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Research Article

CORRELATION BETWEEN VERTEBRAL COLUMN HEIGHT AND THE SPREAD OF SUBARACHNOID 0.5% HYPERBARIC BUPIVACAINE IN THE FULL TERM PARTURIENT

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ABSTRACT

Background: Spinal anaesthesia is the frequently used technique for LSCSs but there is lack of reliable predictor for level of sensory block achieved to tailor the dose of local anesthetic. It has been demonstrated that the height of the spinal column doesn't affect the spread of subarachnoid hyperbaric bupivacaine. This study aims to find out whether there is any relation between the length of the spinal column and the level of sensory block achieved after spinal anaesthesia.

Methods: Convenience sampling was used to enroll 82 term parturients scheduled for elective caesarean section under spinal anaesthesia were enrolled. Spinal column height was measured from C7 to sacral hiatus in sitting position. Single shot spinal- anaesthesia was given at the L3/4 interspace with 2mL of 0.5% hyperbaric bupivacaine intrathecally. Spinal spread was assessed at 5 minutes, 15 minutes and 30 minutes. The patient details were recorded in as per proforma. Descriptive statistics was used for the data of age, height, weight, gravida, vertebral column height and the spread of spinal anaesthesia. Linear regression and correlation analysis were used to analyze the relationship between the height of spinal column and level of block achieved at 5, 15 and 30 minutes.

Results: The average height of vertebral column is 51.5 ± 3.1cm ranging from 45 to 62 cm. After 15 minutes of spinal anesthesia, 52.4% cases achieved block upto T6 followed by 22% in T7 and after 30 minutes, 51.2% cases achieved T6 followed by 19.5% T7. The significant linear relation was not observed between the height of spinal column and level of block achieved at 15 and 30 minutes as indicated by correlation coefficient of 0.032 and 0.075 respectively.

Conclusion: The spinal column height measured between C7 and Sacral hiatus (SH) showed no significant correlation with the height of the spinal block achieved with heavy bupivacaine in parturients.

Keywords: Spinal anaesthesia; Local anaesthetic spread; Pregnancy, Spinal column

INTRODUCTION

Spinal anaesthesia has become the preferred technique for lower segment caesarean section (LSCS). General anaesthesia in parturients is associated with higher risks of pulmonary aspiration and failed endotracheal intubations compared to other types of surgery, causing higher rates of morbidity and mortality due to anatomical and physiological changes during pregnancy. Spinal anaesthesia also offers less neonatal exposure to potentially depressant drugs and allows early bonding between mothers and their babies and the option of using spinal opioids for postoperative pain relief.[1]

Caesarean section requires blockade up to the T4 dermatome level to blocks the somatic sensations of the caesarean sections and also to eliminate the visceral pain from peritoneal manipulation.[1] Many factors can affect the height of block achieved like volume of drug, baricity of drug, position of patient after spinal anaesthesia and intra-abdominal pressure (twin pregnancy, abdominal mass).[2]

Subarachnoid local anesthetics provide rapid and profound anesthesia for Caesarean sections; however, the final spread of spinal anesthesia is unpredictable.

Greene commented that "common sense and clinical experiences" dictate that a shorter patient is associated with a more cephalad spread of the subarachnoid local anesthetics in comparison to a taller patient.[2] Anaesthesiologists are practicing different doses of bupivacaine for different height of patients based on previous clinical common sense even though literature shows no relation with height of patient. Even now many anaesthesiologists provide subarachnoid local anesthetic dosage based on the height of parturient. Therefore, this study was carried out to evaluate whether the length of the spinal column of term parturient influences the highest level of sensory blockade achieved.

MATERIALS AND METHODS

After obtaining the approval from institutional review committee of phect Nepal (Public Health Concern Trust, Nepal) and informed consent from the participants, 82 singleton term parturients of American Society of Anaesthesiologists (ASA) physical status I or II scheduled for elective LCSCs were enrolled. Apart from the usually contraindicated conditions to spinal anaesthesia, patients younger than 18 years old, those with a gestational age of less than 36 weeks, those with any spinal abnormalities and allergic to bupivacaine were excluded. Before spinal anaesthesia, all parturients were fasted for six hours and were only allowed clear fluids up to two hours prior to the surgery. Standard non-invasive monitoring like blood pressure, Pulse oxymetry, and electrocardiogram were used and intravenous infusion of 500 ml of Ringer's lactate solution were commenced.

