

A Randomized Prospective Study to Compare the Effect of Wedge, Manual Displacement of Uterus and no Intervention, to Reduce The Hemodynamic Effects of Aortocaval Compression in Parturients Undergoing Caesarean Section Under Subarachnoid Block

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ABSTRACT

Introduction: Aortocaval compression is an important cause of supine hypotension syndrome in the pregnant women. Subarachnoid block administered for Caesarean Section can further compound the hypotension and impairs uteroplacental circulation. Many methods have been evaluated to decrease degree of aortocaval compression during LSCS like left lateral tilt with wedge, tilting of operating table, mechanical or manual displacement of uterus. We have evaluated the effect of left lateral tilt with wedge, manual displacement of uterus and no intervention on pregnant women coming for lower segment Caesarean Section (LSCS) to decrease effect of aortocaval compression.

Method: Parturients were randomly allocated into Group S: 30 parturients placed in supine position; Group W: 30 parturients had wedge placed under right side of pelvis Group MD: 30 parturients were given manual displacement of uterus to left side.

Results: The incidence of hypotension post subarachnoid block (SAB) was highest in Group S i.e. 56.67% while it was similar in Group W and Group MD i.e. 26.67%. The mean (Standard Deviation) Mephentermine requirement in Group S was 4.6(4.4); Group W 1(2.3) while in Group MD 2(3.6) which is statistically significant $p < 0.001$. While the time to fall in SBP was not statistically different in all three groups.

Conclusion: We found leftward tilt of uterus with wedge or manual displacement effectively reduces incidence of maternal hypotension and subsequent need for vasopressor. It is easier to put wedge. We conclude that all the parturients posted for caesarean section should have wedge placed under the right side of pelvis and lumbar region to decrease incidence of hypotension.

Key words: Aortocaval Compression, Parturients, Wedge, Table Tilt, Manual Displacement, Hypotension.

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INTRODUCTION

Aortocaval compression (ACC) during pregnancy when parturients are supine is well recognized cause for supine hypotension syndrome.¹⁻⁴ Although the syndrome has been described to occur as early as 16 weeks of gestation, as the pregnancy proceeds, the uterus grows and compression becomes more pronounced. Symptoms may range from non-specific complaints to severe hypotension, cardiovascular collapse, loss of consciousness and subsequently fetal depression. Inferior vena caval compression decreases venous return and in turn cardiac output while aortic compression can lead to uteroplacental hypoperfusion. Majority of parturients with ACC are able to maintain blood pressure due to compensatory mechanisms and are clinically asymptomatic. Only

about 8% pregnant women in the 2nd and 3rd trimesters develops hypotension in supine position when ACC is severe.^{5,6} Sympathetic blockade after subarachnoid block can cause severe hypotension which further compounds the uteroplacental hypoperfusion and lead to fetal acidemia.^{7,8} It is therefore recommended to avoid ACC during LSCS by left uterine displacement. Many methods have been evaluated to decrease degree of aortocaval compression during LSCS like left lateral tilt with wedge⁹, tilting of operating table¹⁰, mechanical¹¹ or manual^{12,13} displacement of uterus. In our study we have compared the effect of left uterine tilt with wedge (W), manual uterine displacement (MD) and no intervention(S).

METHOD

After obtaining approval from Institutional Ethics Committee and written informed consent from participants 90 parturients posted for LSCS were randomly allocated into one of the three groups with help of randomization table.

Group S: (30 patients) parturients were placed in supine position

Group W: (30 patients) had wedge placed under right side of pelvis

Group MD: (30 patients) were given manual displacement of uterus to left side.^{12,13}

Parturients with comorbidities of Preeclampsia, eclampsia, Diabetes Mellitus, Gestational Hypertension, Heart disease, Bronchial Asthma, Anaemia and height less than 145 cm were excluded from the study. Pregnant women with fetal comorbidities (IUGR, abnormal Doppler and congenital anomalies), multiple gestation, polyhydromnios were precluded from joining this study. All the parturients were cannulated with 18G IV cannula and received premedication with intravenous Ranitidine 50mg and Metoclopramide 10mg half an hour before surgery. Ringers lactate 500ml was transfused over 10 min. In the operating room baseline parameters i.e. pulse rate, Blood pressure, SpO₂, Electrocardiogram (ECG) were noted in supine position and no patient in our study group had abnormal blood pressure readings preoperatively. Subarachnoid block was administered in sitting position with 25 gauge spinal needle (Quincke) in the L3-4

interspace and 2.0ml of hyperbaric bupivacaine (0.5%) was injected after obtaining free flow of cerebrospinal fluid. Parturients were immediately placed in supine position (Group S) or with wedge under right pelvis and lumbar region (Group W) or manual displacement of uterus (Group MD). The maneuver depending on the group was maintained till delivery of baby. The sensory block was assessed by loss of sensation to pin prick. Continuous Pulse rate, ECG and SpO₂ were monitored and NIBP was recorded every 2 min until delivery of the placenta and at 5-min intervals thereafter. Ringer’s Lactate was infused throughout the surgery at 100ml/hr.

