Original Article

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Effect of Two Different Doses of Intravenous Phenylephrine on the Prevention of Oxytocin Induced Hypotension in Lower Segment Caesarean Section Under Subarachnoid Block: A Randomised Controlled Study

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ABSTRACT

Introduction: Postpartum haemorrhage with an atonic uterus is one of the leading causes of maternal mortality during Lower Segment Caesarean Section (LSCS) in nearly 50% of cases. Oxytocin is the most commonly administered drug for achieving post-delivery adequate uterine contractions and placenta expulsion, thereby preventing postpartum haemorrhage. Co-administration of phenylephrine during LSCS under spinal anaesthesia inhibits Oxytocin-induced hypotension.

Aim: To compare the effectiveness of co-administration of two different doses of phenylephrine with oxytocin in preventing the incidence of Oxytocin-induced hypotension.

Materials and Methods: A randomised, double-blinded controlled trial was in the Department of Anaesthesiology, SMS Medical College and Attached Group of Hospitals, Jaipur, Rajasthan, India from August 2021 to July 2022, involving 120 parturients with American Society of Anaesthelsiologists (ASA) grade second undergoing LSCS under subarachnoid block. They were randomised into three groups: Group A received oxytocin 3U with normal saline, Group B received Oxytocin 3U with Phenylephrine 50 mcg, and Group C received Oxytocin 3U with Phenylephrine 75 mcg administered intravenously over five minutes after the baby's extraction. The incidence of hypotension, requirement for the total rescue dose of Phenylephrine, and side effects were recorded. Statistical analysis was performed using Analysis of Variance (ANOVA) and Chi-square test.

Results: Demographic parameters such as age, height, weight, gestational age, and duration of surgery were comparable in all groups. The incidence of hypotension (Group A (Control): 77.5%, Group B (PE50): 47.5%, Group C (PE75): 22.5%, p<0.001), lowest Mean Arterial Pressure (MAP) after Oxytocin infusion (Group A: 67.80±6.16 mmHg, Group B: 68.23±3.96 mmHg, Group C: 72.50±5.87 mmHg, p<0.001), dose of rescue vasopressor requirements (Group A: 75.5±56.61, Group B: 40±50.89, Group C: 17.50±34.99, p<0.001), and incidence of side effects were significantly lower in Group C compared to Group B and Group A.

Conclusion: Compared to Phenylephrine 50 mcg, the co-administration of Phenylephrine 75 mcg with Oxytocin 3U reduces the incidence of Oxytocin-induced hypotension and the need for rescue vasopressors during LSCS under subarachnoid block.

Keywords: Arterial blood pressure, Postpartum haemorrhage, Vasopressor

INTRODUCTION

Maternal hypotension causes various maternal and foetal complications [1-6]. In parturients undergoing LSCS under spinal anaesthesia, maternal hypotension is primarily caused by a higher level of sympathetic blockade due to the increased spread of local anaesthetic in the cerebrospinal fluid during spinal anaesthesia and by Oxytocin-induced hypotension after the delivery of the baby, resulting from the relaxation of smooth muscles in the arteries caused by Oxytocin [7-12]. Prompt treatment with various vasopressors such as phenylephrine, Mephentermine, and Ephedrine, along with fluid co-loading, is the cornerstone in the management of hypotension during LSCS under spinal anaesthesia, as they increase systemic vascular resistance and maintain MAP through vasoconstriction [13-15]. Phenylephrine, a directly acting α-1 adrenergic agonist with a short duration of action, is the first line choice of vasopressor for preventing and treating maternal hypotension in parturients [13-15]. It offers various advantages over other vasopressors, such as better ability to maintain uteroplacental blood flow, better maintenance of MAP during spinal anaesthesia due to its quick peak effect within one minute, absence of foetal acidosis, and suitability in situations where tachycardia is undesirable as it can cause baroreceptor mediated reflex bradycardia and decreased cardiac output [13-15]. When co-administered with Oxytocin in titrated doses as an infusion, Phenylephrine blunts the effects of Oxytocin-induced hypotension and reflex tachycardia [4]. Gangadharaiah R et al., compared two different doses of Phenylephrine (50 mcg and 75 mcg) in preventing Oxytocin-induced hypotension in 90 parturients undergoing LSCS under spinal anaesthesia [4]. Only a few studies recommend a minimum effective dose of phenylephrine as 75 mcg for co-administration with Oxytocin during LSCS under spinal anaesthesia to prevent Oxytocin-induced hypertension and its other cardiovascular side effects [3-7]. However, further studies are needed to strengthen this hypothesis. The present study aimed to further contribute to the existing literature by demonstrating that the minimum effective dose of phenylephrine for preventing Oxytocin-induced hypotension is 75 mcg, and that co-administration of phenylephrine 75 mcg with Oxytocin 3U more effectively reduces the incidence of Oxytocin-induced hypotension compared to phenylephrine 50 mcg in parturients undergoing LSCS under spinal anaesthesia [4]. The current study compares the effectiveness of co-administering two different dosages of phenylephrine with Oxytocin in reducing the incidence of Oxytocin-induced hypotension.

