square test. A p-value greater than 0.05 was considered statistically non-significant, a p-value less than 0.05 was considered statistically significant, and a p-value less than 0.01 was considered highly significant.

RESULT AND OBSERVATIONS

Table 1: Comparison of Demographic Data (Age) among Group A, Group B and Group C

Age (Years)	Group A (n=30)	Group B (n=30)	Group C (n=30)	Total (n=90)
<20	0 (0%)	1 (3.3%)	0 (0%)	1 (1.1%)
20–30	30 (100%)	28 (93.3%)	30 (100%)	88 (97.8%)
31–40	0 (0%)	1 (3.3%)	0 (0%)	1 (1.1%)
Total	**30 (100%)**	**30 (100%)**	**30 (100%)**	**90 (100%)**
Mean ± SD	**24.10 ± 1.71**	**24.00 ± 3.38**	**23.27 ± 2.30**	**23.79 ± 2.56**

P value = 0.392 (Not Significant)

The demographic profile with respect to age was comparable among all three groups. Most patients belonged to the 20–30 years age group. There was no statistically significant difference in mean age distribution among the groups (P = 0.392), indicating that the study groups were age-matched.

Table 2: Comparison of Time of Extraction of Baby (in Minutes) among Three Groups of Patients Studied

Time of Extraction of Baby (Minutes)	Group A (n=30)	Group B (n=30)	Group C (n=30)	Total (n=90)	P value
From Induction	10.57 ± 2.06	10.67 ± 2.22	11.10 ± 2.28	10.78 ± 2.18	0.606
From Skin Incision	6.90 ± 1.83	7.10 ± 1.88	7.27 ± 1.89	7.09 ± 1.85	0.749

Statistical Test Used: One-way ANOVA test

The mean time for the extraction of the baby from induction as well as from skin incision was comparable among all three groups. There was no statistically significant difference between the groups with respect to extraction time (P > 0.05). This indicates uniformity in surgical duration and operative conditions among the study groups.

Table 3: Comparison of Uterine Tone among Three Groups of Patients Studied

Uterine Tone	Group A (n=30)	Group B (n=30)	Group C (n=30)	Total (n=90)
Adequate	30 (100%)	30 (100%)	30 (100%)	90 (100%)
Inadequate	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	**30 (100%)**	**30 (100%)**	**30 (100%)**	**90 (100%)**

P value = 1.000 (Not Significant)

Statistical Test Used: Fisher Exact Test
Uterine tone was adequate in all patients across the three groups. No statistically significant difference was observed among the groups with respect to uterine tone (P = 1.000).

Table 4: Comparison of Side Effects among Three Groups of Patients Studied

Side Effects	Group A (n=30)	Group B (n=30)	Group C (n=30)	Total (n=90)	P value
Intraoperative Nausea/Vomiting	5 (16.7%)	1 (3.3%)	12 (40%)	18 (20%)	0.002**
Intraoperative Uterine Bleeding	30 (100%)	30 (100%)	30 (100%)	90 (100%)	1.000

Statistical Test Used: Chi-square test/Fisher Exact Test
The incidence of intraoperative nausea and vomiting was significantly higher in Group C (40%) compared to Group A (16.7%) and Group B (3.3%) with a statistically significant difference (P = 0.002). No other major side effects or abnormal uterine bleeding were observed among the groups.

Table 5: Comparison of APGAR Score among Three Groups of Patients Studied

APGAR Score	Group A (n=30)	Group B (n=30)	Group C (n=30)	Total (n=90)	P value
1st Minute	8.13 ± 0.43	8.07 ± 0.58	8.03 ± 0.49	8.08 ± 0.50	0.739

5th Minute	8.73 ± 0.58	8.60 ± 0.50	8.80 ± 0.41	8.71 ± 0.50	0.295

Statistical Test Used: One-way ANOVA Test
The mean APGAR scores at both 1 minute and 5 minutes were comparable among the three groups with no statistically significant difference (P > 0.05). This indicates similar neonatal outcomes and safety profiles among all study groups.

Median (range) APGAR score at 1 minute was 8 (7–9) in all three groups. Median (range) APGAR score at 5 minutes was 9 (7–9) in Group A, 9 (8–9) in Group B, and 9 (8–9) in Group C.

