ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 11 | November - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

THE STUDY OF ANTHROPOMETRIC MEASUREMENTS ON INCIDENCE OF HYPOTENSION IN PARTURIENT'S UNDERGOING CESAREAN SECTION UNDER SPINAL ANAESTHESIA

Anaesthesiology

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ABSTRACT

Background Hypotension following spinal anaesthesia is one of the most common complication leading to poor maternal and fetal outcomes. This study is designed to assess the association between anthropometric parameters and incidence of hypotension in parturient's undergoing cesarean section under spinal anaesthesia. **Aim and objectives** The aim of this study is to evaluate if maternal anthropometric parameters like abdominal circumference, vertebral column length and symphysiofundal height has any effect on incidence of hypotension during cesarean section under spinal anaesthesia. **Methods** 100 term pregnant women aged between 18-45 years, ASA-PS grade 1-2 undergoing cesarean section under spinal anaesthesia were included in the study.The preoperative anthropometric parameters - Abdominal circumference(AC), symphysiofundal height(SFH) and vertebral column length (VC)were recorded. Spinal Anaesthesia was induced with 2ml of 0.5% Heavy Bupivacaine at the level of L2-L3. The haemodynamic parameters were recorded every 2 minutes up to 10 minutes and thereafter every 5 minutes up to 20 minutes after spinal anesthesia. Correlation analysis (Spearman's rank test) was performed to find the correlations of AC , VC length and SFH with the incidence of hypotension. Statistical analysis was done using Chi square test, t test and one way ANOVA . $P < 0.05$ was considered statistically significant . **Results** The incidence of hypotension was directly proportional with increasing SFH and AC. The incidence of hypotension was 83% with SFH of 36–40 cm, 57% with AC 95–99cm, 78% with VC length of 50-55 cms and 22% with VC length of 56-60 cms which was statistically significant ($P < 0.001$). **Conclusions** The anthropometric measurements like AC, VC length and SFH can be a reliable predictor of hypotension and level of sensory blockade and can help in optimising the dose of spinal anesthetic drug .

KEYWORDS

Abdominal circumference; Vertebral column length; Symphysiofundal height; Pregnancy.

INTRODUCTION

Spinal anesthesia is the most preferred anesthetic method for cesarean section since it provides easy and rapid induction with effective sensory and motor blockade with no significant effects on the fetus. [1] A high level of sensory block after spinal anesthesia increases the incidence of hypotension in pregnant women. Hypotension in pregnant women following spinal anaesthesia is significantly more compared to non-pregnant women. This is attributed to physiological changes in pregnancy like increase in the weight, body mass index, enlarged uterus compressing the greater vessels like inferior vena cava and abdominal aorta, enlarged epidural vessels and fat. [2].

Subarachanoid block is the anaesthetic technique of choice in elective cesarean sections in parturients with low-risk pregnancy. [3] However, hypotension following spinal anaesthesia is one of the most common complication that may lead to poor maternal and fetal outcomes. In most of the studies different 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, [1]but the roles of these are controversial and had little predictive value for the spread of spinal anesthesia and incidence of hypotension. Various studies based on the parameters like age, height, weight, body mass index, abdominal girth, vertebral column length, symphysiofundal height, waist to hip ratio etc. have been studied for assessing mainly the level of sensory blockade and dosage of spinal drug in parturient's. [4]

However, none of the studies till date have been studied correlating the incidence of hypotension with parameters like abdominal circumference, vertebral column length and symphysiofundal height in parturient's undergoing cesarean section under spinal anaesthesia. Therefore,this prospective observational study was designed with primary objective to assess the association between anthropometric parameters including abdominal circumference, vertebral column length and symphysiofundal height and incidence of hypotension in parturient'sundergoing cesarean section under spinal anaesthesia.[5,6] This study can identify the parameter that best correlates with the ascent of drug leading to hypotension in the study population. Hence the study would help us modify the drug doses in the patients at risk, thus avoiding complications to both mother and baby.