Hypotension was defined as systolic blood pressure (SBP) of less than 100mm Hg and was treated with intravenous Mephentermine 6mg intravenous bolus until SBP was restored to 100mmHg while bradycardia (Heart Rate < 60/min) was treated with Atropine 0.3mg intravenously. After the delivery of baby Oxytocin 20 units in 500ml RL was administered as an infusion. Total Mephentermine requirement, SAB to delivery time, skin incision to delivery time, surgical time and interval to blood pressure drop from induction of block, amount of blood pressure fall from baseline, APGAR score at 0 and 5min were all recorded.

Statistical Analysis

Data was analyzed by using Epic info 7software. Mean and standard deviations were used for descriptive data. ANOVA test was used to compare means.

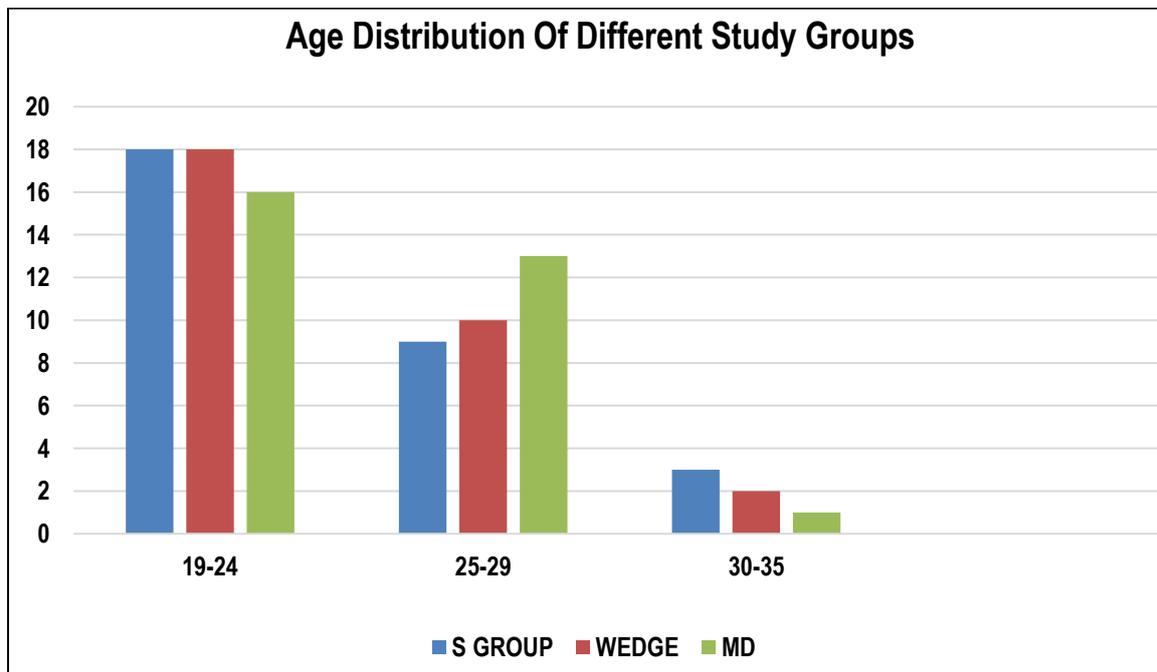


Table 1: Demographic data and Baseline vitals

Variable	MD		S		W		p-value
	Mean	SD	Mean	SD	Mean	SD	
Age	23.7	2.8	24.4	3.0	24.4	2.8	0.557
BMI	30.2	2.9	30.7	2.1	30.1	2.4	0.584
SBP	121.3	6.7	124.6	9.5	123.6	11.7	0.384
DBP	78.0	8.3	79.1	8.8	77.6	9.3	0.805
PR	96.2	14.8	98.4	15.0	98.0	14.1	0.828
SpO ₂	99.7	0.5	99.7	0.5	99.5	0.5	0.297

RESULTS

All the parturients were between the age group of 18 -32years (figure 1). Demographic data (age, BMI) and baseline vitals (PR, SBP, DBP, SpO₂) were comparable between three groups. (table1)

SAB to delivery, skin incision to delivery, surgical time were comparable in all three groups. (table2)

The incidence of hypotension was highest in Group S i.e. 56.67% while it was similar in Group W and Group MD i.e.26.67%.

The mean SBP fall in Group S was 36.5(13.9); Group W 27.8(6.5) while in Group MD 29.4(11) which was not statistically significant (p value 0.173).

