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CORRELATION BETWEEN VERTEBRAL COLUMN LENGTH AND SPREAD OF ISOBARIC SUBARACHNOID ROPIVACAINE IN THE TERM PARTURIENT

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ABSTRACT

The spread of spinal anaesthesia is unpredictable. There is a correlation between vertebral column length, abdominal girth, BMI and spread of spinal an aesthesia.

Methods: Age, weight, height, BMI, and vertebral column length (Straight and Curved) were recorded in 100 patients. 15 mg of 0.75% isobaric ropivacaine along with 15 microgram fentanyl was given in subarachnoid space via L3-4 interspace using 25 g pencil point spinal needle. The cepahalad spread (loss of temperature sensation and loss of pinprick discrimination was assessed at 5, 10, 15, 20 and 30 minutes after intrathecal injection. The data was analysed using statistical software SPSS 16.0. We measured Area Under Curve (AUC) to consider both dimensions of time and extent of cephalad spread and then studied relation of vertebral column length and AUC by Scatter plot. A coefficient of relation of 0.4 was considered to be significant.

Results: From all these correlations between vertebral column lengths and vertebral level of loss of pin prick and temperature sensation statistically significant >0.4 were observed in case of vertebral column length. Abdominal girth and BMI on other hand showed an insignificant relation with spread of anaesthesia.

Conclusion: Vertebral column length (both straight and curved) was a significant determinant of the level of spread of anaesthesia with a fixed dose of isobaric ropivacaine. The need to adjust the dose of drug according to vertebral column length is recommended to obtain an adequate level of block.

KEYWORDS: Spinal Anaesthesia, Isobaric Ropivaciane, Vertebral Column Length, Spread of Spinal Anaesthesia

INTRODUCTION

Spinal anaesthesia is the preferred technique for most of the lower abdomen and lower limb surgeries. Several studies have shown an increase in the use of spinal anaesthesia especially for elective and emergency caesarean deliveries.(1) Spinal anaesthesia is a reliable technique which is simple to perform, the onset of anaesthesia is also quick allowing surgery to commence immediately and provides postoperative analgesia as well.(2) Since small amount of local anaesthetic is needed for spinal blockade, so there is negligible maternal risk of systemic local anaesthesia toxicity and no drug transfer to fetus. Majority of anaesthesiologists use the absence of cold temperature sensation to T4 level as reference to adequate block for caesarean delivery.(3,4,5). Intrathecal ropivacaine is now gaining popularity in view of its reduced

cardiac toxicity, good tolerability and efficacy.(6) Since it is a known fact that spinal injections in full term pregnant women produce higher than expected levels of anaesthesia so the dose of ropivaciane should be kept at minimum possible.(7) Among other factors cerebrospinal fluid volume and pressure are major determinents of spinal anaesthesia spread, but due to practical difficulties in measuring these parameters patient characteristics like height , weight, and body mass index are instead used to predict spinal anaesthesia spread.(8,9,10) The current study was done to evaluate a correlation between vertebral column length, abdominal girth and spread of isobaric subarachnoid ropivaciane in term parturient so that safe and effective dose of drug for parturients of different vertebral column lengths may be established.

MATERIALS AND METHODS

This prospective study was conducted in department of anaesthesiology and critical care at Sheri-kashmir institute of Medical sciences and its associated SKIMS medical college. The study was conducted according to declaration of Helsinki (1996) and was approved by Institute Ethical committee. A written consent was obtained from a total of 100 healthy term parturients of ASA status 1 and 2 from deparment of Obstetrics and Gynaecology SKIMS medical college for spinal anaesthesia to perform elective ceasarian delivery. Patients who had history of hypersensitivity to study drugs, severe cardiovascular disease, and history of spinal surgery were excluded from the study. Weight and height of patient was recorded. BMI was also recorded. Abdominal girth was measured with the patient standing and at the level of midpoint of lowest point of lower costal margin and highest point of iliac crest. Vertical Vertebral column length and vertebral column length in curvature was measured in erect sitting posture and with curvature in flexion sitting posture on operating table. After preloading patient with 20 ml /kg ringer lactate spinal anaesthesia was given with 15mg of 0.75% isobaric ropivacaine along with 15 microgram of fentanyl using 25 G pencil pointed needle inserted at L3-L4 interspace in sitting posture. Patients were immediately placed in supine position with a left lateral tilt. Assesment of cephalad spread of spinal anaesthesia was done bilaterally in midclavicular line using ice for loss of temperature sensation and an 18G needle for loss of pinprick sensation at 5, 10, 15, 20, and 30 minutes after spinal anaesthesia injection . The testing was done from anaesthetized area to unanaesthetized area. Ice was applied for approximately 2 seconds before a negative determination was recorded and three needle touches were used for recording loss of pinprick sensation. Patients having a discrepancy in sensory level between right and left side were excluded from study. The data was analyzed by using statistical software (SPSS-16). We compared the linear relationship between vertebral column length and the vertebral level up till which spinal anaesthesia was achieved. Since parameters of pinprick sensation and temperature sensation were taken at various times so we measured the area under curve (AUC) in order to consider both dimensions of time and extent of spread of spinal anaesthesia. Relation of vertebral column length and AUC was studied by Scatter Plot. A coefficient of relation of 0.4 was considered to be significant.