Methodology

This Prospective observational study was conducted in ESIC medical college and Hospital Kalaburagi, during the period October 2021 – July 2022 after obtaining Institutional ethical committee clearance and CTRI registration (CTRI/2022/01/039378). All term pregnant women aged between 18-45 years and ASA-PS grade 1-2 undergoing cesarean section under spinal anaesthesia were included in the study. Multiple pregnancies, morbid obesity (BMI >40); height less than 145 cms and height more than 170cms; patients with spinal deformities, parturients with previous history of spine surgeries and those contraindicated to spinal anesthesia were excluded from the study. All parturients fulfilling the inclusion criteria for study underwent a thorough pre-anesthetic checkup and an informed consent was taken. The parameters like height and weight were noted for each patient. The patients were kept nil per oral 8 hours prior to surgery. On the day of surgery, the following anthropometric parameters were measured in the preoperative holding room by the investigators. Abdominal circumference at the level of umbilicus during end of expiration in supine position ; Symphysiofundal height from pubic symphysis to highest point in the midline at the fundus of the uterus in supine position on a horizontal table and Vertebral column length measured from C7 to sacral hiatus.

In the operation theatre, standard monitors were connected (NIBP, ECG and pulse oximetry) and 10-12ml/kg ringer's lactate were infused through peripheral venous access using a 18G IV cannula 15 minutes before administration of subarachnoid block. Baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) were recorded. Spinal Anesthesia was given with 2ml of 0.5% Heavy Bupivacaine by a trained Anesthesiologist independent of the study who recorded the intraoperative vital parameters of the patient. Patient were positioned supine with 15 degree left lateral tilt immediately after administration of spinal anaesthesia. The level of spinal anesthesia targeted to achieve T-6 level was assessed by loss of sensation to cold using ice packs every 5 minutes for up to 20 minutes. The hemodynamic parameters like SBP,DBP,MAP and heart rate were recorded every 2 minutes up to 10 minutes and thereafter every 5 minutes up to 20 minutes after spinal anesthesia. Hypotension was defined as fall in baseline BP > 20% and intravenous ephedrine 6mg boluses were given to achieve a MAP of at least 65mmHg and the total dose of ephedrine was recorded. Bradycardia was defined as HR <50 bpm and injection atropine 0.6mg IV was given. Baseline fetal parameters like APGAR score at 1 and 5

minutes, birth weight were also noted. Correlation analysis (Spearman's rank test) was performed to find the correlations of abdominal circumference, vertebral column length and symphysiofundal height with the incidence of hypotension and level of maximum sensory blockade.

According to the Zhou et al. [4],65.2 % had loss of pinprick discrimination at T_{12}. Hence, the sample size with the precision/ absolute error of 5% and at type 1 error at 5%, we used the formulan=$Z_{1-\alpha/2}^2$ p (1-p)/d^2 and the minimum of the sample size to identify this relationship was 90. We increased the sample size to 100 considering 10% dropout rate. For analytical purposes, abdominal circumference, vertebral column length and symphysiofundal height were presented as ordinal data with defined class intervals. Chi-square test was applied for categorical data. T test and one-way ANOVA test was applied for discrete data. P < 0.05 was considered statistically significant for all the tests. The data were analyzed using SPSS 25 version software.

RESULTS

All the enrolled parturients completed the study. The mean age, weight, and height of parturients enrolled for the study were 24.5±3.2 years, 78.2±10.3 kg, and 150.4±3.5 cm, respectively (Table 1). Figure 1 depicts the BP trends among the groups. The incidence of hypotension was higher with increasing symphysiofundal height which was17% with SFH of 30–35 cm, 83% with SFH of 36–40 cm and was found to be statistically significant ($P < 0.001$). Similarly the incidence of hypotension was 6% with abdominal girth between 85-89 cm, 37% with abdominal girth90–94 cm and 57% with abdominal girth 95–99 cmwhich was statistically significant ($P < 0.001$) . The incidence of hypotension was 78% with vertebral column length of 50-55 cms and 22% with vertebral column length of 56-60 cms (Tables 1 and 2). The use of rescue vasopressor (ephedrine) paralleled the incidence of hypotension. The mean requirement of ephedrine for SFH 30-35 cms was 7.56±2.14mg and for those subjects with SFH above 36 cm it was 12.51±2.4 mg. The difference was found to be statistically significant ($P < 0.001$). The mean requirement of ephedrine was higher in women whose abdominal girth was 95–99 cm compared to those of 85–94 cm($P < 0.001$) (Table2). On analyzing the correlation between the patients' anthropometric values and the level of spinal anesthesia, it was found that the greater the standing abdominal circumference, the higher the level of spinal anesthesia reached at 5, 10, and 15 minutes after the injection of spinal anesthetic (P < 0.05). The BMI and vertebral column length correlated with the level of spinal anesthesiaat all measurement points (P < 0.05) and the correlation coefficiency at 15 minutes after spinal anesthesia was also the greatest (r = 0.43, P < 0.001) (Table 3).

