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ORIGINAL ARTICLE

Effect of left tilt of operating table during elective caesarean section on maternal haemodynamics and vasopressor requirement.

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ABSTRACT… Objective: To compare the effects of left tilt of operating table on maternal hemodynamics and vasopressor requirement in contrast to supine position during caesarean section. **Study Design:** Comparative Analytical Study. **Setting:** District Head Quarter Hospital, Rawalpindi. **Period:** December 2021 to February 2022. **Material & Methods:** A total of 38 participants were included by the lottery method of randomization into the two groups according to the inclusion and exclusion criteria: supine group and left tilt group. For Supine Group, spinal anesthesia was administered in the sitting position, and then supine position was maintained. For Left tilt group, spinal anesthesia was administered in the sitting position and was then maintained in the supine position until the full anesthetic effect was achieved, and the table was tilted 15 °to the left. The Systolic and the diastolic blood pressures were noted at regular intervals. Data were entered and analyzed using SPSS version 25. **Results:** The results showed that systolic blood pressure decreased significantly in the supine group ($F = 16.65$, $p < 0.000$) compared to the left-tilted group ($F = 2.1$, $p = 0.12$). Intraoperative phenylephrine was required by four out of 20 participants in the supine group after 10 and 15 minutes, of out 2/20 participants after 20 minutes and out of 6/18 participants after 30 minutes. None of the participants in the left-tilt group required intraoperative phenylephrine. **Conclusion:** The left tilted position of the operating table is better than the supine position in terms of maternal hemodynamics and vasopressor requirement during Caesarean section.

Key words: Aortocaval Compression, Caesarean Section, Hypotension, Left Tilt Position, Phenylephrine, Vasopressor.

INTRODUCTION

Caesarean Section also known as C-Section is the procedure in which fetus is delivered through an incision in mother's abdomen. It is usually indicated when considered safer for both the child and mother.[1,2] The World Health Organization recommends that the C-section rate should not more than 10-15%.[3] However, many underdeveloped countries have a relatively higher rate of cesarean section and may have adverse effects on fetal health. Common complications associated with cesarean section include hypotension, postpartum hemorrhage, bladder, ureter, bowel injuries, postoperative ileus, sepsis, and Ogilvie syndrome.[4]

C-section is usually performed under either general or regional (epidural or spinal) anesthesia. In spinal anesthesia, a specialized needle is used to inject an anesthetic agent into the subarachnoid space.[2,5] However, during the supine position, hypotension results from reduction in venous return by weight of gravid uterus.[6] This aortocaval compression (ACC) further accentuates hypotension during spinal anesthesia administered during surgery.[7] Even brief episodes of hypotension can have adverse effects on both the mother and fetus. Many have advocated the tilted supine position of the operating table to displace the gravid uterus from the aorta and Inferior Vena Cava, but even 34 °of tilt has been associated with ACC.[8] A Cochrane

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database review rejected the role of using a wedge or tilting the operating table to improve the hemodynamics of patients undergoing C-sections.[9] This has prompted many trials regarding the role of the left tilt of the operating table in maternal hemodynamics.[10] However, the left tilt position of the operating table has been supported by evidence for maintaining better maternal hemodynamics during C-section.[11]

Our study aimed to investigate the effect of the left tilt of the operating table on systolic blood pressure (SBP) and diastolic blood pressure (DBP), heart rate, and the frequency of phenylephrine requirement to maintain blood pressure within the normal range.

MATERIAL & METHODS

The present study is a comparative analytical study which was carried out from December 2021 to February 2022. It was conducted in District Headquarter Hospital, Rawalpindi, an affiliated hospital of Rawalpindi Medical University, after ethical approval from institutional ethical review board of District Headquarters Hospital (REF:2022/ANS/1013-D) as per Declaration of Helsinki.