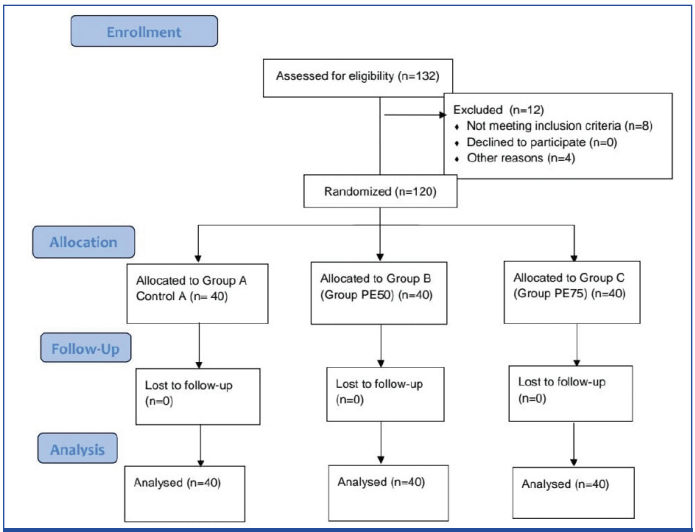
MATERIALS AND METHODS

This randomised double-blinded controlled trial was conducted from August 2021 to July 2022 in the Department of Anaesthesiology at SMS Medical College, Jaipur, Rajasthan, India. The study received approval from the Institutional Ethics Committee (IEC No.-1034/MC/EC/2021) and was registered under the Clinical Trials Registry of India (CTRI No.-CTRI/2022/04/042110).

Inclusion criteria: The study involved a sample of 120 parturients scheduled for elective or semi-elective LSCS, with a body weight between 40 to 70 kg and an age between 18 to 35 years. The participants had to be classified as ASA grade second.

Exclusion criteria: The study excluded parturients who were unwilling to participate, those classified as ASA grade 3rd, 4th, or 5th, individuals with a history of allergic reactions to hyperbaric Bupivacaine or phenylephrine, those with a skin infection at the injection site, individuals with Pregnancy-Induced Hypertension (PIH)/eclampsia/preeclampsia, those with a history of blood coagulopathies, and those with hepatorenal impairment.

Sample size calculation: To calculate the sample size and randomise the participants, a total of 40 cases were required in each group. The study aimed to detect a minimum difference of 2 mmHg in the Median Mean Arterial Pressure (MAP) between the two groups, with a 95% confidence interval, 80% power, and 0.05 alpha error. The sample collection was performed using a simple random technique through the opaque sealed envelope method [Table/Fig-1].



[Table/Fig-1]: Consolidated Standards of Reporting Trial (CONSORT) flow diagram.

Study Procedure

In this double-blinding trial, the researcher (an anaesthesiologist) and the patient were both unaware of the specific drug and its quantity being studied. The anaesthesiologist administering the spinal anaesthesia and the one studying the drug's effects were different individuals.

Group A (Control Group) received 3U of oxytocin and a 10 mL infusion of 0.9% normal saline over five minutes.

Group B (Group PE50) received 3U of oxytocin and a 50 mcg infusion of phenylephrine, diluted to 10 mL normal saline, over five minutes.

