

A study to evaluate the efficacy of left lateral tilt in preventing hypotension after spinal anesthesia in elective caesarian section patients

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Abstract

Introduction: During caesarean delivery, post-spinal hypotension is a typical complication among women. Post-spinal hypotension is thought to be caused by Aortocaval compression caused by the fetus. It's unknown whether left lateral tilting improves maternal cardiac output following "subarachnoid block (SAB)". The goal of this study is to see the efficacy of the left lateral tilting in preventing hypotension after spinal anesthesia in elective C- section patients. **Material and Methods:** We piloted a prospective study with 50 age matched subjects admitted for the C-section. The clinical findings like systemic vascular resistance, stroke volume, cardiac output, heart rate and Mean arterial pressure that are affected at the various lateral tilts of (30°,15°) were compared to supine position. The values were collected preoperatively, after the SAB and after the delivery. The data was analyzed using the ANOVA test deliberating P<0.05 as significant. **Results:** We observed no significant difference in the cardiac parameters before the surgery between the supine and for the lateral tilt angles of 15 and 30 degrees. However after the anesthesia significant variation of the cardiac parameters was noted in the supine position than supine position before the SAB. While after the SAB in the lateral tilt the MAP, Cardiac output, and Stroke volume were significantly greater compared to the supine position at both the angles of the left tilts. There was no difference in the values between the two tilt positions. After the delivery MAP, Cardiac output, and Stroke volume significantly increased in the supine position while the heart rate lowered significantly compared to the supine position after the SAB. **Conclusions:** The hypotension commonly seen among the pregnant women after the SAB can be prevented by the lateral tilt positions at both the 15° and 30° angles. Hence this position is encouraged for the after the C-section.

Keywords: C-section, Hypotension, Left lateral tilts, Cardiac output, Spinal anesthesia.

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Introduction

The women's body undergoes a great deal of changes during the pregnancy. There are both physiological and psychological changes that a woman has to endure at this time. The developing fetus causes the "Aortocaval compression" that leads to the hypotension in the supine position. This is a complete physiological phenomenon that is usually observed at the end of the third trimester[1,2]. Aortocaval compression has been proposed as the leading cause of the hypotension in the women who are presented for the delivery.

Various studies have been conducted in the past to evaluate the significance of the left lateral tilt in the prevention of the "post-spinal hypotension (PSH)" among the women during the C-section. However the alterations in the hemodynamics is debatable in these studies[3,4]. Contradictory studies have been done where the lateral tilt position to the left side has shown to impact the hemodynamics of the mother[4-6]. The changes after the surgery in the blood pressure at the various degrees of the left lateral tilts are yet to be elucidated. Hence in this study we aim to evaluate the efficacy of the left lateral tilting of two angles in preventing hypotension after spinal anesthesia in elective C- section patients

Material and methods

The study design

We piloted an observational prospective clinical study among 50 subjects who were admitted for the elective C-section. The study was conducted at the department of obstetrics and gynecology at the

territory medical care hospital and college.

The study was conducted for a period of one years from 2020-2021.

The institutional ethics clearance was obtained for the study. The study design was explained to the subjects and later the written consent was taken.

Selection criteria

We selected the age matched subjects, who were at full term, singletons, and were posted for the elective C-section. The selected subjects were free of any other medical conditions and were on no medications. We excluded the subjects with cardiovascular conditions, fetal disorders, diabetes mellitus, obese, and any other medical conditions that may alter the hemodynamics. We also excluded the subjects in whom the SAB was not successful during the procedure.

Data collection

The clinical parameters were noted on the day of the surgery before and after the procedures. We recorded the arterial blood pressure (ABP), systemic vascular resistance (SVR), cardiac output (CO), stroke volume (SV), and heart rate. The baseline readings were considered as those that were taken in the supine position after rest of 5 min. All the readings were recorded from the monitors that were applied at the start of the surgery using the "non-invasive blood pressure monitor", "electrical cardiometry", "pulse oximeter", and ECG. The recordings of all the parameters were done before the start of the premedication and the insertion of the intravenous line. The parameters were compared at supine, 15° and 30° angles of the lateral left tilt. The wedges were used for achievement of the desired position. The measurement of the parameters was repeated by taking a rest of 1min.

The surgical procedure

The intravenous administration of the metoclopramide (10 mg) and ranitidine (50mg) were done as premedication. Lactated ringer's

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infusion (500ml) with a twenty five gauge spinal needle, and in a sitting position SAB was done. The anesthesia was accomplished using hyperbaric bupivacaine (10 mg) with fentanyl (25µg) by intrathecal injection. After five minutes of the administration of the anesthetic the success of the SAB was verified and if it reached T4 dermatome it was reflected as successful.

