Original Article

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Relationship between Preoperative Maternal Abdominal Circumference Measurement and the Level of Sensory Block in SAB in Cesarean Section: Prospective Observational Study

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Abstract

Background and aims: Inferior venacaval compression during pregnancy causes extradural venous engorgement which may reduce the lumbar cerebrospinal fluid volume. A subsequent greater cephalad spread of sensory block is observed. We hypothesized that maternal abdominal circumference measurement can reflect the compressive effect of uterus and investigated the relationship between maternal abdominal circumference and the level of sensory block, the maximum level of sensory block, incidence of hypotension, nausea, vomiting, requirement of ephedrine in term parturients undergoing cesarean section under spinal anasethesia.

Methods: Abdominal circumference of 40 term parturientswere measured before performing subarachnoid block. 0.5% hyperbaric bupivacaine (2ml, 2.2ml, 2.4ml) was injected into L3-L4 subarachnoid space according to parturients height .The level of sensory block was assessed at various time intervals. The statistical tests applied were Onewayanova, product moment correlation and independent sampleT Test.

Results: The correlation coefficient between abdominal circumference and the level of sensory block was significantly positive at various time intervals ($p<0.05$) following spinal anesthesia. There was a positive correlation between abdominal circumference and highest level of sensory block. No significant correlation was found between abdominal circumference and incidence of hypotension, requirement of ephedrine, nausea and vomiting after spinal anaesthesia ($p>0.05$).There was a significant positive correlation between BMI and the level of sensory block ($p<0.05$).

Conclusion: Parturients with greater abdominal circumference value have a higher level of sensory blockade after spinal anaesthesia. Abdominal circumference cannot predict the incidence of hypotension, nausea, vomiting and the dose of ephedrine required.

Keywords: Abdominal Circumference; Subarachnoid block; Level of sensory block.

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Introduction

Spinal anaesthesia is a safe, simple, rapid, effective and easy to apply anaesthetic technique for cesarean section. Despite the advantages of spinal anaesthesia, hypotension is a common complication with an incidence of 70% to 85% in parturients.[1-4]

Many factors including the Characteristic of injected solution, Patient position, Height, Pregnancy, Intra abdominal pressure, Lumbosacral cerebrospinal fluid volume determine the intrathecal spread of local anaesthetics.In obstetric patients physiological changes due to pregnancy includingchanges of spinal curvature,venous pooling secondary to progesterone induced decrease in vascular tone,aortocaval compression by the gravid uterus contribute to hypotension during cesarean section under spinal anesthesia.[1-6]

Abdominal circumference (AC) correlates with intra abdominalvolume. Maternal abdominal circumference increases during pregnancy and it is influenced by fetus size,amniotic fluid volumeand size of the uterus.

This study was undertaken to determine the relationship between preoperative maternal abdominal circumferencemeasurement, level of sensory block and the maximum level of sensory block achieved and the incidence ofhypotension, nausea and vomitingand requirement of Injection ephedrinefollowing spinal anaesthesia with 0.5% hyperbaric bupivacaine in parturients undergoing cesarean section.

Materials and Methods

We conducted this prospective observational study between June 2020 and December 2020 among 40 parturients who belonged toASA Grade I and Grade II in the age group of 20-40 years, with uncomplicated, singleton and term pregnancy, undergoing elective and emergency cesarean section under spinal anesthesia and willing to give informed written consent.

Those parturients not willing to give informed consent, contraindication to spinal anaesthesia, Preeclampsia, diabetes mellitus, cardiac diseases, Pre term, multiple gestation, Morbid obesity (BMI>35), height <155cm or > 170 cm, Placental, fetal abnormalities, oligohydramnios, polyhydramnios were excluded from the study.

After obtaining approval and clearance from the institutional ethics committee, the parturients fulfilling the inclusion criteria were enrolled for the study after obtaining informed consent.

All study participants were informed about the purpose of the study and the method used to measure the level of sensory blockade prior to anaesthesia.

When the parturient arrived at the operating room, abdominal circumference was measured with the parturient in supine position at the level of the umbilicus. Injection Ranitidine 50mg iv and Injection Metoclopramide 10mg iv were given 30 minutes before surgery. Intravenous hydration of 20 mL/kg crystalloids was given. Standard monitors were installed, including an automated noninvasive blood pressure device, a pulseoximetry monitor, and an electrocardiography monitor. Baseline blood pressure, heart rate and oxygen saturation were recorded.