A total of 38 participants aged ≥ 18 years who underwent elective Caesarean section for a term singleton pregnancy (ASA I/II) were included after informed written consent for participation in the study. Participants with comorbidities (hypertension, diabetes mellitus, cardiovascular or cerebrovascular disease, and a history of coagulation disorders), any contraindication to spinal anesthesia, multiple pregnancies, pre-eclampsia, obesity (body mass index more than 30 kg/m2), and intrauterine growth were excluded from the study.

No control was used for this observation, and all groups were studied independently. All participants fasted for 6 h before Caesarean section. Baseline blood pressure was recorded as the mean of three recordings.

After fulfilling the inclusion and exclusion criteria, participants were randomized by the lottery method into two groups: supine (Group S) and left tilt. (Group L).

Before induction of spinal anesthesia, participants were administered an intravenous bolus of normal saline infusion at 10 ml/kg body weight over 15 min. Antiemetic prophylaxis was administered using an intravenous injection of metoclopramide (10 mg).

Spinal anesthesia was administered in the sitting position with 1.25 ml (12.5 mg) 0.5% hyperbaric bupivacaine at the L3-L4 interspace using a 25-gauge Quincke's spinal needle over 12–15 seconds. The extent of the neuraxial blockade was assessed using the pinprick, and surgical incision was allowed when a sensory level of at least T6 was attained.

For Group S (n = 20): spinal anesthesia was administered in the sitting position and then the supine position was maintained. For Group L (n = 18), spinal anesthesia was administered in the sitting position and was then maintained in the supine position until full anesthetic effect (motor and sensory loss) was achieved, and then the table was tilted 15 ° to the left.

During surgery, intravenous fluids were administered at a maintenance dose based on the weight of the patient. An Additional dose of antiemetic with ondansetron (8 mg) was later administered when there was an episode of vomiting or when nausea scored >7 on the verbal rating scale. After clamping the cord, 10 Units Inj. Oxytocin stat dose was administered intravenously, followed by infusion of total 30 units of oxytocin given at a rate of 5 units per hour via peripheral canula.

Standard monitoring included non-invasive blood pressure and pulse oximetry. The systolic and diastolic blood pressures were noted at 0,5,10,15,20,25 and 30 minutes intraoperatively and postoperatively. Hypotension was defined as a decrease in blood pressure > 20% of the baseline, systolic blood pressure less than 100 mmHg, or mean blood pressure less than 60 mmHg. Hypotension was treated with an

intravenous bolus of 100μg phenylephrine per protocol.
Age, symphysis-fundal height, birth weight, frequency of hypotension, total intravenous vasopressor (phenylephrine) requirements, and the use of additional antiemetics were also noted. The primary outcome variable was maternal hypotension incidence. The secondary outcome was the percentage of participants who required phenylephrine treatment.

The data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 25. Quantitative variables such as systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate, and mean arterial pressure (MAP) are reported as means and standard deviations. These parameters were compared between the two groups after 5 min using the independent sample " t-test. Within-group differences were compared using repeated-measures analysis of variance (ANOVA). Phenylephrine usage was recorded as a frequency and percentage. Statistical significance was set at $P \leq 0.05$.

RESULTS

The mean age of the 38 participants was 26.6 ± 3.8 years. The Mean symphysis-fundal height was 38.1 ± 1.8 cm and the mean weight of the baby was 2.9 ± 0.56 kgs. Twenty of 38 (52.6%) patients were operated in the supine position, whereas 18/38 (47.4%) were operated in the left tilt position. The demographic distributions of the supine and tilted groups are shown in Table-I.

Intraoperative Findings

The mean systolic and diastolic blood pressures at the time of induction of anesthesia, five, 10, 15, 20, 25, and 30 min with stratification between the two study groups are shown in Table-II.