RESULTS

Demography of the study Population

Our study had 100 fullterm parturients who were selected for ceaserian delivery for different obstetric indications. Mean and Medain values of various parameters are indicated in Table 1 and Table 2 below.

Table 1: Age, Weight, Height and BMI of the Subjects

Parameter	Mean+S	Median	Range
Age(Years)	26.92±3.15	27	19-34
Weight (kgs)	70.49±5.3	70	60-82
Height(cms)	157±4.65	157	148-168
BMI(Kg/m2)	28.54±1.30	28.74	24.24-30.48

Table 2: Vertebral Column Length (Vertical and In Curvature), Abdominal Girth and Gestational Age of the Subjects

Parameter	Mean+SD	Median	Range
Vertebral column length(cms)vertical	37.14±4.12	37.75	29-44.5
Vertebral column length(cms) curvature	41.01±4.01	41	34-48.50
Abminal girth(cms)	109.74±4.7	110	98-122
Gestational age(months)	38.87±1.09	39	36-40

From demographic study values of mean and median age being almost same implies that age of our subjects were normally distributed and there was no skewed distribution.

Average peak level of anaesthesia for loss of temperature sensation was related to vertebral column length, both vertical and with curvature. Coefficient of the relation came to be 0.623 between erect vertebral column length and level of temperature sensation loss (Figure 1)

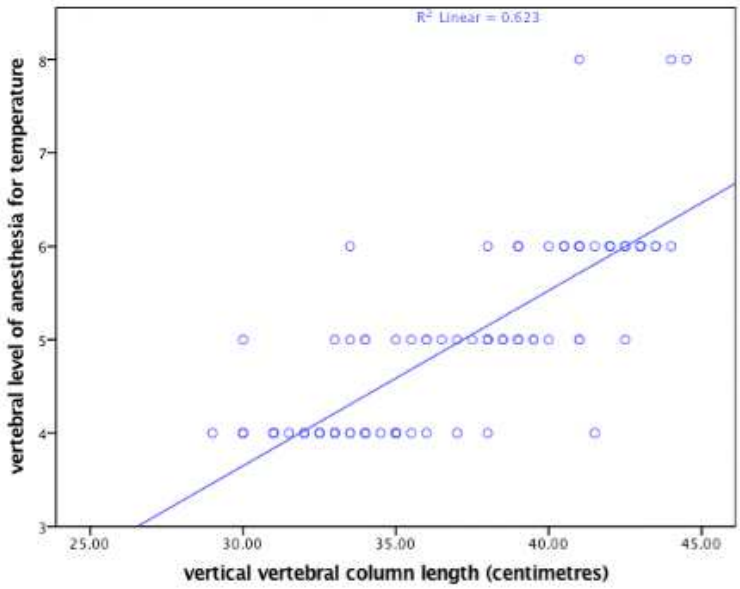

Figure 1: Relation between Vertical Vertebral Column Length (VVL) and Vertebral Level of anaesthesia for Loss of Temperature Sensation, r=0.623 (Note: Higher the Vertebral Number, Lower the Level it Represents, The Figure Thus shows that as the Vertebral Column Length Increased, the Peak Level of anaesthesia Achieved Was Low, As Represented by Higher Numbered Vertebrae

Similarly coefficient of relation between peak temperature sensation loss and vertebral column length with curvature was 0.593 (Figure 2). A coefficient of relation of >0.4 is considered to be statistically significant.

