

Effect of position - Trendelenburg and horizontal on the height of sensory block in patients undergoing lower abdominal surgery



Sarmila Guha Banerjee¹, Shantanu Hazra², Akashleena Banerjee³, Ujjwal Bandyopadhyay⁴

¹Associate Professor, ²Assistant Professor, ³Postgraduate Resident, Department of Anesthesiology, Calcutta Medical College, Kolkata, ⁴Associate Professor, Department of Pathology, Raiganj Government Medical College, Raiganj, West Bengal, India

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ABSTRACT

Background: Subarachnoid anesthesia also known as spinal anesthesia is now considered to be a safe form of anesthesia for lower abdominal and lower limb surgeries. The height of sensory block achieved in spinal anesthesia after drug administration can be altered by changing the position of the patient, and this precisely is the advantage of using hyperbaric local anesthetic drug. **Aims and Objectives:** The aim of this study is to compare the effect of position – horizontal and Trendelenburg on the height of sensory block in spinal anesthesia. **Materials and Methods:** After obtaining the institutional ethical clearance, total 66 patients scheduled for lower abdominal surgery under spinal anesthesia were selected and divided into two groups – Group A patients were placed in Trendelenburg position with 20° head down for 40 s and then returned to horizontal position and Group B patients were placed in horizontal position after spinal anesthesia. The level of sensory block was compared among the two groups at different points of time up to 30 min of drug administration. **Results:** The patients who remained in Trendelenburg position for 40 s after spinal anesthesia achieved a higher level of sensory block earlier as compared to the horizontal group and the maximum block height was two spinal segments higher than that of the horizontal group. **Conclusion:** From our current study, we can conclude that Trendelenburg position can be used to achieve a higher level of sensory block as compared to horizontal position after successful neuraxial block.

Key words: Spinal anesthesia; Height of sensory block; Trendelenburg position; Horizontal position

INTRODUCTION

Subarachnoid anesthesia is now considered to be a better alternative form of anesthesia for lower abdominal and lower limb surgeries. In this procedure, a small amount of local anesthetic injected into subarachnoid space produces a dense block for a finite period of time depending on the drug used. After drug delivery into the correct space, a dense neuraxial block is achieved below the site of injection which can be altered by changing the position of patient, and this precisely is the advantage of using hyperbaric local anesthetic drug.^{1,2} The height of sensory block again depends on various factors:

1. Drug factor:- dose, baricity, volume, and concentration
2. Patient factors:- CSF volume, age, pregnancy, weight, height, spinal anatomy, and intra-abdominal pressure
3. Procedure factors:- position, post-spinal epidural injection in combined spinal-epidural anesthesia, level of injection, fluid currents (rate of injection of local anesthetics), needle orifice direction, and needle type.

Out of all these factors, the most important one is patient position,^{1,3,4} intrathecal local anesthetic appears to stop spreading 20–25 min after drug administration, but the level of block may change even up to 2 h.

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Address for Correspondence:

Dr. Ujjwal Bandyopadhyay, Associate Professor, Department of Pathology, Raiganj Government Medical College, Raiganj, West Bengal, India. **Mobile:** +91-9433447068. **E-mail:** ujjwal.kalindi@gmail.com

The advantages of spinal anesthesia over general anesthesia are no airway instrumentation needed, profound analgesia, stable hemodynamics (i.e., absence of sympathetic surge during intubation and extubation), less surgical blood loss, and thus improved operating condition.^{1,5,6}

Aims and objectives

The aim of this study is to compare the effect of position – horizontal and Trendelenburg on the height of sensory block in spinal anesthesia.

MATERIALS AND METHODS

This was a prospective randomized study. This study was conducted after receiving approval from the Institutional Ethical Committee. 66 patients in the age group of 18–55 years were chosen, belonging to American Society of Anesthesiology (ASA) physical status I and II, who were undergoing elective lower abdominal surgeries. This was a single-blind randomized study with blinding of the patients only. The patients were randomized by simple randomization method into two groups:

Group A – 33 patients were placed in Trendelenburg position for 40 s after spinal anesthesia and then returned to horizontal position and

Group B – 33 patients were placed in horizontal position after spinal anesthesia.

On considering 10% dropouts, we added another 6 patients in total, thereby making the total sample size as 72.