Group C (Group PE75) received 3U of oxytocin and a 75 mcg infusion of phenylephrine, diluted to 10 mL normal saline, over five minutes.

After obtaining approval from the research review board and Institutional Ethics Committee, and obtaining informed written consent from the parturients, a detailed preanaesthetic check-up was conducted. The patients were then randomly divided into three equal groups, each comprising 40 parturients, using the opaque sealed envelope method. Upon receiving the patients in the operation theater, monitors were attached, and an 18 G intravenous cannula was secured. The cannula was preloaded with Ringer's lactate solution at a rate of 10 mL/kg of body weight.

All the patients in each group received premedication with intravenous injection of 50 mg ranitidine and 10 mg metoclopramide before the administration of spinal anaesthesia. Patient vitals were recorded just before the induction of spinal anaesthesia. The spinal anaesthesia was administered to the patients in each group while they were in the left lateral position, targeting the L3-L4 space using a 2.2 mL dose of 0.5% hyperbaric bupivacaine through a 25 G Quincke spinal needle. The time of induction was noted. Immediately after the induction, the patients were repositioned in the supine position with a wedge placed under the right buttock to achieve a 15-degree tilt. Oxygen inhalation was initiated at a rate of 5 L/min using a simple face mask, and intravenous infusion of Ringer's lactate solution at 10 mL/min was started and maintained throughout the surgery. Vital signs including Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP), Heart Rate (HR), and Oxygen Saturation (SpO_2) were recorded just after the delivery of the baby, and these readings were considered as the baseline for present study.

Following the delivery of the baby, an infusion of Oxytocin was initiated at a rate of 10 U/hour in 500 mL of Ringer's lactate solution, which continued until the completion of the surgery. Phenylephrine, either 50 mcg or 75 mcg, diluted in 10 mL of Normal Saline (NS), was administered along with 3U of Oxytocin over a period of five minutes using a syringe pump through a separate intravenous line. In the control group (Group A), patients received an infusion of 3U oxytocin and 10 mL of 0.9% NS over five minutes. In Group PE50 (Group B), patients received an infusion of 3U Oxytocin and phenylephrine 50 mcg, diluted in 10 mL of NS, over five minutes. In Group PE75 (Group C), patients received an infusion of 3U Oxytocin and phenylephrine 75 mcg, diluted in 10 mL of NS, over five minutes.

After the co-administration of intravenous phenylephrine with Oxytocin 3U, intraoperative vitals were recorded at two-minute intervals up to 10 minutes, and then at five-minute intervals until the end of the surgery. If hypotension occurred, it was treated with a 100 mL bolus of intravenous fluid and a rescue dose of 50 mcg of phenylephrine administered intravenously over two minutes. This rescue dose was repeated at two-minute intervals until the MAP increased to within 20% of the baseline value (up to a maximum of four rescue doses of phenylephrine). If the hypotension did not respond to phenylephrine, additional doses of 6 mg of Mephentermine were administered until the MAP was restored to within 20% of the baseline. Hypotension was successfully treated in all patients. The primary measure was the prevention of the incidence of oxytocin-induced hypotension, and the secondary measures included preventing adverse changes in various haemodynamic parameters, including SBP, DBP, HR, MAP, and SpO_2, which were associated with oxytocin infusion. The study also aimed to evaluate the requirement for total rescued doses of phenylephrine to prevent the incidence of oxytocin-induced hypotension and to assess the proportion of cases with any side effects in parturients following the administration of oxytocin and phenylephrine.

STATISTICAL ANALYSIS

The data were analysed using Microsoft Excel 2013. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 28.0 (IBM). Descriptive analysis was conducted, presenting categorical variables (qualitative data) as frequencies/percentages using the Chi-square test, and continuous variables (quantitative data) as mean {Standard Deviation (SD)} or median {Interquartile Range (IQR)} using the ANOVA test. A p-value <0.05 was considered statistically significant.

RESULTS

[Table/Fig-2] showed that age, weight, height, mean duration of surgery, mean duration from induction to delivery, and from skin incision to delivery were statistically non significant (p>0.05).

[Table/Fig-3] showed that the mean systolic blood pressure (after delivery of the baby) was statistically significant at 10 minutes to 45 minutes among all three study groups (p<0.001).