The length of the spinal column was measured before spinal anaesthesia and an average of three measurements from the C7 spinous process to the sacral hiatus using a standard measuring tape while in a sitting upright and facing forward position, with the legs horizontally on the operating room table. Spinal anaesthesia was given under all aseptic condition in the samesitting position. The skin was infiltrated with local anaesthetic (lignocaine 2%) prior to the 25-G pencil-point spinal needle insertion.The spinal needle was

advanced between the L3/L4 intervertebral space with the quinke' needle opening facing cephalad. Once a free flow of cerebrospinal fluid was evident, 2ml of 0.5% hyperbaric bupivacaine (10 mg) were injected without barbotage over 10 seconds into the subarachnoid space. After spinal anaesthesia patients were placed in the horizontal supine position.The highest level of sensory blockade was determined using a needle prick method after 5 minutes, 15 minutes and 30 minutes after spinal anaesthesia was given.

Demographic variables (age, height, weight, parity and indication for Caesarean section) were also recorded. Data were presented as mean±sd and percentages as appropriate. Correlation and linear regression analysis were used to analyze whether any relation exists between the highest level of sensory blockade achieved and the parturients' spinal column height.

RESULTS

The mean age of the patients was 27.2 ± 3.9 years. The average weight of the patients was 66.01 ± 10.2 kg. The average height of vertebral column was 51.5 ± 3.1cm ranging from 45 to 62 cm.Nearly 47% of cases were gravida 1 followed by 43.9% gravida 2, 6.1% gravida 3, 2.4% gravida4 and 1.2 % gravida 5 cases.

Ht. of block	**Baseline (5 min)**		**Level of block after 15 min**		**Level of block in 30 min**	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
T3	1	1.2	3	3.7	1	1.2
T4	7	8.5	8	9.8	12	14.6
T5	11	13.4	10	12.2	9	11.0
T6	40	48.8	43	52.4	42	51.2
T7	23	28.0	18	22.0	16	19.5
T9	-	-	-	-	1	1.2
Abandon	-	-	-	-	1	1.2
Total	82	100.0	82	100.0	82	100.0

Table 1: Height of the spinal block at different times

The height of the block at different times is shown in Table no 1. At 5 minutes, 1.2% cases were T3, 8.5% T4, 13.4% T5 and 28% T7. About half (48.8%) of the cases were of T6. After 15 minutes, 52.4% cases were T6 followed by 22% in T7. After 30 minutes, 51.2% cases were T6 followed by 19.5% T7. One case was T9 and one case was abandoned due to spinal failure.

	r	R^2
ht of block at 5 min	.103	.011
ht of block after 15 min	.032	.001
ht of block after 30 min	.075	.006

Table 2: Relation between height of vertebral column and height of block at different times

Table no.2 shows relation between height of vertebral column (cm) and height of block at different time. There was very low correlation between height of vertebral column (cm) and height of block at different time. The regression analysis showed very low R^2 values indicating that very low variation in vertebral column is explained by level of block at 15 and 30 minutes.

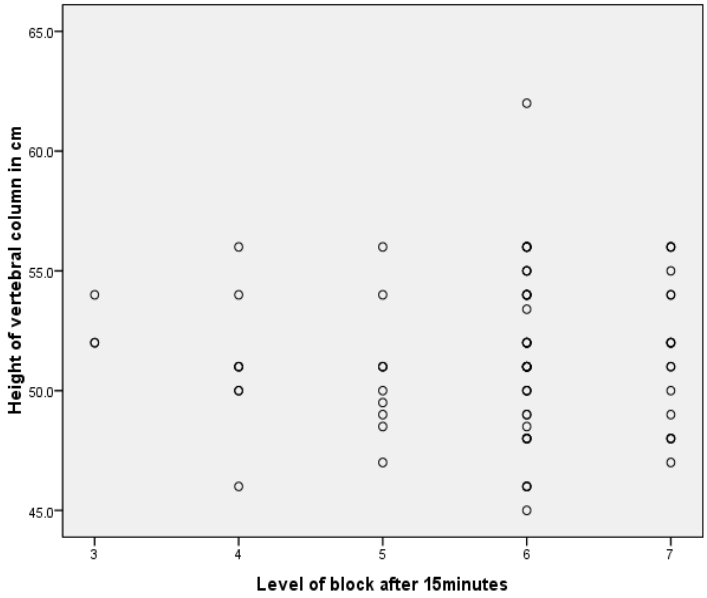

Figure 1: Scatter plot of height of vertebral column and height of block in 15 minutes (number in x axis represents thoracic vertebrae number).