On the night before surgery, the patients were premedicated with tablet ranitidine (150 mg) and tablet alprazolam (0.5 mg). On the day of operation, cannulation was done with an 18 G cannula in peripheral vein. Preloading was done with crystalloid I.V fluid Ringer's lactate 10 mL/kg/h for a period of 30 min. Standard ASA monitoring, that is, non-invasive blood pressure, SPO₂ probe, ECG leads were attached to the patients. Patients were explained about the procedure after taking informed consent. Under strict aseptic conditions, spinal anesthesia was given using 0.5% heavy bupivacaine with a 25 G spinal needle (Quincke needle) at L3-L4 intervertebral space in sitting position through midline approach. The drugs administered were heavy bupivacaine (0.5%) 15 mg and 25 mcg fentanyl as adjuvant. After intrathecal injection of local anesthetic, Group A patients who were placed in Trendelenburg position with 20° head-down tilt for 40 s and then returned to horizontal position and Group B patients were placed in horizontal position.

The onset of sensory block in both the groups was determined by pinprick test with a 25 G needle and cotton

swab soaked in alcohol. The onset of motor block was determined in both the groups by the modified Bromage scale.

Score criteria

1. Complete block (unable to move feet or ankle)
2. Almost complete block (able to move feet only)
3. Partial block (just able to move knee)
4. Detectable weakness of hip flexion while supine
5. No detectable weakness of hip flexion while supine
6. Able to perform partial knee bend.

This table shows the modified Bromage score¹ as used by Breen et al.

Blood pressure was monitored at 3-min interval. Heart rate, SPO₂, ECG were monitored continuously till the end of operative procedure. The height of sensory block was assessed at 2 and 5 min after subarachnoid block and then every 5-min interval for 30 min with pinprick test using a 25 G needle. If blood pressure falls below 20% of the baseline, the patients were treated with injection (inj) phenylephrine IV using 50 mcg bolus. If bradycardia (pulse below 50/min) was treated with inj atropine IV (0.6 mg). Sedation was provided with inj midazolam IV (0.04 mg/kg) as needed by an individual patient. After surgery, the patients were sent to the post-operative care room and monitored for 3 h for any adverse effect.

Sample size has been calculated with help of Epi Info (TM) 3.5.3. Epi Info is a trademark of the Centers for Disease Control and Prevention. For statistical analysis, data were entered into a Microsoft Excel spreadsheet and then analyzed by SPSS 27.0. and GraphPad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Unpaired proportions were compared by Chi-square test or Fisher's exact test, as appropriate. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. P≤0.05 was considered statistically significant.

Informed consent in proper format, of all the patients were taken, and analyzed using standard statistical software.

RESULTS

In our study, we have included only those patients belonging to the age group between 18 and 55 years.

Table 1 shows that the sensory block level at 2 min in Trendelenburg and horizontal position was comparable. The calculated “P” value comes to be 0.6243 which is statistically insignificant.

Figure 1 shows the level of sensory block at 2 min. The P value comes to be 0.06243 and is therefore statistically insignificant.

Table 2 shows that at the end of 5 min, the maximum block height achieved was T6 and each of the groups had one patient with T6 blockade.

Most of the patients in the horizontal group had achieved a sensory block height of T10 whereas the Trendelenburg group had a block height of T8. Thereby, it shows that the rise in the height of block between 2 and 5 min was more in case of the Trendelenburg group. The P-value calculated was 0.011109 and showed that it was statistically significant.

Figure 2 shows the level of sensory block at 5 min. The P value comes to be 0.01 and is therefore statistically significant.

Table 3 depicts that by the end of 10 min, the maximum level of block achieved in either group was at T4 level. Five of the patient had achieved T4 level block in the Trendelenburg position group as opposed to only one patient in the horizontal position group. Maximum patients had achieved T8 level of sensory block in the horizontal group while 22 of them had achieved so in the Trendelenburg group with P=0.00003 which is statistically significant.

Figure 3 shows the level of sensory block at 10 min. The

P value comes to be 0.00003 and is therefore statistically significant.

Table 4 depicts that by 15 min, most patients in either group had achieved a block height of T6 level. The “P” value was 0.001 which was statistically significant. In the Trendelenburg group, 12 patients achieved T4 level while only one achieved T4 level in the horizontal group.

Figure 4 shows the level of sensory block at 15 min. The P value comes to be 0.001433 and is therefore statistically significant.

