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CORRELATION OF SYMPHYSIOFUNDAL HEIGHT AND ABDOMINAL GIRTH WITH THE OCCURRENCE OF HYPOTENSION IN CESAREAN SECTION UNDER SPINAL ANAESTHESIA USING BUPIVACAINE WITH FENTANYL AS ADJUVANT – CLINICAL STUDY IN A TERTIARY CARE CENTRE

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ABSTRACT

Aim: The objective of this study was to assess the relationship between SFH, Abdominal girth and 1) The highest level of sensory blockade and 2) Occurrence of hypotension.

Methods: 140 parturients under ASA I and II scheduled for elective Cesarean section under spinal anaesthesia in Sapthagiri institute of medical sciences and research center were studied. The SFH and abdominal girth of all parturients had been measured just before spinal anaesthesia. Hyperbaric Bupivacaine 9mg with Fentanyl 12.5 microgram was administered for subarachnoid block. The level of sensory block and the occurrence of hypotension, nausea and vomiting was assessed and treated. Fisher's exact test, One-way ANOVA and Spearman correlation coefficient were applied to analyze the data.

Results: According to the results of the correlation analysis, there is statistically significant correlation between the SFH and maximum sensory blockade level(correlation coefficient 0.602, p- value -<0.001), Abdominal Girth and maximum sensory blockade level (correlation coefficient 0.781, p- value -<0.001) .There is a statistically significant positive correlation between SFH and number of hypotension episodes (correlation coefficient 0.455, p- value -<0.001), Abdominal Girth and number of hypotension episodes (correlation coefficient 0.221, p- value - 0.009).

Conclusion: In term parturients undergoing Cesarean section, the SFH has a significant positive correlation with the occurrence of hypotension and highest level of sensory block achieved. Abdominal girth also has a positive correlation with the occurrence of hypotension and highest level of sensory block achieved, during spinal anaesthesia.

Keywords: Cesarean section; Hypotension; Nausea; Spinal anaesthesia; Vomiting

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1. INTRODUCTION

Spinal anesthesia is the most preferred anesthetic method for cesarean section since it provides easy and rapid induction and effective sensory and motor blockade with no significant effects on the fetus. However, in a pregnant woman, many of the physiological changes that occur during pregnancy increase the effect of a local anesthetic (LA) injection. The incidence of hypotension following spinal anesthesia can vary between 55% and 90%.[1] Contrary to the traditional belief, the change in venous capacitance due to sympathetic blockade rather than a decrease in cardiac output has been postulated as a major cause for hypotension in these patients.[1,2] The extent of sympathetic block is determined by the spread of LAs in the subarachnoid space.

Many variables have been suggested as influencing the ultimate spread of sensory blockade such as height, weight, body mass index of the patient, and fetal weight, but the roles of these factors are controversial. The use of adjuvants to LA such as intrathecal fentanyl with bupivacaine also influences the spread of the LA and the incidence of hypotension.[3,4] Intrathecal fentanyl up to 25 μg can be used with not much side effects or effects on the fetus.[5] The size of the enlarged uterus may influence the LA spread by affecting the pressure in the subarachnoid space, thereby influencing sympathetic blockade.[6] Symphysiofundal height (SFH) and abdominal girth (AG) measure the size of the gravid uterus and have classically been used to assess the fetal growth during pregnancy. SFH is measured in cm from the pubic symphysis to the highest point in the midline at the fundus of the uterus, in a supine position, and AG is measured in cm at the lower border of umbilicus.

Norris[7] reported that height, weight and BMI are not related to the level of spinal anesthesia during Cesarean section. However, in a recent study, Harten et al[8] reported that when the local anesthetic dose is administrated considering the height and weight of parturient women, hypotension incidents are reduced compared to the cases reported using a fixed dose. A recent study revealed that abdominal girth and vertebral column length (VCL)have a significant predictive value for the cephalad spread of spinal anesthesia in non-pregnant patients[9] a result that was also found in term parturients.[10] Sugerman H, et al[11] reported that abdominal girth was associated with intra-abdominal pressure (IAP) in non-pregnant patients. The relationship between abdominal girth and IAP in non-pregnant patients or in term parturients may be different because factors such as pregnancy or morbid obesity can cause different IAPs in patients with the same abdominal girth.

Chung et al. conducted a study to determine the relationship between SFH and the intravenous (IV) ephedrine dose in parturients undergoing cesarean section under spinal anesthesia and found a statistically significant positive correlation between SFH and the amount of ephedrine administered.[6]

The objective of this study was to assess the relationship between SFH, Abdominal girth and 1) The highest level of sensory blockade and 2) Occurrence of hypotension.