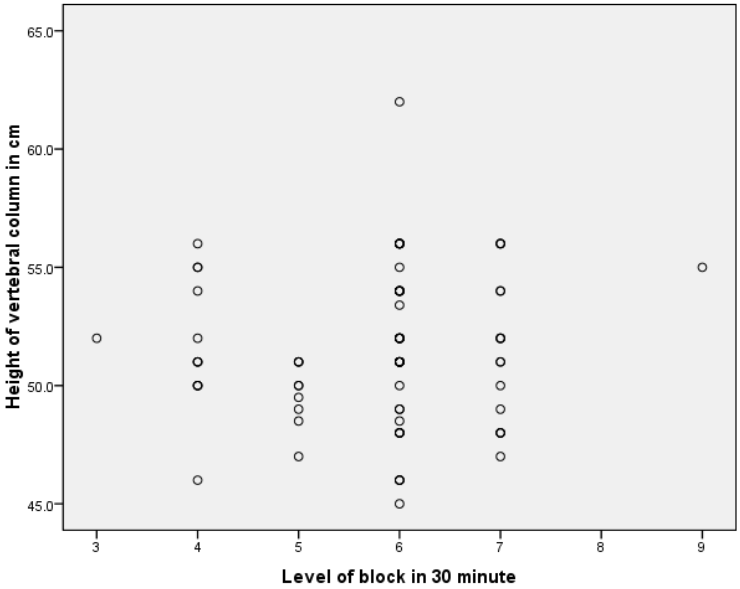

Figure 2: Scatter plot of height of vertebral column and height of block in 30 minutes (number in x axis represents thoracic vertebrae number).

DISCUSSION

This study indicates that the height of spinal column does not have significant correlation to the maximum height of sensory block achieved with 0.5% hyperbaric bupivacaine. The maximum level in most parturient was between level of T4 and T7. The hyperbaricity of 0.5% bupivacaine heavy makes it move to the most dependant parts.[1] Barker and Kitaharain their studies demonstrated that hyperbaric local anaesthetic pools in the dependent part of the spinal column.[2,3] The dependent point of the thoracic spinal canal in supine position was located at a higher thoracic region in the pregnant (T6 to T7-8).[4]The factors like the patient's age, height, anatomic configuration of the spinal column, the site and the direction of the needle during the injection, the volume and the density of CSF, the density and baricity of the anaesthetic solution injected, the position of the patient immediate after spinal anaesthesia, the dosage and the volume of anaesthetic solution injected were pointed out to be responsible to influence the distribution of subarachnoid local anesthetic in a review by Green[5].

MC Norris (1988) revealed no significant correlation between height, weight and body mass index and the spread of spinal anaesthesia. He concluded that in term parturient patient's height, weight and body mass index does not significantly affect the spread of hyperbaric spinal anaesthesia.[6]

MC Norris (1990) revealed age, height, weight, body mass index, and vertebral column height did not correlate with the spread of sensory blockade.[7]

Hartwell BL evaluated vertebral column height and spread of hyperbaric subarachnoid bupivacaine in the term parturients and their result showed that a significant correlation existed between vertebral height.[8]

Chanimov M concluded that there was a significant correlation between vertebral column height and subarachnoid local anaesthetic spread.[9]

Wei CN showed multiple linear regression analysis showed that parturients abdominal girth and vertebral column height were the key determinants of spinal spread.[10]

Rahman R. (2010) concluded that there was no correlation between the parturient spinal column height and the highest level of sensory blockade achieved.[11]

Mehmet Cantürk concluded that the cephalad spread of spinal anaesthesia is correlated with hip/shoulder width ratio in term parturient patients. Vertebral column height has no correlation with the spinal anaesthesia spread but correlates with the height of the parturient. The hip/shoulder width ratio may be more important than either patient height or vertebral column height in predicting the cephalad spread of spinal anaesthesia for each parturient.[12]

The result of this study was in accordance with MC Norris (1990)[6], Rahman R. Et al (2010)[11], Mehmet Cantürket. Et al (2016)[12] showing no significant correlation between vertebral column height and spread of the subarachnoid local anaesthetic. Despite the variation in spinal column height between parturients there is no significant relationship between vertebral column height and spread of subarachnoid local anaesthetic (0.5% bupivacaine heavy), this might be due to the fact that the major factors are the baricity of the solution injected and the subsequent posture of the patient.[13]

CONCLUSION

This study concluded that there is no significant correlation between the parturients' spinal column height and subarachnoid spread of 0.5% bupivacaine heavy (highest level of sensory blockade achieved).

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