Total mephentermine requirement was highest in group S followed by group MD followed by group W (figure 2). The mean

Mephentermine requirement in Group S was 4.6(4.4); Group W 1(2.3) while in Group MD 2(3.6) which is statistically significant (p-0.001). The time to fall in SBP was not statistically different in all three groups (Table 3).

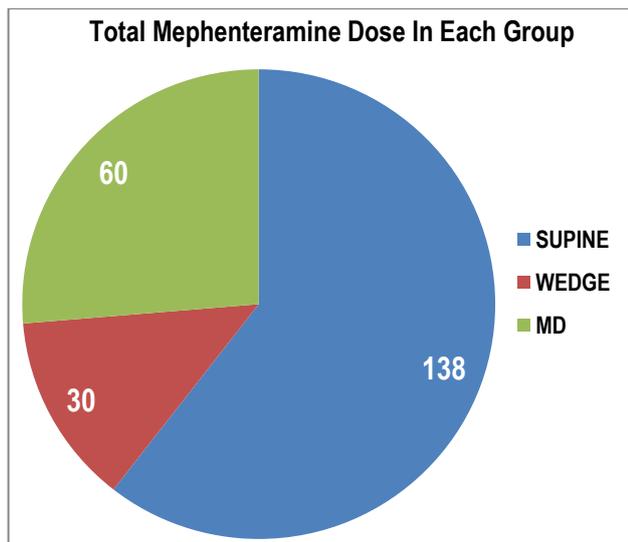
In our study we have demonstrated that mean value of Mephntermine requirement secondary to fall in SBP after SAB for LSCS was statistically higher in parturients positioned supine (4.6) while less in parturients with wedge (1) or Manual displacement (2) with a p value of 0.001.The mean fall in SBP in Group W was 27.8 and group MD was 29.4 and subsequently mean Mephentermine was not statistically significant. APGAR score at 0 and 5min were not statistically different in all three groups. No patient in all groups developed bradycardia, hence Atropine was not used.

Table 2: SAB to delivery, skin incision to delivery, surgical time Statistics

Variable	MD		S		W		p-value
	Mean	SD	Mean	SD	Mean	SD	
SAB-DELIVERY	5.8	1.6	6.6	2.0	6.7	2.0	0.162
INCISION-DELIVERY	3.3	1.3	3.3	1.8	3.7	1.6	0.236
SURGICAL TIME	28.47	7.85	28.5	8.57	27.6	8.32	0.678

Table 3: Mephentermine dose, SBP fall, Time to SBP fall Statistics.

Variable	MD		S		W		p-value
	Mean	SD	Mean	SD	Mean	SD	
MEPH DOSE	2.0	3.6	4.6	4.4	1.0	2.3	0.001
SBP Fall	29.4	11.0	36.5	13.9	27.8	6.5	0.173
Time to Fall	3.0	1.5	4.5	2.4	5.3	1.0	0.080



DISCUSSION

“Supine-hypotension” syndrome was first described in 1953 when Howard et al.¹ described a significant decrease in blood pressure in 18 of 160 term parturients placed in supine position; they ascribed the syndrome to occlusion of the inferior vena cava (IVC) by the gravid uterus. Abdominal aorta could also be occluded in the supine position by gravid uterus, potentially decreasing uterine artery blood flow as was observed by Bieniarz et al.⁴ in mid 1960s in series of patients using angiography and differential blood

pressure measurements in upper and lower extremities. Aortocaval compression (ACC) during late pregnancy when parturients are supine is well recognized cause for supine hypotension syndrome.^{1,4}

Use of lateral table tilt, pelvic tilt or uterine displacement to reduce aortocaval compression during Caesarean section (CS) is now inherent in obstetric anaesthesia practice. The common recommendation is a 15° lateral tilt which was first described by Crawford and colleagues in 1972 and was achieved using a wedge.¹⁴ However the degree of tilt needed to avoid ACC varies in each parturient and this could be the reason for hypotension observed in 26.67% parturients inspite of having wedge in our study. Further most parturients felt uncomfortable with tilt of 12.5° or more.¹⁵ Most of the surgeons are also not comfortable with the displacement and tend to neutralize it during uterine incision.

Kundra et al in their study demonstrated that manual displacement of the uterus effectively reduces the incidence of hypotension and ephedrine requirements when compared to 15° left lateral table tilt in parturients undergoing Caesarean section.¹³ In our study the mean fall in SBP in manual displacement was less (29.4) compared to supine group(36.5) and the mean mephentermine requirement was statistically significant (2) compared to supine (4.6) with a p value 0.015.Despite manual displacement in this group 26.67% parturients experienced hypotension which could be explained due to subjective nature of manual displacement and also surgeons demanded to relieve displacement while giving uterine incision.