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2. MATERIALS AND METHODS

Total 140 parturients under ASA 1 and 2 aged between 20-30 years undergoing elective cesarean section under spinal anaesthesia in Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore were taken for this observational clinical study from December 2019-November 2021. The inpatients who were scheduled to undergo elective cesarean section under spinal anasesthesia in Sapthagiri institute of medical sciences and research Centre, Bangalore, Karnataka under Department of Anaesthesiology.

Inclusion criteria-

- Parturients of ASA 1 and 2
- Parturients in age group 20 – 30 years
- Parturients of height 150 – 160 cms
- Parturients of weight 60 – 70 kgs
- Parturients of term gestation undergoing Caesarean section
- Vertex presentation
- Non reactive NST (Non stress test)
- Failed inductions
- Parturients giving valid informed consent

Exclusion Criteria

- Parturients in active labour
- Parturients with placenta previa
- Twin pregnancy
- Oligohydramnios and Polyhydramnios
- Pregnancy induced hypertension
- Intra Uterine Growth Restriction
- Ruptured membranes
- Significant medical or obstetric morbidity
- Obstructed labour
- Abnormal lie and presentation
- >3 previous Caesarean deliveries
- Parturients with orthopedic deformities
- Parturients who did not give valid informed consent

Investigations done:

- Routine blood investigations like haemoglobin, platelet count ,white cell count, bleeding time, clotting time
- Blood sugar levels
- Renal parameters: Blood urea, Serum creatinine
- ECG

Methods:

Parturients posted for Cesarean section were kept nil by mouth after 10 pm on the night before surgery. Informed consent was taken from all parturients and all received15 ml/kg of Ringer Lactate via peripheral venous access using 18 gauge IV cannula . NIBP ,

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pulseoximetry and ECG was connected prior to spinal anaesthesia and resting HR and BP were recorded . SFH was measured from the upper margin of the uterine fundus to the superior margin of the pubic symphysis of pregnant women who are in supine position on a horizontal table , and AG was measured using a tape at the lower border of the umbilicus.

Dural puncture was performed by putting the patient in left lateral recumbent position and with 25 G Quincke needle in a midline approach after disinfecting the area between L3 – L4 lumbar intervertebral space. After checking the cerebrospinal fluid outflow, 0.5% hyperbaric Bupivacaine 1.8 ml (9mg) with 12.5 µg intrathecal fentanyl was given at a rate of 0.1 ml/sec without changing the direction of bevel.

Immediately after injection, parturient was put in supine position with left lateral tilt of table by 15 degrees. Sensory level was checked with pin prick from umbilicus and epigastrium to the center of the neck along the midline every 1 minute until the level does not change anymore, this was done to determine the maximum sensory blockade level. IV fluids were administered at a rate of 100ml in 10 minutes. After completing the drug injection, BP was measured every 2 minutes. When systolic BP fell more than 20% from the baseline value, injection ephedrine 6mg was given to correct hypotension, same dose was repeated if BP fall continued after 2mins. Oxygen supplementation was given at the rate of 5 l/min. Injection oxytocin 10 units in 500 ml normal saline was administered by separate infusion at a rate of 20 ml/min to all parturients following extraction of the baby. The side effects like hypotension, nausea, vomiting was observed and recorded and treated. The APGAR Score of the newborn baby was recorded after the delivery.

Parameters evaluated- HR, BP, SFH, Abdominal girth, Maximum sensory block level, Incidence of hypotension, Dose of Ephedrine administered and Incidence of side effects such as nausea, vomiting.

Statistical methods

Data was analyzed using R software version 4.1.1. R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. All categorical data was presented using Frequency and percentage and all continuous measurements was summarized using Mean±SD after assessing normality assumption using Shapiro wilk test. The association of each clinical factors with Hypotension episodes and Maximum sensory was assessed using Fisher’s exact test for categorical factors and One- way ANOVA for continuous measures factors. Spearman correlation coefficient was estimated to present the relationship of No of Hypotension episodes and Maximum sensory level with SFH and Abdominal Grith. Pearson correlation coefficient was estimated to represent relationship between SFH and Abdominal girth. P-Value is considered significant at 5% level of significance for all comparisons.