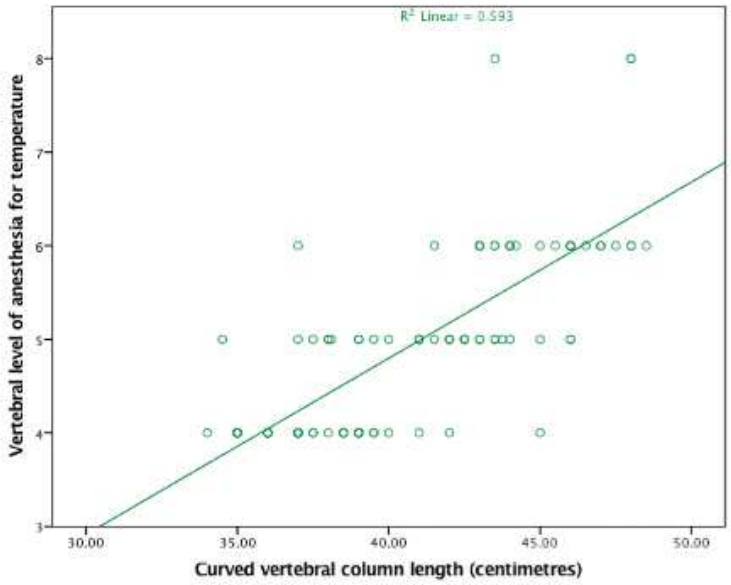

Figure 2: Relation between Vertebral Level of anaesthesia for Loss of Temperature Sensation and Curved Vertebral Column Length (VLC), r=0.593

Similarly the relation between peak level of pinprick sensation loss and both vertical (VVL) and curved (VLC) vertebral column sensation loss was statistically significant with r value of 0.623 for VVL and 0.599 for VLC (Figure 3 and 4)

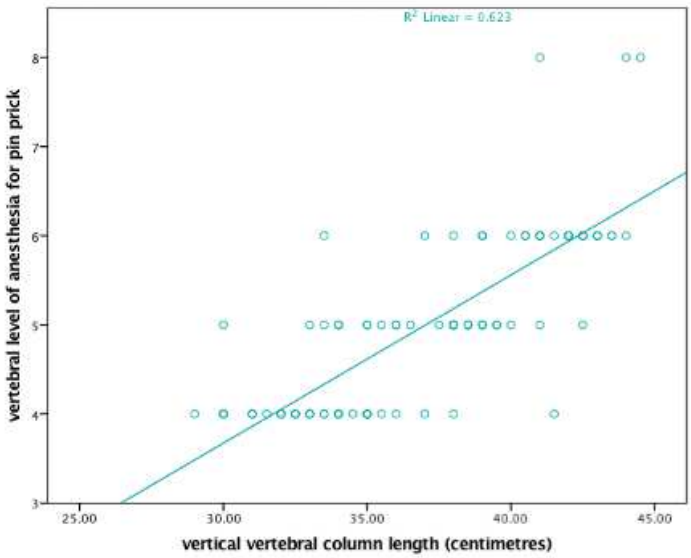

Figure 3: Relation between Vertical Vertebral Column Length (VVL) and Vertebral Level of anaesthesia for Loss of Pin Prick Sensation, r=0.623

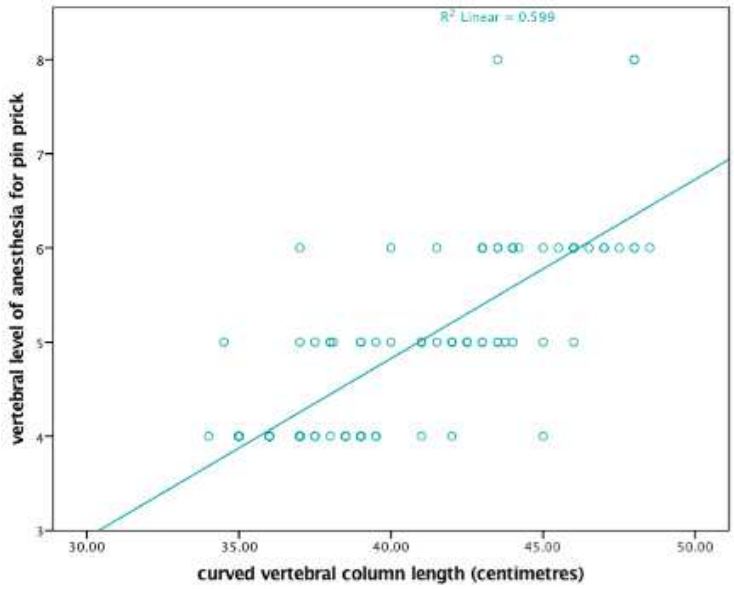

Figure 4: Correlation between Curved Vertebral Column Lenth and Vertebral Level of anaesthesia for Loss of Pin Prick Sensation, r=0.599

From all these correlations observed between vertebral column lengths and vertebral level of loss of pin prick and temperature sensation it is quite clear that with increased vertebral column length there is a fall in the peak level of block achieved.