Once the surgery started and the subject was returned to the supine position, the measurement of the blood pressure along with other hemodynamic values were recorded at every five minutes till the fetus was delivered. All the parameters were recorded before and after five minutes of the SAB at all the three positions. The readings were again recorded at the end of fetus delivery in supine position. The injection of Oxytocin as a bolus of 0.5 IU over 5 sec followed by 40 mIU/min infusion, was later administered. If the hypotension was to occur, the injection of ephedrine (9 mg) was given.

Outcomes

The demographics, cardiac output, mean arterial blood pressure, as well as the primary outcome the hypotension were taken before and after the surgery at the three positions.

Statistical analysis

All the data was recorded and was analyzed using the IBM SPSS ver 20. The percentages were applied to describe the categorical data. The comparison of the various parameters at the various positions was done applying the ANOVA test, while deliberating the $P < 0.05$ as significant.

Results

We observed that among the 50 women, the mean age was 27.1 ± 2.3 years, the mean weight 72.8 ± 4.9 Kg. The number of the subjects who showed hypotension was over 50 percent and that was observed in the supine position before and after the surgery. Only 2% subjects in the lateral tilt groups showed the hypotension.

We observed no significant change in the SVR, MAP, Cardiac output, Heart rate, and Stroke volume before the SAB was given for all the three positions. **Table 1**

We observed a significant lowering in the SVR, MAP, Cardiac output, and Stroke volume while the Heart rate increased after the SAB in the supine position when compared to the supine position before SAB. The MAP, Cardiac output, and Stroke volume were significantly greater compared to the supine position after the SAB at both the angles of the left tilt. The stroke volume and the resistance however were similar to the supine position for the two left lateral tilts. **Table 2**

After the delivery the MAP, Cardiac output, and Stroke volume significantly increased in the supine position while the heart rate lowered significantly compared to the supine position after the SAB. **Table 3**

The subjects with the hypotension were given ephedrine to elevate the blood pressure. The measurements were recorded before administration of the drug. There was no significant variation observed for the subjects who were and were not administered the ephedrine.

Table 1: Comparison of the parameters for the various positions before SAB

Parameters	Supine	15°	30°	P
Stroke volume (ml)	73.2 ± 6.3	73 ± 5.1	73 ± 3.2	NS
Heart rate (Bpm)	92 ± 1.2	94 ± 2.8	94 ± 7.3	NS
Cardiac output (L/min)	6.6 ± 5.2	6.7 ± 1.6	6.8 ± 8.3	NS
Mean arterial blood pressure (mmHg)	76 ± 8.5	77 ± 2.5	76.3 ± 5.1	NS
Systemic vascular resistance (dyn.s/cm ⁵)	932 ± 52.1	892 ± 25.1	887 ± 65.3	NS

Table 2: Comparison of the parameters for the various positions after SAB

Parameters	Mean ± SD			
	Supine	15°	30°	P
Stroke volume (ml)	53.2 ± 5.1	55 ± 6.2	55 ± 7.3	NS
Heart rate (Bpm)	101 ± 2.1	113 ± 5.3	111 ± 4.6	0.001
Cardiac output (L/min)	5.5 ± 3.9	6.2 ± 5.3	6.1 ± 4.3	0.001
Mean arterial blood pressure (mmHg)	50 ± 2.3	59 ± 8.3	59 ± 6.3	0.001
Systemic vascular resistance (dyn.s/cm ⁵)	760 ± 52.1	790 ± 63.2	789 ± 45.3	NS

Table 3: Comparison of the parameters for the various positions after delivery

Parameters	Mean ± SD		
	Supine before delivery	Supine after delivery	P
Stroke volume (ml)	53.2 ± 5.1	83.2 ± 2.0	0.001
Heart rate (Bpm)	101 ± 2.1	91 ± 4.6	0.001
Cardiac output (L/min)	5.5 ± 3.9	8 ± 6.2	0.001
Mean arterial blood pressure (mmHg)	50 ± 2.3	72 ± 1.7	0.001
Systemic vascular resistance (dyn.s/cm ⁵)	760 ± 52.1	701 ± 36.8	NS

Discussion

The pregnant women most commonly face the problem of hypotension at the end of the third trimester and after the spinal anesthesia during the C-section [7-10]. The lateral left tilting of the patients has been previously reported with a lower incidence of the hypotension. Hence in our study we aimed to evaluate different angles of the lateral tilt and its effect on the hypotension as well as other hemodynamic factors.