Variables	Group A	Group B	Group C	p-value
Age (years)	25.88±3.48	25.73±3.82	27.18±3.75	0.158
Weight (kg)	58.75±2.92	59.90±3.06	59.45±2.56	0.177
Height (cm)	158.58±2.42	159.83±2.11	157.12±2.62	0.541
Mean duration of surgery (in min)	38.50±2.62	39.20±3.05	38.83±2.51	0.521
Mean duration from induction to delivery time (in min)	9.18±1.01	9.33±1.01	9.15±0.95	0.692
Mean duration from skin incision to delivery time (in min)	5.18±1.22	5.33±1.67	5.4±1.01	0.720

[Table/Fig-2]: Distribution of parturients according to age, weight, height, duration of surgery, duration from induction to delivery and skin incision to delivery among all groups.
p-value >0.05 was statistically non significant; Test used: Chi-square test

Time	Group A (Control)	Group B (PE50)	Group C (PE75)	p-value
Before induction	124.38±8.79	123.7±9.09	127.58±9.49	0.133
Before oxytocin	114.38±9.8	114.88±8.65	118.25±11.25	0.171
2 min	111.05±9.96	111.33±7.79	114.95±10.04	0.134
4 min	110.73±9.73	110.25±7.45	113.63±9.57	0.195
6 min	105.33±9.44	106.9±6.58	108.8±8.16	0.166
8 min	101.45±8.51	101.75±7.13	104.58±8.12	0.807
10 min	100.15±8.54	103.2±6.87	108.53±8.39	<0.001
15 min	100.48±8.8	106.93±7.6	111.2±6.21	<0.001
20 min	101.93±9.31	110.63±6.88	113.35±5.76	<0.001
25 min	105.88±8.28	113.13±6.59	114.28±5.74	<0.001
30 min	108.8±8.59	115.2±6.31	115.83±5.99	<0.001
35 min	111.2±8.15	117.15±7.02	117.2±5.54	<0.001
40 min	111.6±8.3	118.78±6.93	119.5±5.86	<0.001
45 min	112.93±8.48	119.38±6.45	120.24±5.77	<0.001
50 min	116.65±9.66	119.54±6.51	119.05±4.12	0.412

[Table/Fig-3]: Distribution of systolic blood pressure (after delivery of baby) among the parturients of all groups.
p-value <0.001 was statistically significant; Test used: ANOVA Test

[Table/Fig-4] showed that the mean Diastolic Blood Pressure (DBP) (after delivery of the baby) was statistically significant at 10 minutes to 50 minutes among all three study groups (p<0.001).

Time	Group A (Control)	Group B (PE50)	Group C (PE75)	p-value
Before induction	78.5±8.67	81.3±7.25	79.83±9.14	0.332
Before oxytocin	68.4±8.4	69.55±7.68	71.75±8.56	0.184
2 min	65.93±7.57	66.28±7.1	69.08±7.67	0.121
4 min	64.05±7.47	64.15±6.94	66.28±7.04	0.295
6 min	59.18±6.17	61.8±6.81	61.85±7.36	0.136
8 min	56.5±4.78	59.43±6.42	58.58±6.93	0.093
10 min	53.7±4.16	56.95±6.65	57.43±6.12	0.008
15 min	55.1±4.11	56.98±5.95	58.48±5.89	0.022
20 min	54.05±4.37	57.43±6.07	59.13±6.5	<0.001
25 min	56.95±3.97	60.18±6.54	61.2±5.59	0.002
30 min	57.75±3.95	60.7±6.41	62.9±5.81	<0.001
35 min	57.85±3.65	61.5±5.99	64.3±5.87	<0.001
40 min	58.13±3.84	62.38±5.95	64.95±6.39	<0.001
45 min	58.23±3.66	61.93±6.09	64.9±6.72	<0.001
50 min	58.5±3.1	63.0±5.2	67.5±7.7	<0.001

[Table/Fig-4]: Distribution of Diastolic Blood Pressure (DBP) (after delivery of baby) among the parturients of all groups.
p-value <0.001 was statistically significant; Test used: ANOVA Test

[Table/Fig-5] showed that the mean MAP (after delivery of the baby) was statistically significant at 10 minutes to 50 minutes among all three study groups (p<0.001).

