Original Article

Relationship between Abdominal Circumference and Incidence of Hypotension during Cesarean Section under Spinal Anesthesia

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ABSTRACT

Introduction: The spread of local anaesthetics during spinal anaesthesia is affected by various factors and can be unpredictable especially in parturients undergoing caesarean section. Previous studies have shown a positive association between the abdominal circumference and size of the uterus. Enlarged uterus can compress the inferior vena cava and cause hypotension when lying supine.

Methods: After obtaining well informed written consent, total 88 women were studied. Patients were divided into two groups according to the median abdominal circumference (<98 cm and ≥98 cm). The primary outcome of this study was the relationship between abdominal circumference and incidence of hypotension after spinal anaesthesia in term pregnant women. Unpaired t-test was used for data analysis.

Results: There was no difference in incidence of hypotension between the groups. However, the decrease in mean arterial pressure and its percentage decrease from baseline were greater in the larger than in the smaller abdominal circumference.

Conclusion: Large abdominal circumference in pregnancy is associated with greater decreases in mean arterial pressure from baseline. However, there was no significant difference in incidence of hypotension between larger and smaller abdominal circumference groups.

Key words: abdominal circumference, spinal anaesthesia, caesarean section, hypotension

INTRODUCTION

Regional administration of anesthesia using local anesthetics is the preferred anesthetic technique for cesarean delivery.[1] This is due to the proven lower morbidity and mortality[2] when compared to general anesthesia that has a higher incidence of complications, such as: difficult intubation, rapid desaturation, greater chance of aspiration, and neonatal depression.[3] Plain bupivacaine is often used for spinal anesthesia.[4,5] However, the intrathecal spread of plain bupivacaine is highly unpredictable, especially in parturients due to increased abdominal pressure and decreased lumbosacral subarachnoid space volume.[6,7] Despite the advantages of regional anesthesia, it is not free of complications and already known limitations, such as difficult puncture in some cases, hypotension, total spinal anesthesia and post-dural puncture headache. Hypotension is one of the most common complications with an incidence of 15% to 33% 5-7 in the general population after spinal anesthesia and directly related to greater mortality.[3] In obstetric patients, hypotension is even more worrisome because besides showing greater incidence (20-100%) it can have serious maternal-fetal consequences, from an increased incidence of nausea and vomiting to fetal hypoxia due to changes in uteroplacental blood flow with consequent fetal acidosis.[8] Previous studies have demonstrated associations between larger abdominal circumference (AC) and higher abdominal pressure and level of sensory block,[9] which can lead to higher incidence of hypotension in obstetric patients. Another explanation for hypotension after spinal anesthesia is supine hypotensive syndrome, which is when hypotension while lying supine results from the enlarged uterus directly compressing the inferior vena cava and descending aorta. Thus, the incidence of hypotension may be greater in pregnant women with larger uteri than in those with smaller uteri. We conducted this study to evaluate the relationship between abdominal circumference and incidence of hypotension during cesarean section under spinal anaesthesia.

MATERIALS & METHODS:

We enrolled total 88 parturients with term pregnancy, aged between 20 to 45 years, ASA class I and II who were scheduled for cesarean section under spinal anesthesia. We excluded High-risk pregnancy (for example: placenta previa, abruptio placentae, eclampsia or preeclampsia), Multiple pregnancy, patients with Cardiovascular comorbidities, Obesity (body mass index>30), any contraindication to neuraxial anaesthesia, history of spinal surgery or spinal deformity, any bleeding disorder or patient on anticoagulants. All patients underwent a thorough pre-anaesthetic checkup which included detailed history taking, general examination and systemic examination. Routine investigations like complete haemogram, blood urea, serum creatinine, random blood sugar, ECG were carried out for all patients. Patients were explained in detail about the objective of the study, methodology, advantage and likely complications. Informed written consent was taken from those willing to participate in the study.

Abdominal circumferences of all patients were measured in supine position at the level of umbilicus by one operator throughout the study. An intravenous line was secured with an intravenous cannula and crystalloids were started. Patients were premedicated with Inj. Glycopyrrolate 0.2 mg i.v. and Inj. Ondansetron 4 mg i.v. All patients were monitored with standard monitoring including pulse oximetry, noninvasive blood pressure monitoring and electrocardiography before initiation of spinal anaesthesia. Then, spinal anaesthesia was performed by the same anaesthetist in all patients in sitting position using the median approach through the L3-L4 intervertebral space. A Quincke 25-gauge spinal needle was inserted with its bevel oriented parallel to the dural fibers and then rotated 90° to direct the bevel cephalad. Then, 0.5% hyperbaric bupivacaine was injected into the subarachnoid space. The level of spinal anaesthesia was assessed by pinprick sensation. The operative table was adjusted to achieve T4 level of spinal anaesthesia.