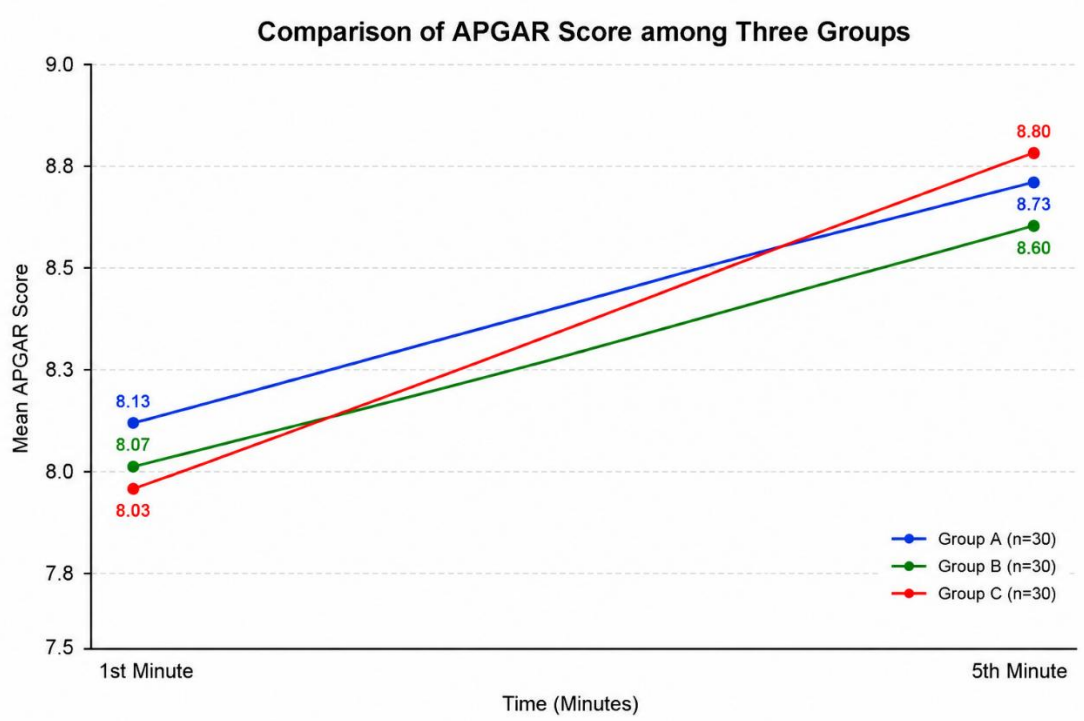

Table 6: APGAR Score Distribution among Three Groups of Patients Studied

APGAR Score	Group A (n=30)	Group B (n=30)	Group C (n=30)	Total (n=90)	P value
1st Minute					1.000
1–3	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
4–6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
7–10	30 (100%)	30 (100%)	30 (100%)	90 (100%)	
5th Minute					1.000
1–3	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
4–6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
7–10	30 (100%)	30 (100%)	30 (100%)	90 (100%)	

Statistical Test Used: Chi-square Test/Fisher Exact Test
All neonates in the three groups had APGAR scores between 7–10 at both 1 minute and 5 minutes. No statistically significant difference was observed in APGAR score distribution among the groups, indicating favourable neonatal outcomes in all study groups.

DISCUSSION

Spinal anaesthesia is the preferred anaesthetic technique for caesarean section because it provides rapid and effective sensory blockade while allowing the mother to remain conscious during childbirth.[1] However, maternal hypotension remains one of the most common complications associated with spinal anaesthesia and is further aggravated by the administration of oxytocin following delivery.[5] The present study evaluated maternal and neonatal outcomes following co-administration of phenylephrine with oxytocin in patients undergoing caesarean section under spinal anaesthesia.

In the present study, demographic variables including age were comparable among the three groups, with no statistically significant difference observed. Most patients belonged to the age group of 20–30 years. This demographic similarity ensured homogeneity among the study groups and minimized confounding variables. Similar findings were reported by

Ngan Kee et al., who observed comparable demographic characteristics among study groups evaluating vasopressor use during caesarean section.[7]

The time required for extraction of the baby from induction and from skin incision was also comparable among the three groups, indicating similar operative conditions and surgical duration. This finding suggests that differences in maternal or neonatal outcomes were unlikely to be influenced by variations in surgical timing. Similar observations have been documented in previous obstetric anaesthesia studies.[9]

Adequate uterine tone was achieved in all patients across the three groups, and no statistically significant difference was observed. This indicates that co-administration of phenylephrine with oxytocin did not adversely affect uterine contractility. Oxytocin remains highly effective in promoting uterine contraction even when administered in combination with vasopressors.[4] Similar findings were reported by Thomas et al., who demonstrated preservation of uterine tone with concurrent phenylephrine administration.[10]

One of the significant findings of the present study was the reduced incidence of intraoperative nausea and vomiting in patients receiving phenylephrine along with oxytocin. Group C, which received oxytocin alone, showed the highest incidence of nausea and vomiting (40%) compared to Group A (16.7%) and Group B (3.3%), with statistical significance ($P = 0.002$). Maternal nausea and vomiting during caesarean section are strongly associated with hypotension and decreased cerebral perfusion.[14] Maintenance of blood pressure with phenylephrine likely contributed to the lower incidence of these symptoms in Groups A and B. Similar results have been reported by Cooper et al. and Ngan Kee et al., who found that prophylactic phenylephrine significantly reduced maternal nausea and vomiting during spinal anaesthesia for caesarean section.[8,9]