Uterine displacement can be done by the use of mechanical displacers^{11,12,16} and has been shown to have good outcomes. The use of displacement devices may tend to extend uterine incision towards uterine vessels. If uterus needs to be repositioned for the incision it takes longer time to make readjustment in the device resulting in extending time to delivery and increase chances of maternal hypotension. Uterus can be repositioned faster in manual displacement method by withdrawing the hand. Various methods have been evaluated to reduce hemodynamic effect of ACC with the left tilt of operating table by 15 – 30° being an easy and popular method. But there some disadvantage as estimating the angles by eye has been found to be grossly inaccurate as studied by Morgan et al, with the true angle being much smaller than the estimated one.^{17,18} The tilt in the table also adds to the unease of the parturients with the added fear of sliding off the table, especially at angles beyond 12.5° of table tilt.¹⁵ The degree of table tilt effective for uterine displacement again is contentious as Higuchi et al have found with magnetic resonance imaging study of pregnant females that at least 30 degrees or more is needed to reduce the IVC compression¹⁹, but this is not correlated to blood pressure changes or effect on placental perfusion. The feasibility of performing LSCS in a patient with a 30 degree table tilt is to be considered, especially in situations demanding emergent delivery of fetus. The definition of supine hypotension syndrome or aortocaval syndrome as a reduction in cardiac output or as an inferior vena caval compression is too simplistic as not every pregnant woman in the supine position presents with hypotension and patients with severe hypotension can also be asymptomatic. Recent reports have even questioned whether the use of pelvic tilt has any effect on the incidence of hypotension after subarachnoid block.²⁰

Our study has found that though the physiology of supine hypotension might be more enigmatic than defined objectively parturients without any intervention needed statistically significant dose of mephentermine to maintain a systolic blood pressure above 100 mm Hg.

Besides the measures to keep the gravid uterus off the aorta and inferior vena cava by different means, magnitude of hypotension occurring in parturient undergoing caesarean section under subarachnoid block have also been reduced with prophylactic use of vasopressor, reducing the dose of intrathecal local anaesthetic, preloading with crystalloids or colloids. Low dose spinal anaesthesia i.e. 7.5 mg Hyperbaric bupivacaine provides adequate level of analgesia for LSCS without much fall of blood pressure and bradycardia.²¹ However some parturients experience visceral pain which makes it necessary to supplement with narcotics. Kee WD et al studied prophylactic use of vasopressor ephedrine to prevent hypotension due to sympathetic blockade during caesarean section, they concluded it does not completely eliminate chances of hypotension and may cause maternal side effects like nausea, vomiting, reactive hypertension and fetal acidosis.^{22,23}

Preloading with crystalloid to attenuate severity of hypotension was reevaluated by Rout C C et al and they found no difference in severity of hypotension, requirement of ephedrine dose and neonatal outcomes.²⁴ It is important to consider that the half-life of crystalloid in intravascular space is short and does not cause sustained maintenance of intravascular volume and may lead to

maternal fluid overload by decreasing colloid oncotic pressure.²⁵ Although use of colloid for preloading has been successful in decreasing incidence of hypotension.²⁶ It has concerns of anaphylactoid reaction, interference with coagulation tests, cost and risk of maternal fluid overload once autotransfusion occurs with delivery of baby.²⁷

Kundra et al suggest that moving a full-term parturient from the full left lateral to the lateral tilt position may prevent aortocaval compression more efficiently than when positioning the parturient from a supine to left lateral tilt position.²⁸

Even though interventions such as colloids, ephedrine, phenylephrine or lower leg compression can reduce the incidence of hypotension, none have been shown to eliminate the risk of maternal hypotension and need to treat it during spinal anaesthesia for caesarean section.²⁹ Also no conclusions are made with respect to rare adverse effects of interventions to prevent maternal hypotension, may be due to their probable low incidence and the small number of women studied.³⁰

CONCLUSION

In our study we found leftward tilt of uterus with wedge or manual displacement effectively reduces incidence of maternal hypotension and subsequently the need for vasopressor use. It is also important to keep in mind that hypotension should be prevented and managed by both physical means and use of appropriate vasoactive agents. Using the wedge is easier and surgeons at our institute found it more comfortable than manual displacement of uterus. Still further studies involving large sample size and multiple centers are needed to come to conclusion regarding the best method for displacement of uterus. We conclude that all the parturients posted for caesarean section should have wedge placed under right pelvis and lumbar region to decrease incidence of hypotension occurring due to aortocaval compression. Anaesthesiologist should be alert to treat hypotension if it occurs despite use of preventive intervention by having large bore iv cannula in place and intervening with vasopressors and intravenous fluids and not rely on any one technique but with judicious use of all.

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