Parturient was turned to the right lateral decubitus position on a horizontal operating table for spinal anaesthesia. Under strict aseptic precautions spinal anaesthesia was performed using the median approach through the L3-L4 intervertebral space. A Quincke 27-gauge spinal needle was inserted with its bevel oriented parallel to the dural fibers and then rotated to direct the bevel cephalad. Then, 0.5% hyperbaric bupivacaine was injected into the subarachnoid space. The dose of bupivacaine was determined by the parturient's height. Thus, 0.5% hyperbaric bupivacaine 2.0 mL was administered when the height was between 156 cm and 160 cm; 0.5% hyperbaric bupivacaine 2.2 mL was administered when the height was between 161 cm and 165 cm; and 0.5% hyperbaric bupivacaine 2.4 mL was administered when the height was between 166 cm and 170 cm.

After the spinal injection, the parturients were immediately turned to the supine position. A left uterine displacement of about 15 degree was maintained by inserting a folded blanket placed under the patient's right hip. No attempt was made to influence the level of sensory blockade by manipulating the operating table. A proforma was used to collect the data which includes patient details, diagnosis, surgery proposed, anaesthesia details etc. The blood pressure, heart rate and oxygen saturation was measured at 1minute, 3minutes, 5 minutes and thereafter every 10 minutes till the completion of the surgery.

Drop in systolic blood pressure to below 100mmHg, or a decrease of more than 30% in the baseline mean arterial blood pressure (MAP) was considered as hypotension and treated with Injection ephedrine (6 mg) iv. Intravenous atropine (0.6 mg) was given when the heart rate wasless

than 60 beats/min. Level of sensation loss for cold will be checked by using an ice cube at 1 minute, 5 minutes, 10 minutes, 15 minutes and 20 minutes after spinal anaesthesia. The level of sensory blockade at 20 minutes after spinal injection was defined as the level of maximum sensory blockade. Loss of cold sensation was assessed by asking the patient to report when the cold stimulus appears similar to a reference point (forehead skin).

The dermatomal level below the detected stimulus was recorded as the level of sensory blockade. Time taken to achieve maximum level of sensory block was noted. The doses of ephedrine given and the incidence of nausea and vomiting were recorded. Nausea and vomiting was treated with injection ondansetron4mg iv.

Statistical Analysis

The sample size was calculated using the formula.

$$n = \frac{(Z\alpha + Z\beta)\, X(SD)^2}{(d)^2}$$

The probability of falsely rejecting a true null hypothesis (α)=0.05, Zα= 1.96. The probability of failing to reject a false null hypothesis (β) = 0.80, Zβ= 0.84, Standard deviation = 6.8.

Data was entered into Microsoft excel sheet and analysed using Inc. SPSS 20 India software. The statistical tests applied were: One way Anova, Product moment correlation, Independent sample T Test. P value < 0.05 was considered as statistically significant. The clinical characteristics of the study participants are presented as means and standard deviation for continuous variables .

Results

40 parturients were enrolled for the study. The demographic characteristics of the parturients is shown in table 1. The mean age of the parturients was 25.18±4.8 years. The mean BMI was 27.13 ± 3.18kg/m^2 and the mean abdominal circumference was 117.70±20.58 cm. Table 2 and graph1 shows that higher the abdominal circumference more is the level of sensory block.

The highest median level of sensory blockade achieved was T3 in parturients with abdominal circumference in the range of 151- 155 cm as shown by Table 3. Table 4 shows the relation between BMI and the level of sensory block – more the BMI, higher is the level of sensory block.

Table 1: Demographic characteristics of parturients.