Time	Group A (Control)	Group B (PE50)	Group C (PE75)	p-value
Before induction	93.8±8.05	95.35±6.67	95.75±8.3	0.491
Before oxytocin	83.73±7.42	84.68±6.87	87.25±8.57	0.108
2 min	81±6.99	81.28±6.43	83.73±7.79	0.096
4 min	79.53±7	79.5±6.36	82.03±7.04	0.167
6 min	74.65±5.27	76.75±5.21	77.5±6.96	0.084
8 min	72.13±4.54	74.2±5.41	73.93±6.28	0.186
10 min	69.18±4.44	72.38±5.22	74.53±5.61	<0.001
15 min	70.25±4.54	73.6±5.01	76.1±5.27	<0.001
20 min	70.08±4.68	76.33±4.59	76.1±4.22	<0.001
25 min	73.33±4.41	77.78±4.74	78.9±3.89	<0.001
30 min	74.68±4.41	78.95±4.4	80.6±3.64	<0.001
35 min	75.7±3.99	80.03±4.5	81.98±3.86	<0.001
40 min	75.95±4.08	81.18±4.1	83.2±4.43	<0.001
45 min	76.5±3.95	81.03±3.84	83.25±4.69	<0.001
50 min	77.82±4.39	81.86±3.18	84.63±5.36	<0.001

[Table/Fig-5]: Distribution of Mean Arterial Pressure (MAP) among the parturients of all groups.
p<0.001 was statistically significant; Test Used: ANOVA Test

[Table/Fig-6] showed that the lowest MAP, as well as the mean time (9 and 10 min) at which the lowest MAP (post-baby extraction) after oxytocin infusion, was statistically significant (p<0.001), although the mean time was statistically non significant (p=0.373) among all three study groups.

Variables	Group A (Control) n=40	Group B (PE50) n=40	Group C (PE75) n=40	p-value
Lowest MAP after oxytocin infusion	67.80±6.16	68.23±3.96	72.50±5.87	<0.001
Time at which lowest MAP recorded after oxytocin infusion	10.2±4.23	9.18±2.71	9.25±3.77	0.373

[Table/Fig-6]: Distribution of lowest MAP and mean time at which lowest MAP recorded after oxytocin infusion among the parturients of all groups.
p-value <0.001 was statistically significant and p-value=0.373 was statistically non significant; Test used: ANOVA Test

[Table/Fig-7] showed that the incidence and total episodes of hypotension in parturients were statistically significant among all three study groups (p<0.05).

Variables	Group A (Control) n=40	Group B (PE50) n=40	Group C (PE75) n=40	p-value
Incidence of hypotension	31 (77.5%)	19 (47.5%	9 (22.5%)	<0.001
Total episodes of hypotension	60	32	14	<0.001

[Table/Fig-7]: Distribution of incidence and total no. of episodes of hypotension among the parturients of all groups.
p-value <0.05 was statistically significant; Test used: ANOVA Test

The incidence of hypotension was significantly higher in Group A (Control, 77.5% {max}) compared to Group B (PE50, 47.5%) and Group C (PE75, 22.5%), respectively. Group A had 28 episodes of

hypotension more than Group B and had 46 episodes of hypotension more than Group C. It was observed that Group A (Control) had the highest number of total episodes (60), and Group C (PE75) had the least number of total episodes (14) of hypotension. [Table/Fig-8] showed that the requirement of the total dose of rescue phenylephrine and the mean consumption of rescue phenylephrine were statistically significant among all three study groups.

Variables	Group A Control n=40	Group B PE50 n=40	Group C PE75 n=40	p-value
Requirement of total dose of rescue phenylephrine and dose of rescue Phenylephrine	60	32	14	<0.001
Mean±SD	75.5±56.61	40±50.89	17.50±34.99	<0.001
Median (IQR)	50 (0-200)	0 (0-150)	0 (0-100)	<0.001

[Table/Fig-8]: Distribution of requirement of total dose of rescue Phenylephrine, and mean consumption of rescue phenylephrine among the parturients of all groups.
p-value <0.001 was statistically significant; SD; Standard deviation; IQR: Interquantile Range; Test used: ANOVA Test

[Table/Fig-9] showed the mean heart rate (post-delivery of the baby) among all three study groups. It was observed that there was no statistically significant difference between the mean heart rate among all three groups at all time intervals intraoperatively (p>0.05).