The results of repeated measures ANOVA, after applying Greenhouse-Geisser correction, showed that the systolic blood pressure decreased significantly in the supine group ($F= 16.65$, $p< 0.000$) compared to the left tilt group ($F= 2.1$, $p= 0.12$). The diastolic blood pressure followed the same trend. It decreased significantly in the supine position ($F= 11.72$, $p<0.000$). The decrease in diastolic blood pressure was marginally significant in the left tilt angle group ($F= 2.7$, $p= 0.047$).

Consequently, the mean arterial pressure decreased significantly in the supine group ($F= 17.38$, $p<0.000$) compared to the left tilt group ($F= 2.31$, $p= 0.079$). The intraoperative heart rate also decreased significantly in the supine group ($F= 6.69$, $p<0.000$) compared to the left tilt group ($F= 2.39$, $p= 0.085$) (Table-II).

Intraoperative hypotension was seen more frequently in the Supine group with respect to the Left Tilt group as seen in Table-III

Postoperative Findings

The mean postoperative systolic blood pressure at 0, 15, and 30 minutes was 105.5 ± 17.6, 103.3 ± 11.1, 110.7 ± 12.5 in the supine group. Repeated-measures ANOVA showed no statistically significant difference between the values of postoperative systolic blood pressure ($F= 1.6$, $p= 0.216$). In the left tilt position group, the mean systolic blood pressure was 116.8 ± 17.9, 115.8 ± 13.3 and 112.8 ± 12.7 mmHg. There were no statistically significant differences between these values ($F= 0.99$, $P = 0.34$). Similarly, the mean postoperative diastolic blood pressure in the supine group was 64.9 ± 7.4, 62.5 ± 8.0, 68.7 ± 8.5 mmHg. In the left tilt group, the diastolic blood pressure was 75.7 ± 11.4, 72.6 ± 7.9, and 68.8 ± 4.8 mmHg respectively at 0, 15, and 30 min, respectively. There was a statistically significant difference between the supine ($F= 3.5$, $p= 0.039$) and left ($F = 4.2$, $p = 0.023$) tilt groups. The mean arterial pressure changed significantly in the supine group ($F= 3.65$, $p= 0.035$), while the change in the mean arterial pressure in the left tilt group was not statistically significant ($F= 3.06$, $p= 0.083$). Postoperative pulse rate did not show significant change both in the supine group ($F= 0.274$, $p= 0.699$) and the left tilt group ($F= 2.964$, $p= 0.099$) as shown in Table-IV.

Phenylephrine Requirement

Intraoperatively, Phenylephrine was used as a salvage vasopressor in patients in the supine group. None of the patients in the left tilt group

had significant hypotension, warranting the use of phenylephrine. However, postoperatively patients of the supine group more often required phenylephrine as compared to patients of the left tilt group as shown in Table-V.

	Supine (S) Group	Left Tilt (L) Group
Age	26.4 ± 3.7	26.8 ± 4.08
Symphysis-fundal height	38.1 ± 1.7	38.1 ± 1.9
Birthweight of Baby	3.1 ± 0.39	2.8 ± 0.71

Table-I. Demographics and characteristics of participants undergoing elective C-Section