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3. RESULTS

Table 1: Demographic data

PARAMETERS	MEAN	STD. DEVIATION
AGE	25.86	3.14
HEIGHT	152.44	4.69
WEIGHT	65.81	3.49
BMI	28.04	1.47
ABDOMINAL GIRTH	100.77	4.93
SFH	38.48	1.20

The subjects for the study were 140 term parturient women within the age range of 25.86± 3.14 years, the weight of 65.81 ± 3.49 kg, the height of 152.44 ± 4.69 cm and the BMI of 28.04 ± 1.47. The SFH of the pregnant women was 38.48 ± 1.20 cm, the abdominal girth of the pregnant women was 100.77 ± 4.93.

Table 2: Relationship between SFH and Sensory level

SENSORY LEVEL	N	SFH		P-VALUE¥
		MEAN	STD. DEVIATION	
T3	12	39.83	0.39	<0.001
T4	20	39.30	0.66	
T5	44	38.61	0.89	
T6	48	38.27	1.11	
T7	10	36.70	0.82	
T8	6	36.67	0.82	
TOTAL	140	38.48	1.20	

With the SFH of 39.83± 0.39, the sensory level achieved was T3. With the SFH of 36.67±0.82 the sensory level achieved was T8. It was statistically significant with a p value of <0.001.

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Table 3: Relationship between AG and Sensory level

SENSORY LEVEL	N	AG		P-VALUE¥
		MEAN	STD. DEVIATION	
T3	12	107.58	1.38	<0.001
T4	20	106.65	1.87	
T5	44	100.93	2.77	
T6	48	99.00	3.58	
T7	10	93.80	1.75	
T8	6	92.17	1.17	
TOTAL	140	100.77	4.93	

With the AG of 107.58± 1.38, the sensory level achieved was T3. With the AG of 92.17±1.17 the sensory level achieved was T8. It was statistically significant with a p value of <0.001.

Table 4: Relationship between Maximum sensory level and Number of hypotension episodes

MAXIMUM SENSORY LEVEL	NUMBER OF HYPOTENSION EPISODES					TOTAL	P-VALUE¥
	1	2	3	4	5		
3	0	0	0	3	7	10	<0.001
4	0	0	0	8	1	9	
5	0	5	22	5	1	33	
6	1	8	5	0	0	14	
7	1	2	0	0	0	3	
8	1	0	0	0	0	1	
TOTAL	3	15	27	16	9	70	

With the sensory level of T3 many parturients had 5 episodes of hypotension. With the sensory level of T8 the number of hypotension episodes reduced to 1 to nil episodes of hypotension. It was statistically significant with a p value of <0.001.

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Table 5: Relationship between SFH and Number of hypotension episodes

HYPOTENSION EPISODES	N	SFH		P-VALUE¥
		MEAN	STD. DEVIATION	
NIL	70	38.10	1.09	<0.001
1	3	36.00	0.00	
2	15	38.27	1.16	
3	27	38.89	1.05	
4	16	39.50	0.63	
5	9	39.56	0.73	
TOTAL	140	38.48	1.20	

In 140 parturients, 70 parturients had hypotension. Parturients with SFH of 39.56± 0.73, had 5 episodes of hypotension. Parturients with the SFH of 36.00±0.00 had 1 episode of hypotension. It was statistically significant with a p value of <0.001.

Table 6: Relationship between AG and Number of hypotension episodes

SENSORY LEVEL	N	AG		P-VALUE¥
		MEAN	STD. DEVIATION	
T3	12	107.58	1.38	<0.001
T4	20	106.65	1.87	
T5	44	100.93	2.77	
T6	48	99.00	3.58	
T7	10	93.80	1.75	
T8	6	92.17	1.17	
TOTAL	140	100.77	4.93	

In 140 parturients, 70 parturients had hypotension. Parturients with AG of 106.67± 2.00, had 5 episodes of hypotension. Parturients with the AG of 92.67±2.08 had 1 episode of hypotension.

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Table 7: Correlation between SFH and Maximum sensory level, AG and Maximum sensory level, SFH and Number of hypotension episode, AG and Number of hypotension episode

PARAMETERS		N	SPEARMAN'S RHO	P-VALUE
NO OF HYPOTENSION EPISODE	AG	140	.221**	0.009
PARAMETERS		**N**	**SPEARMAN'S RHO**	**P-VALUE**
MAXIMUM SENSORY LEVEL	SFH	140	.602**	<0.001
PARAMETERS		**N**	**SPEARMAN'S RHO**	**P-VALUE**
MAXIMUM SENSORY LEVEL	AG	140	.781**	<0.001
PARAMETERS		**N**	**SPEARMAN'S RHO**	**P-VALUE**
NO OF HYPOTENSIONEPISODE	SFH	140	.455**	<0.001

There was a positive correlation between SFH and Maximum sensory level attained with a Spearman's RHO coefficient of 0.602, AG and Maximum sensory level attained with a Spearman's RHO coefficient of 0.781, between SFH and Number of hypotension episode with a Spearman's RHO coefficient of 0.455 and AG and Number of hypotension episode with a Spearman's RHO coefficient of 0.221. It was statistically significant.