The blood pressure including systolic blood pressure, diastolic blood pressure, mean arterial pressure, and heart rate were obtained at baseline and every minute for 10 minutes after spinal anesthesia. In this study, hypotension was defined as a systolic blood pressure of less than 100 mmHg or a MAP of less than 65 mmHg.[10,11] The primary outcome of this study was the relationship between the incidence of hypotension and the abdominal circumference after spinal anesthesia in term pregnant women.

Total 88 patients were divided into two groups (44 in each group) using the median value (98 cms) of the abdominal circumference. All statistical analysis was performed using Statistical Package for Social Sciences software (SPSS). Quantitative variables were compared using the t-test. P< 0.05 was considered to denote statistical significance.

RESULTS

The study was conducted among 88 cases, 44 in each group. No statistically significant differences were seen in age, weight, ASA grade and duration of surgery.

Graph 1 shows changes in the MAP from the baseline (T0) and over the following 10 minutes at one-minute time interval (T1-T10) after administration of spinal anaesthesia. We observed no statistically significant difference in MAP between both the groups (P>0.05).

Graph 2 shows fall in MAP from baseline till 10 minutes after spinal anaesthesia. Fall in MAP was more in larger AC group as compared to smaller AC group at any point of time from T1-T10. This difference was statistically significant between both the groups at T8 (P<0.05).

There was no significant difference in incidence of hypotension between both study groups. However, decrease in MAP after spinal anaesthesia from baseline was higher in the larger AC group at all time intervals.

Table 1: Demographic data

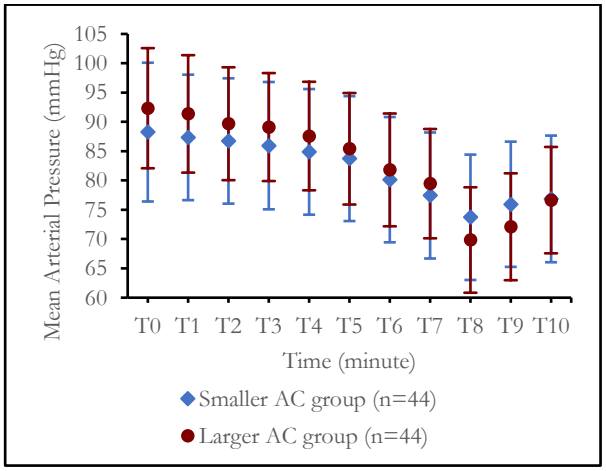
	Smaller AC group (n=44)	Larger AC group (n=44)	P value
Age (years) (Mean±SD)	26.4±8.76	28.11±6.42	>0.05
Weight(kg)	69.32±9.68	72.54±7.26	>0.05
ASA Grade (I/II)	15/29	18/26	>0.05
Duration of surgery (minutes)	56.18±10.87	52.83±8.72	>0.05

Table 2: Hemodynamic variables at baseline

	Smaller AC group (n=44)	Larger AC group (n=44)	P value
Systolic blood pressure (mmHg)	119.82±13.68	124.54±12.10	>0.05
Diastolic blood pressure (mmHg)	72.46±10.92	76.22±9.32	>0.05
Mean arterial pressure (mmHg)	88.25±11.84	92.33±10.25	>0.05
Heart rate (beats per minute)	86.28±9.72	90.46±12.82	>0.05