	Time (Minutes)	Supine (S) Group	Left Tilt (L) Group	Significance (p-value*)
Systolic Blood Pressure	0	133.3 ± 17.7	127.7 ± 18.4	0.298
	5	116.7 ± 10.9	125.9 ± 11.2	0.015
	10	109.6 ± 15.2	131.8 ± 14.5	<0.000
	15	108.2 ± 13.2	129.2 ± 10.5	<0.000
	20	112.8 ± 9.7	122.9 ± 11.2	0.005
	25	115.5 ± 13.9	120 ± 12.5	0.305
	30	103.1 ± 11.7	126.4 ± 7.08	0.000
P-value**		**<0.000**	0.12	
Diastolic Blood Pressure	0	83.4 ± 13.1	73.7 ± 14.03	0.034
	5	71.7 ± 16.9	75.2 ± 13.5	0.486
	10	61.4 ± 13.9	67.5 ± 13.07	0.169
	15	63.4 ± 13	70.7 ± 11.2	0.075
	20	62.8 ± 12.8	64.5 ± 12.9	0.676
	25	63.1 ± 14.1	65.8 ± 16.03	0.587
	30	59.3 ± 16.6	68.1 ± 12.08	0.091
p-value**		**<0.000**	**0.047**	
Mean Arterial Pressure	0	100.03 ± 13.08	91.5 ± 13.8	0.058
	5	86.7 ± 13.9	92.1 ± 11.6	0.204
	10	77.5 ± 11.9	88.9 ± 12.06	0.006
	15	78.3 ± 10.2	90.2 ± 10.7	0.001
	20	79.5 ± 10.2	84 ± 10.8	0.190
	25	80.6 ± 13.7	83.8 ± 13.03	0.455
	30	73.9 ± 13.8	87.5 ± 8.6	0.002
p-value**		**<0.000**	0.079	
Heart Rate	0	103.1 ± 14.08	106 ± 17.9	0.581
	5	95.3 ± 16.3	108.3 ± 15.1	0.015
	10	87.8 ± 16.5	100.4 ± 17.2	0.027
	15	87 ± 13.3	99.3 ± 10.03	0.003
	20	86.8 ± 10.5	98.4 ± 13.6	0.005
	25	89.1 ± 10.2	99.3 ± 11.5	0.006
	30	88.4 ± 11.4	98.6 ± 12.7	0.020
p-value**		**<0.000**	0.085	

Table-II. Comparison of intraoperative hemodynamic parameters between study groups

***Independent samples t test**

****Repeated measures ANOVA**

Parameter	Time	Supine (S) Group	Left Tilt (L) Group
Intraoperative hypotension	0	0 (0%)	0 (0%
	15	4/20 (20%)	0 (0%)
	30	6/20 (30%)	0 (0%)

Table-III. Frequency of patients with hypotension in the supine and the left tilt group.

	Time (Minutes)	Supine (S) Group	Left Tilt (L) Group	Significance (p-value*)
Systolic Blood Pressure	0	105.5 ± 17.6	116.8 ± 18	0.068
	15	103.3 ± 11.1	115.8 ± 13.3	0.004
	30	110.7 ± 12.5	112.8 ± 12.7	0.631
p value**		0.216	0.34	
Diastolic Blood Pressure	0	64.9 ± 7.4	75.8 ± 11.5	0.002
	15	62.5 ± 8.03	72.6 ± 7.9	0.001
	30	68.7 ± 8.6	68.9 ± 4.8	0.942
p value**		**0.039**	**0.023**	
Mean Arterial Pressure	0	78.4 ± 9.4	89.4 ± 12.3	0.005
	15	76.1 ± 8.1	87 ± 8.4	0.000
	30	82.7 ± 7.9	83.5 ± 5.7	0.736
p value**		**0.035**	**0.083**	
Heart Rate	0	86.8 ± 9.3	89.5 ± 9.4	0.396
	15	87.4 ± 9.5	85.5 ± 11.7	0.594
	30	86 ± 10.7	82.9 ± 14	0.452
p value**		0.699	0.099	

Table-IV. Comparison of postoperative hemodynamic parameters in study groups

***Independent samples "t" test**

****Repeated measures ANOVA**

	Time	Supine (S) Group	Left Tilt (L) Group
		Phenylephrine Used	Phenylephrine Used
Intra-Operative Period	At 0 min	0/20 (0%)	0/18 (0%)
	At 10 min	4/20 (20%)	0/18 (0%)
	At 15 min	4/20 (20%)	0/18 (0%)
	At 20 min	2/20 (10%)	0/18 (0%)
	At 30 min	6/18 (33%)	0/18 (0%)
Post-Operative Period	At 0 min	8/20 (40%)	2/16 (12.5%)
	At 15 min	4/20 (20%)	2/16 (12.5%)
	At 30 min	2/20 (10%)	2/16 (12.5%)