Time	Group A (Control)	Group B (PE50)	Group C (PE75)	p-value
Before induction	100.38±15.52	101.73±13.68	96.25±13.24	0.203
Before oxytocin	91.73±15.3	90.18±11.78	93.85±13.34	0.479
2 min	92.18±14.55	90.43±11.25	94.45±12.47	0.375
4 min	92.8±14.31	91.45±11.78	94.05±12.79	0.671
6 min	93.45±14.68	92.4±13.32	93.65±13.85	0.912
8 min	93.33±15.08	93.65±11.48	94.4±12.14	0.931
10 min	94.58±15.68	95.3±12.86	95.45±12.51	0.955
15 min	94.18±14.3	96.5±13.36	96.98±12.98	0.615
20 min	92±14.94	95.33±12.33	94.28±11.66	0.509
25 min	90.5±14.84	93.33±12.01	91.88±11.56	0.620
30 min	90.5±14.21	91.63±13.03	90.48±11.04	0.901
35 min	89.08±14.75	90.05±13.63	89.88±11.31	0.941
40 min	88.58±14.07	91±13.25	89.15±10.88	0.677
45 min	88.14±13.98	90.06±11.57	89.47±9.74	0.778
50 min	95.8±14.82	89±10.59	87.8±10.88	0.286

[Table/Fig-9]: The comparison of mean heart rate (after delivery of baby) among all three groups (beats/min).
Test Used: ANOVA Test

Variations in mean heart rate were less than ±10 beats/min at all time intervals among the three study groups, which did not have any clinical significance. [Table/Fig-10] showed the mean oxygen saturation (post-delivery of the baby) among all three study groups. It was observed that there was no statistically significant difference between the mean oxygen saturation among all three groups at all-time intervals intraoperatively (p>0.05). [Table/Fig-11] distribution of the incidence of complications (after delivery of the baby) among the parturients of all groups.

It was observed that there was a statistically significant difference in the incidence of nausea and vomiting and the incidence of shivering among all three study groups (p<0.005). The incidence of nausea and vomiting in Group A (Control, 35%) was significantly higher than in Group B (PE50, 15%) and Group C (PE75, 7.5%) (p<0.005). Nausea and vomiting were both treated with an intravenous injection of ondansetron 4 mg. The incidence of shivering in Group A (Control, 12.5%) was significantly higher than in Group B (PE50, 5%) and Group C (PE75, 2.5%) (p<0.005). Shivering was treated with an intravenous injection of tramadol 50 mg. Bradycardia only occurred in one patient of Group C (PE75) among the parturients of all three study groups.

Time	Group A (Control)	Group B (PE50)	Group C (PE75)	p-value
Before induction	99.28±0.45	99.3±0.46	99.33±0.47	0.890
Before oxytocin	99.58±0.5	99.4±0.5	99.5±0.51	0.297
2 min	100±1.52	99.68±0.47	99.83±0.38	0.310
4 min	99.73±0.45	99.73±0.45	99.8±0.41	0.676
6 min	99.6±0.5	99.5±0.51	99.58±0.5	0.651
8 min	99.63±0.49	99.53±0.51	99.43±0.47	0.223
10 min	99.45±0.5	99.45±0.5	99.43±0.5	0.968
15 min	99.63±0.49	99.48±0.51	99.6±0.5	0.355
20 min	99.6±0.5	99.53±0.5	99.7±0.46	0.142
25 min	99.63±0.49	99.55±0.5	99.88±1.56	0.307
30 min	99.68±0.47	99.78±0.42	99.6±0.5	0.245
35 min	99.65±0.48	99.7±0.46	99.53±0.51	0.255
40 min	99.63±0.49	99.53±0.51	99.65±0.48	0.489
45 min	99.68±0.53	99.41±0.5	99.92±1.58	0.093
50 min	99.5±0.53	99.4±0.51	99.71±0.47	0.242