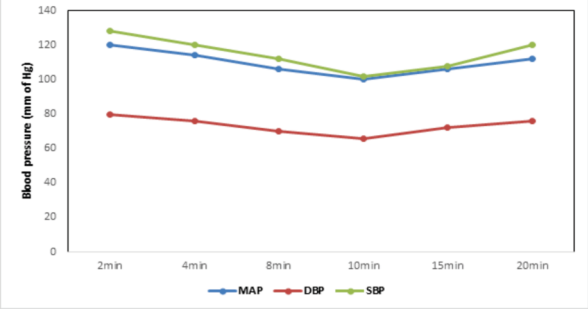

Figure 1: Blood pressure trends among the study participants (N=100)

MAP- mean arterial pressure; DBP-Diastolic blood pressure; SBP-Systolic blood pressure; min-minutes; N-number of patients

Table 1: Distribution of study variables among the study participants (N=100)

Sl no	Variable	Mean±SD
1	Age (y)	24.5±3.2
2	Height (cm)	150.4±3.5
3	Weight (kg)	78.2±10.3
4	BMI (kg/m2)	31.4±3.5
5	AC (cm)	103.5 ± 6.9
6	VCL(cm)	54.2±2.4
7	SFH (cm)	36.23±2.5

N-number of patients; y – years; SD-standard deviation; cm – centimeter; kg-kilogram; BMI-Body mass Index; AC-Abdominal circumference; VCL -Vertebral column length; SFH-Symphysiofundal height

Table 2: Comparison of outcome measure among the study participants (N=100)

Sl no	Variable	Number of patients	Hypotension (%)	p value	Rescue ephedrine dose in mg (mean±SD)	p value
1	Symphysiofundal height (cm) 30-35 36-40	 58 42	 17% 83%	<0.001*	7.56±2.14 12.51±2.4	<0.001*
2	Abdominal Circumference (cm) 85-89 90-94 95-99	 22 31 47	 6% 37% 57%	<0.001*	4±1.25 5.2±1.03 12.63±2.25	<0.001*
3	Vertebral column length (cm) 50-55 56-60	 62 38	 78% 22%	<0.001*	6.46±1.24 8.30±3.21	<0.001*

SD- standard deviation; cm- centimeter; * - Significant

Table 3. Correlations Between Patient Measurements and the Dermatome Level of Sensorial Block 1, 5, 10 and 15 Minutes After Spinal Anesthesia (N=100)

Sl no	Variable	1 min		5min		10min		15 min	
		r	p	r	p	r	p	r	p
1	Height (cm)	-0.02	0.87	-0.17	0.12	-0.34	0.01	-0.35	0.02
2	Weight (kg)	0.34	0.02	0.34	0.01	0.32	0.02	0.41	0.001
3	BMI (kg/m2)	0.28	0.03	0.45	0.01	0.23	0.01	0.25	0.01
4	AC (cm)	0.16	0.45	0.56	0.03	0.31	0.04	0.26	0.04
5	VCL(cm)	0.23	0.05	0.32	0.03	0.34	<0.001	0.43	<0.001
6	SFH(cm)	0.31	0.02	0.15	0.01	0.29	0.001	0.34	0.001

N-number of patients; y – years; SD-standard deviation; cm – centimeter; kg-kilogram; BMI-Body mass Index; AC-Abdominal circumference; VCL -Vertebral column length

DISCUSSION

The pregnant mothers are considered in a special category because of their physiological changes occurring throughout the pregnancy. Most of the caesearian sections are done under spinal anaesthesia due to its rapid induction and minimal side effects. However hypotension is one of the common side effect occuring due to sympathetic blockade. The hypotension varies among the parturients due to various factors like weight, height, BMI, abdominal girth or size , vertebral column length and symphysiofundal height. In parturients the features, such as their age, height, weight, and intra-abdominal pressure, are among the many factors that influence the level of spinal anaesthesia along with the dose of drug. [7-9] Weight and intra-abdominal pressure are two patient features that can alter as a result of the progression of pregnancy. The literature indicates that the level of spinal anaesthesia is higher in twin pregnancy than in mothers of a single child, therefore it would be reasonable to predict a relationship between the degree of weight increase and the amount of spinal anaesthesia. [10]