Table-V. Comparison of phenylephrine requirement between the study groups

DISCUSSION

There have been discrepancies regarding recommendations and the role of treatments to relieve aortocaval compression in the reduction of hypotension during C-section.[12] Some studies have advocated ACC as a possible reason for hypotension in C-section, while others state that it is due to spinal anesthesia.[13,14] However, in our study, both groups received spinal anesthesia, so the increased rate of hypotensive episodes in the supine group could be related to the position of the mother rather than spinal anesthesia, as the latter factor was the same in both study groups.

In our study, intraoperative systolic blood pressure decreased from baseline to 30 min. The SBP decreased gradually from baseline to 15 min. The apparent increase in SBP at 20 and 25 min was due to the phenylephrine required by four participants after 10 and 15 min and two participants after 20 min. In our study, 20% of the mothers in the supine group had hypotensive episodes at 20 min and 30% had hypotensive episodes at 30 min. None of the mothers had hypotension in the left-tilt group. In another study by Mendonca et al., 90% of mothers in the supine group had hypotensive episodes, while 64% of

mothers had the same hypotensive episodes.[15,16,17] The SBP values were also insignificantly different between the two groups at 20, 25, and 30 min because of the phenylephrine, which had to be administered to prevent dangerously low blood pressure. In our study, mean MAP also decreased significantly from 100 to 74 in the supine group compared to an insignificant decrease from 91.5 to 87.5 in the left tilt group. In the study by Hasanin et al., the mean arterial pressure was 59 at a 15 °tilt position compared to an MAP of 50 in the supine position.[10] This strengthens the idea that the supine position causes compression of the inferior vena cava, leading to decreased blood pressure owing to decreased preload. A Left tilt of only 15 °markedly reduces hypotension due to the release of the gravid uterus from IVF.

Diastolic blood is a reflection of peripheral vascular resistance where left tilt position of operating table affects preload without alterations in systemic vascular resistance. In our study, the heart rate decreased gradually from a mean value of 103 at baseline to 88 at 30 min in the supine group. Heart rate values were slightly higher in the left-tilt group at the corresponding time. However, they also decreased from 106 at baseline to 98.6 at 30 min. However, the decrease in heart rate was not statistically significant in the study. An increased heart rate in the left tilt group has also been reported by Hasanin et al., in which the heart rate increased from 102 at 0 °to 114 at 15°.[10] This can be explained by the brain-bridge reflex, according to which the increased preload on the left tilt causes atrial mechanoreceptors to stretch, which increases the heart rate.[18,19]

In the present study phenylephrine was used to treat hypotension more frequently in patients with supine position as compared to left tilt position of operating table. In the study conducted by Mendonca et al. there was no significant difference in the ephedrine dose required by the mothers in the tilt and the supine group.[11] This might be because of the difference in threshold and time at which a vasodilator is used which may affect the frequency and dosage of the drug. We used phenylephrine when the BP dropped below a critical level whereas others might have been more liberal in the use of a vasoconstrictor to prevent any dangerous outcome.

We also studied the difference of SBP, DBP, MAP and heart rate between the two groups in the postoperative period and found that these values were increased in the left tilt group as compared to the supine group. However, the change in the values at 15 and 30 minutes was not significantly different from those at the immediate postoperative period.

However, authors feel that fetal parameters should also be studied and compared between left tilt position and supine position of operating table so as to set global guidelines to ensure maternofetal safety. Moreover, further studies should be conducted on a scale larger than this with varying populations.

CONCLUSION

C-section in the left tilt position of the operating table is far better than in the supine position as it is associated with better maternal hemodynamics, fewer hypotensive episodes and the requirement of vasopressors.

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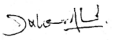
1	Zuhair Ali Rizvi	Research Methodology, Design of work, Draft formulation.	
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