Since we have seen the effect over various points of time we took the area under curve (AUC) of both the sensations. Then we studied the relation of AUCs and the VVL and VLC, which is shown in Figure 5to8

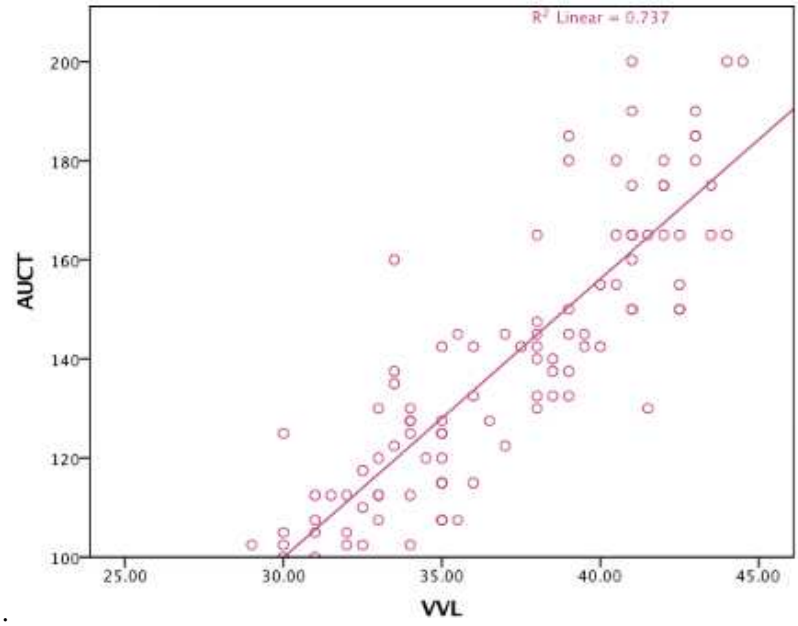

Figure 5: Relation between Area under Curve for Temperature (AUCT) Sensation and Vertical Vertebral Column Length (VVL), r=0.737

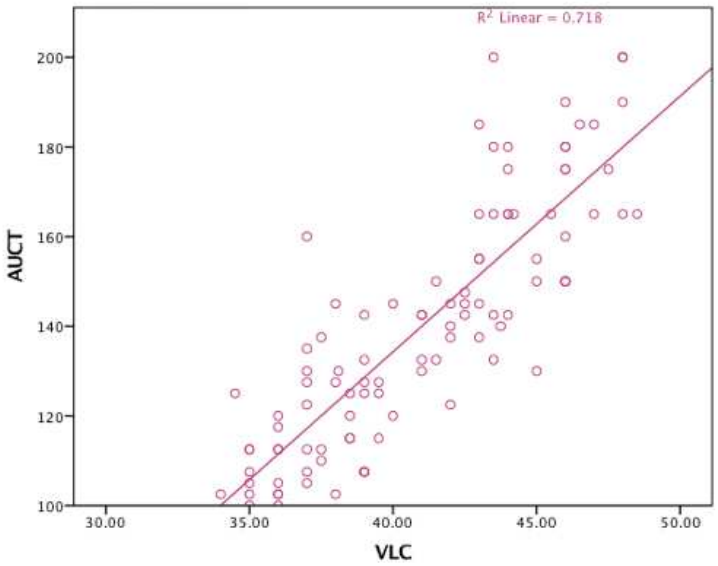

Figure 6: Relation between Area under Curve for Temperature Sensation (AUCT) and Curved Vertebral Column Length, r=0.718