[Table/Fig-10]: The comparison of mean oxygen saturation (after delivery of baby) among all three groups.
p>0.05 was not statistically significant; Test used: ANOVA Test

Complications	Group A (Control)		Group B (PE50)		Group C (PE75)		p-value
	N	%	N	%	N	%	
Bradycardia	0	0	0	0	1	2.5	0.365
Nausea/vomiting	14	35	6	15	3	7.5	0.005(S)
Shivering	5	12.5	2	5	1	2.5	0.005 (S)

[Table/Fig-11]: Comparison of incidence of complications (after the delivery of baby) among all three study groups.
p<0.005 was sttistically significant; Test used: Chi-square test

DISCUSSION

Caesarean sections are commonly performed under single shot spinal anaesthesia [1]. Postpartum haemorrhage with atonic uterus is the leading cause of maternal mortality during LSCS under spinal anaesthesia [4]. The major problem with the use of Oxytocin is that it causes clinically significant maternal hypotension and reflex tachycardia [3,4]. Phenylephrine, as an infusion, is the vasopressor of choice for the prevention and management of hypotension in parturients during LSCS [4]. The incidence of nausea, vomiting, and shivering was statistically significant in Group A (Control) compared to Group B (PE50) and Group C (PE75) (p<0.005). However, the incidence of bradycardia only occurred in one patient in Group C (PE75) among all three study groups. Similar findings have been reported in previous studies, such as:

Gangadharaiah R et al., compared two different doses of phenylephrine (50 mcg and 75 mcg) on Oxytocin-induced maternal hypotension in 90 parturients undergoing LSCS under spinal anaesthesia. They concluded that when combined, oxytocin 3 U and phenylephrine 75 mcg significantly reduce the incidence of oxytocin-induced maternal hypotension during LSCS performed under spinal anaesthesia without producing any unfavourable side effects [4]. Jaitawat S et al., compared the effect of administering two different bolus doses of phenylephrine (75 mcg and 100 mcg) for the prevention of spinal-induced hypotension during LSCS under spinal anaesthesia in 120 parturients of ASA grade 1st and 2nd between 18 to 35 years of age. They concluded that prophylactic administration of bolus phenylephrine significantly decreases the incidence of maternal hypotension. A 75 mcg phenylephrine is preferred over 100 mcg phenylephrine, which causes significant bradycardia and