Table 3: Mean arterial pressure

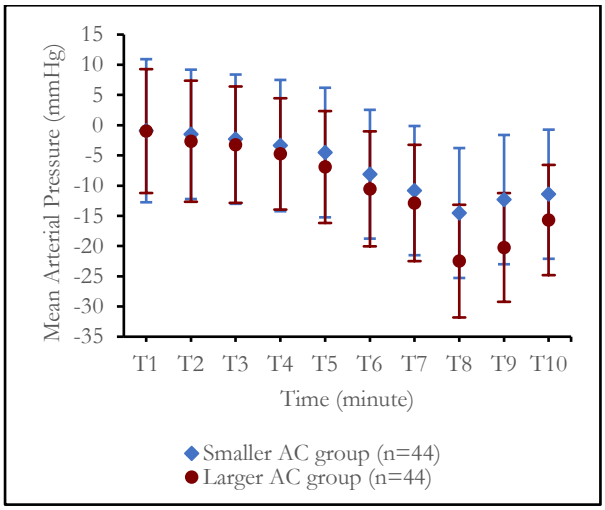
Time	Smaller AC group (n=44)	Larger AC group (n=44)	P Value
T0	88.25±11.84	92.33±10.25	>0.05
T1	87.34±10.70	91.36±10.02	>0.05
T2	86.74±10.69	89.68±9.63	>0.05
T3	85.94±10.87	89.11±9.21	>0.05
T4	84.88±10.72	87.58±9.26	>0.05
T5	83.73±10.66	85.41±9.52	>0.05
T6	80.14±10.69	81.80±9.62	>0.05
T7	77.43±10.75	79.46±9.32	>0.05
T8	73.72±10.70	69.84±9.00	>0.05
T9	75.94±10.69	72.10±9.12	>0.05
T10	76.85±10.81	76.64±9.07	>0.05



Graph 1: Mean Arterial Pressure

Table 4: Fall in MAP from Baseline

Time	Smaller AC group (n=44)	Larger AC Group (n=44)	P value
T1	0.91±18.72	0.97±19.58	>0.05
T2	1.51±18.65	2.65±19.40	>0.05
T3	2.31±18.57	3.22±19.34	>0.05
T4	3.37±18.46	4.75±19.19	>0.05
T5	4.52±18.34	6.92±18.96	>0.05
T6	8.11±17.97	10.53±18.60	>0.05
T7	10.82±17.70	12.87±18.36	>0.05
T8	14.53±17.34	22.49±17.45	<0.05
T9	12.31±17.55	20.23±17.66	<0.05
T10	11.42±17.64	15.69±18.09	>0.05



Graph 2: Fall in MAP From Baseline

DISCUSSION

The purpose of this study is to investigate the relationship between maternal AC and incidence of hypotension following spinal anaesthesia. In our study, we observed that the incidence of hypotension after spinal anaesthesia did not differ between pregnant women with smaller and larger abdominal circumference. However, in the larger AC group, the decrease in MAP from baseline was more as compared to smaller AC group.

There are many possible mechanisms for the more decline in MAP in pregnant women with larger ACs as compared to smaller ACs. First, in a term pregnancy, the uterus is large enough to potentially cause aortocaval compression leading to decreased venous return and cardiac output when lying supine. In pregnant women, the AC reflects the size of the uterus; thus, the larger the AC, the greater the decline in MAP. Second, parturients with greater AC have less lumbosacral CSF volume owing to greater IVC compression and subsequent greater epidural venous plexus distension. This will cause a higher level of sensory blockade and sympathectomy.

Kuok et al., in his study observed a correlation between the AC and sensory block level.[9] However, they did not find any correlation between the incidence of hypotension (defined as ≥30% decrease of blood pressure from baseline) and AC. The Kuok study had a smaller sample size and different objectives than our study.

Zhou et al. found that AC and vertebral column length adjusted for age, weight, and height are the key determinants of the cephalad spread of spinal anaesthesia.[12] This principle has also been used to explain the higher sensory block in twin pregnancies than in singleton pregnancies.[13] The size of the abdomen correlates positively with the abdominal pressure. High abdominal pressure has been shown to cause high spinal anaesthesia and hypotension.[14] However, we did not measure the abdominal pressure in our study. Thus, we concluded that the decrease in MAP in our study resulted from larger ACs which might be the results of enlarged uteri causing aortocaval compression or increased intra-abdominal pressure. The limitation of this study was the lack of abdominal pressure data which could be used to explain the mechanism of this finding. The AC can be measured easily and noninvasively and is also non-operator dependent. Thus, we recommend including this variable to assist anaesthesiologists to prepare for hypotensive events after spinal anaesthesia in pregnant women. The AC can help to determine which pregnant women should receive early and aggressive hemodynamic treatment. Moreover, we recommend reducing local anaesthetic doses on the basis of the AC to reduce the incidence of hypotension.[15],[16]

CONCLUSION

Based on the above observations we concluded that there was no relationship between the incidence of hypotension and abdominal circumference during cesarean section under spinal anaesthesia. However, MAP in pregnant women with larger abdominal circumference significantly decreased from baseline after spinal anaesthesia as compared to pregnant women with smaller abdominal circumference.

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