	N	Minimum	Maximum	Mean	S.D.
Age	40	20	35	25.18	4.888
Height (cm)	40	156	170	160.15	3.697
Weight (kg)	40	57	92	69.43	9.974
BMI (kg/m2)	40	22.80	34.60	27.1375	3.18012
Gestational age(wk)	40	30.00	40.00	37.9250	1.63907
Abdominal circum-ference(cm)	40	86	155	117.70	20.589
Baseline SBP(mmhg)	40	114	150	129.85	8.711
Baseline DBP(mmhg)	40	68	100	80.25	9.857
Baseline MAP(mmhg)	40	83	115	95.80	8.358
Baseline SpO2	40	97	100	99.18	0.712
Baseline RR	40	12	20	15.28	2.160
Baseline HR	40	72	110	93.48	8.840
Ephedrine dose(mg)	40	0	18	4.20	6.256

SBP – systolic blood pressure, DBP- diastolic blood pressure, MAP- mean arterial pressure, RR – respiratory rate, HR- heart rate.

Table 2: Level of sensory block V/S abdominal circumference at different time intervals.

AC (cm) Mean±SD	Level of Sensory Block and Mean Abdominal Circumference							
	T2	T4	T5	T6	T8	T10	T12	p Value
1Min	-	-	-	-	136±13.4	104±2.8	99.5±11.5	<0.001
5Min	-	142.2±14.7	-	128.9±13.8	98.8±8.2	94.8±4.6	-	<0.001
10Min	-	134±12.4	104	108.8±18.3	95.2±5.2	-	-	<0.001
15Min	151.3±5.5	131.6±9.9	104	102.2±13.6	-	-	-	<0.001
20Min	151.3±5.5	132.5±10.3	105±1.4	99.5±9.0	-	-	-	<0.001

AC – abdominal circumference

Graph 1: Level of sensory block v/s abdominal circumference at different time intervals.

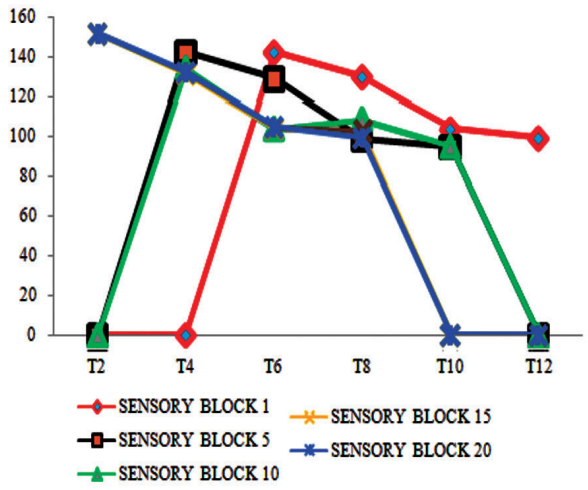

Table 3: Abdominal circumference and the maximum level of sensory block.

Abdominal Circumference (in cm) Groups	Highest level of Sensory Block Achieved (median)
85-90	T 7
91-95	T6
96-100	T6
101-105	T5
106-110	T5
111-115	T5
116-120	T5
121-125	T4
126-130	T4
131-135	T4
136-140	T4
141-145	T4
146-150	T4
151-155	T3

As per the above tabulations we can infer that Higher the BMI, Higher is the level of sensory block

There was no significant correlation between the values of abdominal circumference, incidence of hypotension, nausea vomiting and the ephedrine requirement as shown by the descriptives in the study analysis (p>0.05).

Table 4: Relationship between BMI and level of sensory block at different time intervals.

Time	Level of Sensory Block	BMI mean ± SD	p value
1min	T6	30±4.41	0.008
	T8	28±2.9	
	T10	25.3± 1.9	
	T12	25.5 ±2.3	
5min	T4	30 ±4.41	0.004
	T6	28± 2.7	
	T8	25.5 ±2.45	
	T10	24.4± 1.37	
10min	T4	29.3± 3	<0.01
	T5	26	
	T6	25.9± 2.2	
	T8	23.9± 0.8	
15min	T2	32.4± 0.5	<0.01
	T4	28.6 ±2.8	
	T5	26.0	
	T6	25.2± 2	
20min	T2	32.4 ±0.5	<0.001
	T4	28.5± 2.7	
	T5	26± 0.5	
	T6	25± 2	

Discussion

The purpose of this study is to investigate the relationship between maternal abdominal circumference and the level of sensory blockade following spinal anaesthesia. Kuok CH7 et al conducted a study in 2016 in cesarean section and the spinal bupivacaine dosage was fixed according to parturients height.Hence in our study bupivacaine dose used was fixed according to parturients height. In this study we demonstrated significant correlation between abdominal circumference and the level of sensory blockade at 1min, 5mim,10min, 15min and 20min time interval after spinal anaesthesia.Zhou QH 9et al in their study in 2014 also found a strong positive correlation between abdominal girth and the cephalad spread of spinal anaesthesia similar to our study.