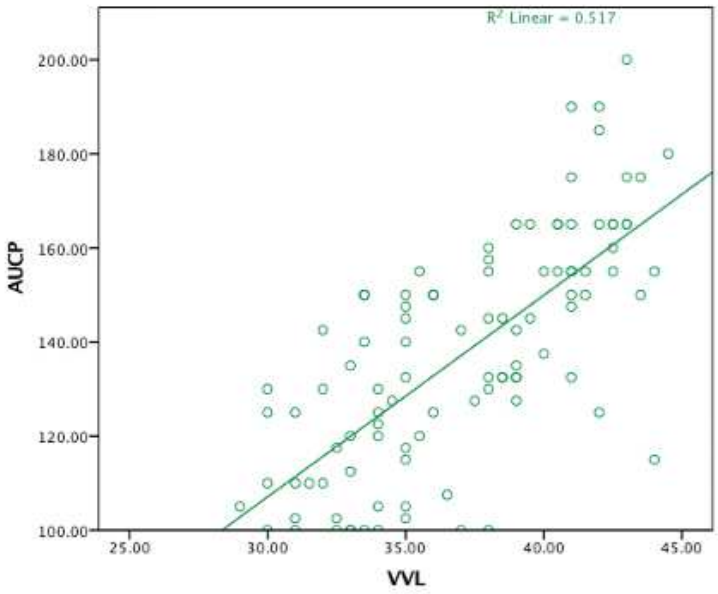

Figure 7: Correlation between Area under Curve for Pin Prick Sensation Loss (AUCP) and Vertical Vertebral Column Length, r=0.517

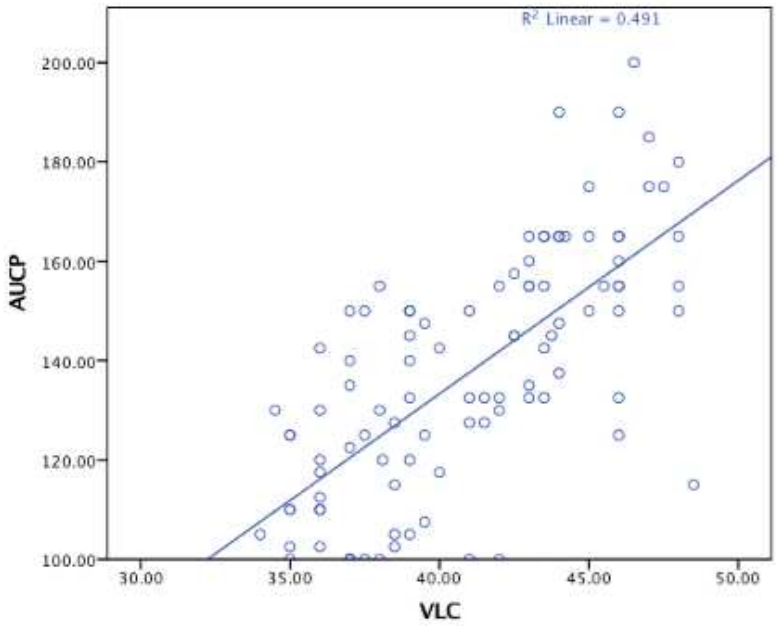

Figure 8: Correlation between Area under Curve for Pinprick Sensation (AUCP) and Vertebral Column Length with Curvature, r=0.491

We also observed the relation between abdominal girth and spread of anaesthesia and spread of anesthesia represented by the respective area under curves, there was no significant relation(r=0.011 and 0.03 for temperature and pinprick sensation respectively), but there was a trend towards a higher level of anaesthesia being associated with higher abdominal girth (Figure 9)

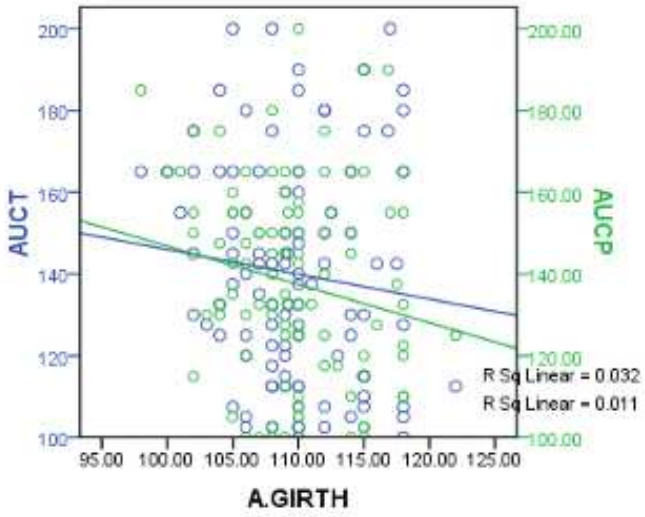

Figure 9: An Insignificant Correlation between Abdominal Girth and Area under Curve for Temperature Sensation r=0.011 and r=0.032

Lastly we observed the relation between BMI and the spread of the anaesthesia, again the relation was insignificant. (r=0.003 and 0.013) for temperature and pinprick sensation respectively.