We observed that there was no significant difference of the cardiac variables before the anesthesia for the lateral tilt when compared to the spine position. After the anesthesia the cardiac parameters improved for the lateral tilt when compared to the supine position in our study. Similarly we observed between the two different angles of the lateral tilt. We had the advantage of comparing the three positions

among the same patient. The patient tilt didn't bring any change no significant variation before the SAB, in the cardiac variables in our study that was similar to the previous study done by Higuchi et al [5]. In their study they have evaluated the impact of the lateral tilts at the angles of 45°, 30°, 15°, by using the MRI to study the changes on the inferior vena cava and the aorta. They have observed that no significant change was seen at 15° tilt however at other angles of the tilt the compression on the inferior vena cava was relieved. They also observed that lateral tilt didn't affect the aorta and no significant change in the cardiac outputs was seen before the anesthesia. However the above study differs with our study in that the number of subjects in the study of Higuchi et al [5]. were only 10, and the values were recorded among them before anesthesia. They didn't compare the values after the anesthesia and after the delivery.

In the study of Bamber et al.[6], they have checked for the change in the cardiac parameters for the lateral left tilts of 12.5° and 5°. They used the “bio-impedance cardiography” to evaluate among 33 women and concluded no significant alterations. This study is contrary to our study[6]. In the study of Lee et al.[4], contrary to our study among women for the elective C-section they observed a greater cardiac output at a left lateral tilt of 15° before the anesthesia. They used the “supra-sternal Doppler” in their study that may have caused the variation between their study and ours. In our study we used the “electrical cardiometry”. Various other modalities of devices were used in the previous studies. The device used in our study uses an updated technology compared to the previous studies[11-15].

Our study is one of the firsts to compare the cardiac parameters after the anesthesia for the different tilt positions. The noticeable alterations of the lateral tilt were appreciated after the anesthesia in our study. The reason for the improved hemodynamics observed in our study may be explained by the relaxed abdominal muscles after the anesthesia[8,12,15]. The relaxed muscles help in the lateral displacement of the uterus that helps decompress the aortocaval system. This will bring about a greater change in the hemodynamics.

The significance of the lateral tilt after the anesthesia to improve the hemodynamics among the C-section subjects is still debated[10-12]. A Cochrane study has stated that the previous studies could not conclude the role of the tilting at the various degrees for the lowering of the hypotension and an alteration of the hemodynamics[3]. In our study we have established that after the anesthesia the lateral tilt has brought about the change in the hemodynamics and elevated the mean arterial pressure along with the cardiac output.

Compared to the management of the hypotension with the medications, this physical method of the management of the hypotension management is preferred as this will not have any side-effects on the fetus, nor on the mother. This lateral tilting method is safe, simple, quick, easy, and cost-effective[10-15].

The monitoring of the cardiac outputs during the C-section is of great implication that has been shown in the present study to benefit from the lateral left tilt. The alterations seen in the outputs after the SAB are debated. Few studies have concluded a greater cardiac output after the block that may be due to the lowered vascular resistance. Contrary to the above studies in the study of Liu et al.[10], have concluded a lower output after the block. In our study the lower output has been noted similar to the study of Liu et al.[10], this could be due to the same device being used in both the studies. In our study the lowered cardiac outputs are in lieu with the lowered arterial pressures and later increased after the left lateral tilt. Hence no conflicts were noted and the findings were within reason. In our study the heart rate lowered after the SAB in the lateral tilt position though no change in the stroke volume was seen. This has been explained by the “Bainbridge reflex”. This reflex is explained by the definition given in 1917 as “tachycardia induced by hypervolemia due to atrial mechanoreceptor stretch”[11]. The lateral tilting removes the pressure on the Aortocaval system, thus increasing the venous return and subsequently the rate of heart beat.

There was no variation for the two degrees of the tilt in our study between the outputs. Our finding are similar to the study of Lee et al.[4], and Kinsella SM[12]. The anesthetists can be benefited from the lateral tilt as the optimal hemodynamics can be achieved using a simple wedge for the lateral left tilt in the C-section[13,16].

There were few limitations in our study. The sample size was small and the investigators were not blinded. The positions were changed in the increasing order but they were not tested randomly. This may have affected the values as they may have been affected by the time rather than the inclination itself. The ephedrine was used in our study to treat the hypotension after the spinal anesthesia. However other pharmaceutical agents are also used for treatment of hypotension that has to be considered in future studies[16].

Conclusion

Within the limitations of the study, we can conclude that the lateral left tilt in the pregnant women may be beneficial in preventing the

hypotension, specifically among those who are to undergo C-section. The benefits are seen significantly after the anesthesia. The two angles of the tilt in our study had no significant difference observed between them. Further studies are suggested to corroborate our findings.

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