We also found a positive correlation between abdominal circumference measurement and the highest level of sensory blockade achieved. Parturients with greater abdominal circumference have greater IVC compression and greater epidural venous plexus distension.This results in less CSF volume which causes higher level of sensory

blockade. In this study we also found a significant correlation between BMI and the level of sensory block similar to the study conducted by Taivainenet al.[11]

The higher spread of local anesthetic in obese patients may be due to compression of inferior vena cava by the weight of the abdominal mass causing engorgement of epidural venous plexus. This causes reduction in the spinal canal volume and increased spread of the local anesthetic in the CSF. The amount of extradural fat surrounding and possibly compressing the dural sac might also be a factor responsible for spread of local anaesthetics in CSF. This study failed to demonstrate significant correlation between the values of abdominal circumference, incidence of hypotension, nausea vomiting and the ephedrine requirement .This may be due to the fact that hemodynamic response to spinal anaesthesia is influenced by various factors like Hydration, Venous capacitance, Baseline peripheral vascular tone, Blood volume, Cardiac output and degree of aortocaval compression. Hence abdominal circumference measurement can be used as a reliable predictor for the spread of local anesthetic in parturients undergoing cesarean section under spinal anaesthesia.

Limitations of this study are:Symphysiofundal height and vertebral column length which are found to correlate with the level of sensory block were not measured.

Conclusion

Parturients with greater abdominal circumference value tend to have higher level of sensory block but no correlation was noted with the incidence of hypotension, nausea / vomiting and the requirement of ephedrine. Abdominal circumference and BMI provide a simple way to predict the effect of spinal anaesthesia.

References

1. Nani F S, Torres ML. Correlation between the body mass index (BMI) of pregnant women and development of hypotension after spinal anaesthesia for cesarean section. Rev Bras Anestesiol 2011;61:21-30.
2. Xu Z, Xu T, Zhao P, Ma R, Zhang M, Zheng J. Differential roles of right and left toe perfusion index in predicting the incidence of post spinal hypotension during caesarean delivery. AnesthAnalg 2017;125:1560-66.
3. Zadeh FJ, Alqozat M, Zadeh RA. Sequential compression pump effect on hypotension due to spinal anaesthesia for caesarean section: a double blind clinical trial. Electron Physician 2017;9:4419-24.
4. Uppal V, Mc Keen DM. Strategies for prevention of spinal associated hypotension during cesarean delivery: Are we paying attention? Can J Anaesth 2017;64:991-6.
5. Hocking G, Wildsmith JA. Intrathecal drug spread. Br J Anaesth 2004;93:568-78.
6. Wei CN, Zhang YF, Xia F, Wang LZ, Zhou QH. Abdominal girth, vertebral column length and spread of intrathecal hyperbaric bupivacaine in the term parturient.Int J ObstetAnesth 2017;31:63-67.
7. Kuok CH, Huang CH, Tsai PS, Lee WS, Hsu YW. Preoperative measurement of maternal abdominal circumference relates to initial sensory block level of spinal anaesthesia for cesarean section: An observational study. Taiwanese J of Obsterics and Gynecology 2016;810-14.
8. Jawan B, Lee JH, Chong ZK, Chang C S. Spread of spinal anaesthesia for caesarean section in singleton and twin pregnancies. Br J Anesth1993;70:639-41.
9. Zhou QH, Xiao WP, Shen YY. Abdominal girth, vertebral column length and spread of spinal anaesthesia in 30 minutes after plain bupivacaine 5 mg/ml. AnesthAnalg 2014;119:203-6.
10. Lee YH, Wang YC, Wang ML, Lin PL, Huang CH, Huang HH. Relationship of abdominal and trunk length with spinal anaesthesia level in term parturient. J Anesth 2014;28(2):202-05.
11. Taivainen T, Tuominen M, Rosenberg PH. Influence of obesity on the spread of spinal analgesia after injection of plain 0.5% bupivacaine at the L3-L4 or L4-L5 interspace. Br J Anesth 1990;64:542-46.