Neonatal outcomes assessed using APGAR scores at 1 minute and 5 minutes were comparable among all groups with no statistically significant difference. All neonates demonstrated APGAR scores between 7 and 10, indicating good neonatal adaptation and absence of clinically significant neonatal depression. These findings suggest that co-administration of phenylephrine with oxytocin does not adversely affect neonatal well-being. Similar observations were reported by Lee et al., who demonstrated that phenylephrine maintained maternal hemodynamic stability without compromising neonatal outcomes.[15]

The present study supports the growing evidence that phenylephrine is an effective vasopressor for maintaining maternal hemodynamic stability during caesarean section under spinal anaesthesia.[7,8] Furthermore, co-administration with oxytocin appears beneficial in reducing maternal adverse effects without affecting uterine tone or neonatal safety.

However, the study had certain limitations. The sample size was relatively small, and the study was conducted at a single centre. Advanced neonatal parameters, such as umbilical cord blood gas analysis were not assessed. Future multicentric studies with larger sample sizes and additional neonatal outcome measures may provide more comprehensive evidence regarding the optimal phenylephrine dose during caesarean section.

CONCLUSION

In conclusion, co-administration of phenylephrine with oxytocin during caesarean section under spinal anaesthesia effectively reduced maternal adverse effects, particularly nausea and vomiting, while maintaining adequate uterine tone and favourable neonatal outcomes. Among the studied doses, phenylephrine 75 µg demonstrated better maternal hemodynamic stability with minimal side effects.

REFERENCES

1. Chestnut DH. Obstetric anaesthesia: principles and practice. 5th ed. Philadelphia: Elsevier; 2014.
2. Corke BC, Datta S, Ostheimer GW, Weiss JB, Alper MH. Spinal anaesthesia for caesarean section. The influence of hypotension on neonatal outcome. Anaesthesia. 1982;37(6):658-662.
3. Rout CC, Rocke DA. Prevention of hypotension following spinal anesthesia for cesarean section. Int Anesthesiol Clin. 1994;32(2):117-135.
4. Thomas JS, Koh SH, Cooper GM. Haemodynamic effects of oxytocin given as i.v. bolus or infusion on women undergoing Caesarean section. Br J Anaesth. 2007;98(1):116-119.
5. Pinder AJ, Dresner M, Calow C, Shorten GD, O'Riordan J, Johnson R. Haemodynamic changes caused by oxytocin during caesarean section under spinal anaesthesia. Int J Obstet Anesth. 2002;11(3):156-159.
6. Langesaeter E, Dyer RA. Maternal haemodynamic changes during spinal anaesthesia for caesarean section. Curr Opin Anaesthesiol. 2011;24(3):242-248.
7. Ngan Kee WD. Phenylephrine infusions for maintaining maternal blood pressure during spinal anesthesia for cesarean delivery. Curr Opin Anaesthesiol. 2017;30(3):319-325.

8. Cooper DW, Carpenter M, Mowbray P, Desira WR, Ryall DM, Kokri MS. Fetal and maternal effects of phenylephrine and ephedrine during spinal anesthesia for caesarean delivery. Anesthesiology. 2002;97(6):1582-1590.
9. Ngan Kee WD, Khaw KS, Ng FF. Comparison of phenylephrine infusion regimens for maintaining maternal blood pressure during spinal anaesthesia for caesarean section. Br J Anaesth. 2004;92(4):469-474.
10. Thomas DG, Robson SC, Redfern N, Hughes D, Boys RJ. Randomized trial of bolus phenylephrine or ephedrine for maintenance of arterial pressure during spinal anaesthesia for caesarean section. Br J Anaesth. 1996;76(1):61-65.
11. Mercier FJ. Cesarean delivery fluid management. Curr Opin Anaesthesiol. 2012;25(3):286-291.
12. Apgar V. A proposal for a new method of evaluation of the newborn infant. Curr Res Anesth Analg. 1953;32(4):260-267.
13. Dyer RA, Reed AR, James MF. Obstetric anaesthesia in low-resource settings. Best Pract Res Clin Obstet Gynaecol. 2010;24(3):401-412.
14. Datta S. Obstetric anesthesia handbook. 5th ed. New York: Springer; 2010.
15. Lee A, Ngan Kee WD, Gin T. A quantitative, systematic review of randomized controlled trials of ephedrine versus phenylephrine for the management of hypotension during spinal anesthesia for cesarean delivery. Anesth Analg. 2002;94(4):920-926.