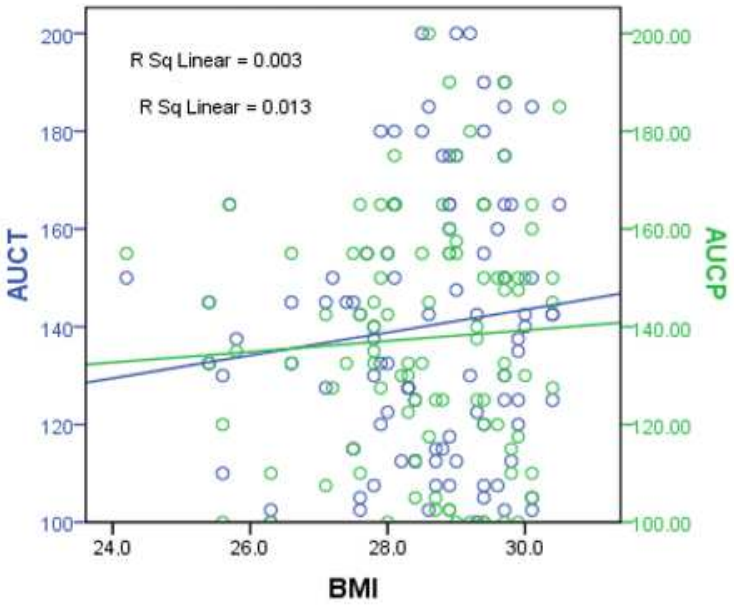

Figure 10: An Insignificant Correlation between BMI and the Spread of anaesthesia for Temperature and Pinprick Sensation

DISCUSSIONS

Neuroaxial techniques are preffered methods, especially spinal anaesthesia for both elective and emergency ceaserean deliveries. A sensory block that extends rostrally from the sacral dermatomes to T4 should be the goal for caesarean delivery anaesthesia. Majority of anaesthesiologists use absence of cold temperature sensation to a T4 level to indicate an adequate blockade height for caesarean delivery. Ropivaciane which blocks sensory nerve fibers more readily than motor fibers is now gaining popularity due to its reduced cardiac and neurotoxicity, good tolerability and efficacy.(4)

We observed in our study that relation between peak level of anaesthesia for loss of temperature sensation and vertebral column length, both straight and with curvature was statistically significant(r value of 0.623 and0.593 for straight and curved vertebral column length) Similarly statistically significant relationship was seen between peak level of anaesthesia for loss of pin prick sensation and vertebral column length, both straight and with curvature.(r values 0.623 ans0.599). From all these correlations it is clear that with increased length of vertebral column there is fall in the peak level of block achieved. On the other hand abdominal girth and spread of anaesthesia showed insignificant relation. Hartwell et al(11) observed that height of patient as such did not correlate with the cepahalad spread of anaesthesia but vertebral column length did correlate.Our study also shows this correlation. In another study Khalid et al (12) observed that taller subjects took longer time to achieve a block of a particular level again emphasizing the same point that spread of anaesthesia may be affected by height of a person. Zhou et al (13) in his study found that more the vertebral column length lower was the vertebral level of analgesia to pin prick sensation. From all these observations it seems that there is a need to alter and adjust the dose of the drug depending on vertebral column length in order to obtain an adequate level of block. Regarding relation of BMI and spread of anaesthesia similar results as us were seen by Norris et al (14) in his study using bupivacaine in term parturients that there was no significant relation. Similar results were observed by Hartwell et al (11) in his study. In contrast to our study Zhou et al (13) observed that abdominal girth is a strong indicator of the spread of the anaesthesia along with vertebral column length

In the study by Barclay et al (15) it was observed that pregnant women required less dose of spinal anaesthetic agent as compared to nonpregnant subjects. This may be explained by the pressure effect of the inferior vena cava by gravid uterus.

CONCLUSIONS

It was concluded from our study that there is a need to adjust the dose of the drug according to the vertebral column length, so as to achieve an adequate level of block.BMI and abdominal girth have no significant effect on spread of anaesthesia.

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