Author's name and Reference no.	Place of study	Population studied	Drugs used	Parameters assessed	Outcome
Present study	Jaipur, Rajasthan	120 parturients posted for elective and semi elective LSCS with ASA grade II, Age=18 to 35 years, Body weight= 40 to 70 kg	Injection phenylephrine 50 mcg and 75 mcg Injection oxytocin	Incidence of oxytocin-induced maternal hypotension. Incidence of side effects	Co-administration of phenylephrine 75 mcg with oxytocin after delivery of baby more effectively reduces the incidence of oxytocin induced hypotension amd less rescue vasopressor requirement as compared to co-administered 50 mcg during caesarean section under spinal anaesthesia.
Raja Ram N et al., [1]	Andaman and Nicobar Island, India	100 ASA physical status class II parturient with singleton foetus	Inj. Phenylephrine 100 mcg in 500 mL Ringer's Lactate (R.L) solution Inj. ephedrine 6mg in 500 mL RL solution	Incidence of maternal hypotension. Incidence of nausea and vomiting	Prophylactic phenylephrine 100 mg added to coloading solution, prevents incidence of maternal hypotention significantly more than prophylactic ephedrine 5 mg.
Chaturvedi NK et al., [3]	Kolkata, West Bengal, India	40 (20 in each group) ASA 1 and 2 pregnant women with term uncomplicated singleton pregnancy	Inj. phenylephrine-prophylactic infusion started at rate of 60 mL\hr (50 mcg/min} Injection Mephentermine prophylactic infusion started at rate of 600 mcg/min	Incidence of maternal hypotension	Both drugs are comparable in terms of prevention of maternal hypotension. However phenylephrine has better control of maintenance over blood pressure than that of mephertermine.
Gangadharaiah R et al., [4]	Bengaluru, Karnataka, India	90 Parturients with uncomplicated singleton pregnancy	Injection phenylephrine (50 mcg and 75 mcg) Injection oxytocin	Incidence of oxytocin induced hypotension Incidence of side effects	Co-administration of phenylephrine 75 mcg with oxytocin after delivery of baby more effectively reduces the incidence of oxytocin induced hypotension as compared to coadministered 50 mcg during caesarean section under spinal anaesthesia.
Dokaniya S et al., [5]	Nepal	60 parturients with ASA grade I and II	Inj. phenylephrine 100 mcg i.v. bolus Inj. ephedrine 6 mg i.v. bolus Inj. mephentermine 6 mg i.v. bolus	Incidence of maternal hypotension	i.v. bolus mephentermine is as effective as phenylephrine and ephedrine in maintenance of arterial pressure (on prevention of maternal hypotension) during spinal Anaesthesia. However phenylephrine has quicker peak effect comparatively and it causes reduction in heart rate.
Das S et al., [6]	Kolar, India	60 parturients, with ASA I and II grade	Inj. phenylephrine 50 mcg i.v. bolus Inj. ephedrine 6 mg i.v. bolus Inj. mephentermine 6 mg i.v. bolus	Incidence of maternal hypotension	All three vasopressor's is effectively maintained arterial Blood Pressure (BP) (or prevent maternal hypotention) during Spinal anaesthesia for caesarean section. Phenylephrine has quicker peak effect but more bolus doses were required to control the hypotension. Phenylephrine causes significant reduction in heart rate than ephedrine and mephentermine.
Raja SK K et al., [11]	Guntur, India	60 ASA type I and II parturients	Inj. phenylephrine 100 mcg i.v. bolus Inj. mephentermine 6 mg i.v. bolus	Incidence of maternal hypotension neonatal outcome	Both vasopressor drugs are effectively maintained B.P during spinal anaesthesia for caeserean section. As per this study, phenylephrine has quicker peak effect when compared to mephentermine and causes reduction in heart rate.

[Table/Fig-12]: Comparison of various haemodynamics and other parameters of present study with previous existing study [1,3-6,11]
Test used: Chi-square test

reactive hypertension [7]. Dokaniya S et al., conducted a prospective randomised double-blinded study to compare the effect of intravenous bolus of phenylephrine, Ephedrine, and Mephentermine for the maintenance of haemodynamic status and its inference on foetal outcome in 60 parturients undergoing LSCS under spinal anaesthesia. They concluded that intravenous bolus mephentermine is as effective as phenylephrine and Ephedrine in the prevention of the incidence of maternal hypotension during spinal anaesthesia for caesarean section [5]. Chaturvedi NK et al., conducted a randomised single-blinded prospective study to evaluate the effectiveness and safety of Mephentermine and phenylephrine intravenously for the treatment of hypotension in 40 expectant mothers undergoing LSCS under spinal anaesthesia. They concluded that both drugs were comparable in terms of preventing the incidence of maternal hypotension, but phenylephrine had better control over blood pressure maintenance [3].

Rajaram N et al., compared the effect of prophylactic phenylephrine and Ephedrine added to the coloading solution on maternal hypotension, nausea, and vomiting in 100 parturients undergoing LSCS under spinal anaesthesia. They concluded that compared to preventive Ephedrine 6 mg, the addition of phenylephrine 100 mcg to the crystalloid solution considerably reduces the risk of maternal hypotension. There was no difference in the maternal heart rate, nausea, and vomiting between the two groups. Comparison of various haemodynamics and other parameters ofpresent study with previous study had been shown in [Table/Fig-12] [1,3-6,11].

Limitation(s)

Haemodynamic changes were assessed using non invasive measurements of SBP, DBP, and MAP. Invasive blood measurements were not performed, which could have shown beat-to-beat variations and provided a more precise demonstration of haemodynamic changes in the three groups.

CONCLUSION(S)

The prophylactic co-administration of 75 mcg phenylephrine with oxytocin after the delivery of the baby effectively reduced the incidence and episodes of Oxytocin-induced hypotension and the requirement for rescue vasopressors compared to the prophylactic co-administration of 50 mcg phenylephrine with Oxytocin in parturients during LSCS under spinal anaesthesia, without causing any untoward side effects.

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