4. DISCUSSION

Cesarean sections have become one of the most commonly performed surgical procedures to deliver a baby. Several factors influence the increased rate of cesarean section, especially more in developed countries. Indications like maternal characteristic, maternal comorbidities and obstetric practices are mainly responsible for rise in caesarean section rate. In order to reduce the poor maternal outcome , especially risk of uterine rupture and fetal outcome of hypoxic ischemic encephalopathy with vaginal birth, after previous caesarean section (VBAC) and breach presentations , cesarean section is more preferred. The concerns of law suits and most importantly maternal request for an elective cesarean section have influenced obstetricians to perform caesarean section despite lack of positive indication.[12]

In pregnant woman many physiological changes occur which increases the effects of the injected LA . There is a decreased lumbosacral subarachnoid space volume due to the compression effect of the hypertrophied uterus on the inferior venacava and in the epidural space there will be development of plexus venous collateral circulation. The above mentioned

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changes cause decreased CSF volume in lumbosacral area, even with the administration of a small dose, LA spreads cephalad causing an increase in the incidence of hypotension.[3]

Hallworth et al[13] conducted a study that the specific gravity of a local anaesthetic and the body position, significantly affect the occurrence of hypotension during spinal anaesthesia in parturient women. To exclude the effect of specific gravity of local anaesthetic and the body position in our study, we employed one specific gravity and one kind of local anaesthetic , and the body position of the parturient was maintained as horizontal , except when it was tilted to the left by 15° to prevent supine hypotensive syndrome immediately after the spinal anaesthesia. The amount of fluid administered in advance should be considered as a factor that can affect the maximum sensory blockade level and the occurrence of hypotension. Shin et al[14] inferred that the crystalloid solution rapidly injected before the spinal anaesthesia converted the flow of the cerebrospinal fluid to the direction of the lumbar region and consequently decreased the diffusion of the local anaesthesia towards the cephalic region. In order to exclude the differences in the maximum sensory blockade level and the hypotension incidents, Ringer Lactate (15 ml/kg) was infused prior to anaesthesia, in the same manner , to all the target parturient women in our study, and the BP measured after the infusion was considered as the reference value.

Hypotension is the most common side effect found after spinal anaesthesia for Caesarean section some patients also developed nausea and vomiting. The causes of nausea and vomiting include cerebral ischemia by blood pressure drop, hyper- function of the vagus nerve and intraoperative intestine traction. When hypotension, nausea and vomiting occurred after spinal anaesthesia in this study, Ephedrine and Injection Ondansetron 4 mg IV were administered to treat the nausea and vomiting accompanying hypotension. In the study by Kol et al[15], it was reported that the incidence of hypotension, as well as the incidence of nausea and vomiting was effectively reduced in the group of parturient women to whom Ephedrine was administered during spinal anaesthesia for Caesarean section. Since all the nausea and vomiting cases were accompanied by hypotension, blood pressure drop was assumed to be the cause of the nausea and vomiting that took place after the spinal anaesthesia during the operation.

Carpenter et al[16] determined from their study that lumbosacral CSF volume is a very important determinant of the spread of spinal analgesia. Onuki E et al[17] in his study compared MRI images of women in their pregnant and non pregnant state and opined that pregnancy was associated with a compression of the dural sac resulting in significantly reduced CSF volume and dural sac surface area. In the case of parturient women, the cephalad diffusion of local anaesthetic was enhanced by pressure on the IVC by the hypertrophic uterus, shrinkage of the subarachnoid space by expansion of the lumbar vein and vertebral artery around the spinal cavity and the reduction of CSF. The SFH was measured in this study to calculate the actual size of the uterus. To exclude the variations caused by measurement by different individuals, the same person measured the SFH.

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5. CONCLUSION

SFH has a positive correlation with maximum sensory blockade achieved during spinal anaesthesia. Abdominal girth has a positive correlation with maximum sensory blockade achieved during spinal anaesthesia. SFH has a significant positive correlation with the incidence of hypotension. Abdominal Girth (AG) also has a significant positive correlation with incidence of hypotension. Measurement of the SFH and Abdominal girth prior to administration of spinal anaesthesia for patients scheduled for caesarean section can be used as a predictor in anticipating the degree of hypotension produced.

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