However, no consistent results were achieved from any of the investigations that compared the characteristics of the parturient with the level of spinal anaesthesia. Ekelof and colleagues [11] showed that weight increase was not related to the level of spinal anaesthetic administered. This was in consistent with our study. In contrast to this, Norris et al. [8] did not find any significant relationship between the level of spinal anaesthesia and the height, weight, and height of the vertebral column of the parturient. The authors concluded that the weight in pregnancy can vary among the parturients and is influenced by various factors and therefore weight cannot be used as a reliable

criteria in predicting the level of spinal anaesthesia during pregnancy. In another study the maximal level of spinal anaesthesia was favourably connected with AC, BMI, and weight, and negatively correlated with symphysiofundal height, body surface area, and the AC/HC ratio. [10]

Since There is no single parameter which can accurately correlate to the incidence of hypotension in parturients, we hypothesized that a combination of parameters could determine the positive correlation to the incidence of hypotension. Thereforein our study , three important anthropometric measurements like abdominal circumference, vertebral column length and symphysiofundal height were employed to determine the correlation of these parameters to the incidence of hypotension in parturients.

The results of our current study showed that the standing abdominal circumference and vertebral column length were found to be positively correlated with the level of spinal anaesthesia at 5, 10, and 15 minutes after the injection of spinal anaesthetic. Also the BMI and body weight were found to be positively correlated with the level of spinal anaesthesia across all sections. In our study we found that abdominal girth size was directly proportional to the incidence of hypotension. The parturients with highest abdominal girth of 95-99cm had significantly highest incidence of hypotension (57%). This was in correlation with study ,where the authors reported the abdominal circumference has a positive correlation with the incidence of hypotension but is not significant with the ascent of spinal anesthesia. [1] However, Malbrain et al. [12] did not demonstrate any association between AC and intra- abdominal pressure, and concluded that AC cannot be used as a predictor of the amount of spinal anaesthetic drug. Similarly Kuok et al. [6] also reported that the parturients with greater AC achieved high sensory blockade after spinal anaesthesia but cannot predict the maximum sensory blockade and incidence of hypotension.

In our current study we found that SFH was directly proportional to the incidence of hypotension along with the dose of ephedrine required. In accordance to this Chung et al. [13] also reported a positive relationship between SFH and dose of ephedrine required . Similarly another study showed that the parturients with greater AC achieved high sensory blockade along with hypotension. [1] In One of the meta-analysis , the AC/hip ratio and AC/height ratio was shown to be a significant predictor of the incidence of metabolic syndrome owing to obesity. [14,15]

Among the variables examined in this study, weight, abdominal circumference, vertebral column length and SFH all exhibited positive relationships, demonstrating that anthropometric values associated with obesity are significantly associated with the level of spinal anaesthesia and incidence of hypotension. Furthermore, a large number of studies have reported that maternal hypotension during caesarean section occurs in 25 percent or more of instances, but there are variances between research. [16-18] .

In term parturients undergoing caesarean section under spinal anaesthesia the anthropometric measurements like AC, vertebral column length and SFH can be a reliable and significant predictor of hypotension and level of sensory blockade. Hence it can further help in optimizing the dose of spinal anesthetic drug accordingly

Limitations of study

The current study has some limitations, which are as follows: Firstly, the identical dose of local anaesthetic was administered to all of the patients. There have been various studies that have demonstrated that using a local anaesthetic dose that has been corrected for height or weight results in less side effects. [19,20] In the current trial, neither the mother nor the foetus experienced any major adverse effects as a result of hypotension; nonetheless, it is anticipated that adopting the corrected doses will further minimise the incidence of hypotension in future studies. Secondly, we were unable to identify an anthropometric value that was superior than the BMI in terms of predicting the level of spinal anaesthetic to be used. We may be able to identify a variable that has a greater link if we experiment with more combinations of anthropometric values. Therefore we recommend further studies using different anthropometric measurements to precisely determine correlation of incidence of hypotension in parturients. There are no conflict of intersest.

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