Table 5 shows that, at 20 min, almost half of the patients in the Trendelenburg group had achieved block height of

Table 1: LSB at 2 min		
Group A	Group B	Level of sensory block
1	7	Thoracic 9 (T9)
12	12	T10
13	12	T11
7	2	T12

LSB: Level of sensory block

Table 2: LSB at 5 min			
Group A	Group B	LSB	
1	1	T6	
1	1	T7	
21	9	T8	
1	1	T9	
9	21	T10	

LSB: Level of sensory block

Table 3: Level of sensory block (LSB) at 10 min		
Group A	Group B	LSB
5	1	T4
1	1	T5
22	6	T6
1	1	T7
4	24	T8

LSB: Level of sensory block

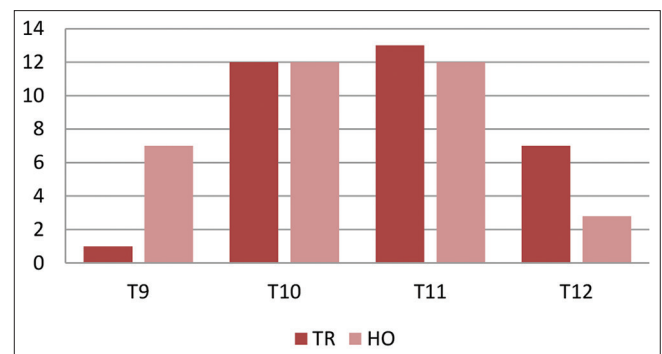


Figure 1: Level of sensory block at 2 min. TR: Trendelenburg position, HO: Horizontal position

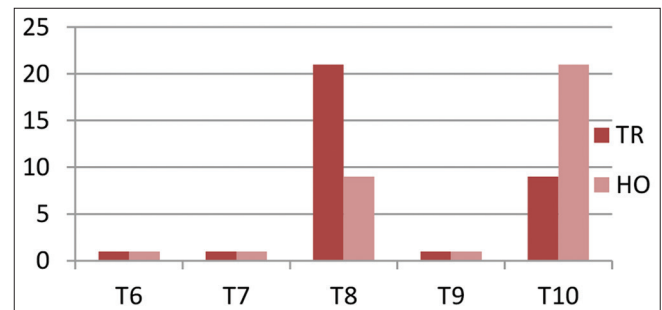


Figure 2: Level of sensory block at 5 min. TR: Trendelenburg position, HO: Horizontal position

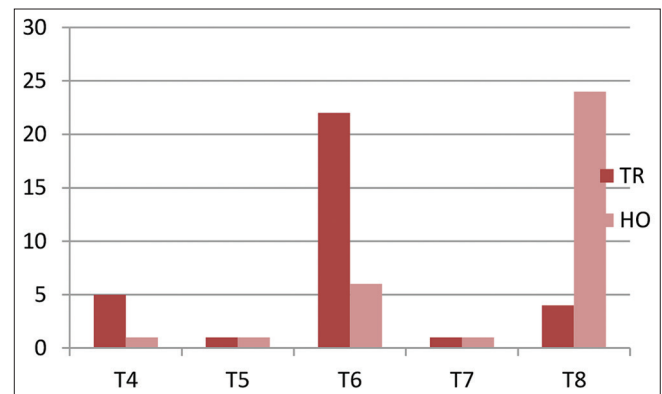


Figure 3: Level of sensory block at 10 min

T4 and the rest of them mostly had block height of T6. The “P” value was 0.05 which was statistically significant.

Figure 5 shows the level of sensory block at 20 min. The P value comes to be 0.05 and is therefore statistically significant.

Table 6 shows that, at 25 min, almost half of the patients in the Trendelenburg group had achieved block height of T4 and the rest of them mostly had block height of T6. The “P” value was 0.05247 which was statistically significant.

Figure 6 shows the level of sensory block at 25 min. The P value comes to be 0.054 and is therefore statistically significant.

Table 7 shows that, at 30 min, almost half of the patients in the Trendelenburg group had achieved block height

of T4 and the rest of them mostly had block height of T6. The “P” value was 0.033318 which was statistically significant.

The level of sensory block attained by both the groups of the patients remains same at 20 min, 25 min, and 30 min after intrathecal drug administration.

Table 4: LSB at 15 min		
Group A	Group B	LSB
12	1	T4
1	1	T5
18	19	T6
1	1	T7
1	11	T8

LSB: Level of sensory block

Table 5: LSB at 20 min		
Group A	Group B	LSB
12	3	T4
1	1	T5
18	22	T6
1	1	T7
1	8	T8

LSB: Level of sensory block

Table 6: Level of sensory block (LSB) at 25 min		
Group A	Group B	LSB
12	3	T4
1	1	T5
18	22	T6
1	1	T7
1	6	T8

LSB: Level of sensory block

Table 7: LSB at 30 min		
Group A	Group B	LSB
13	3	T4
1	1	T5
17	22	T6
1	1	T7
1	6	T8

LSB: Level of sensory block

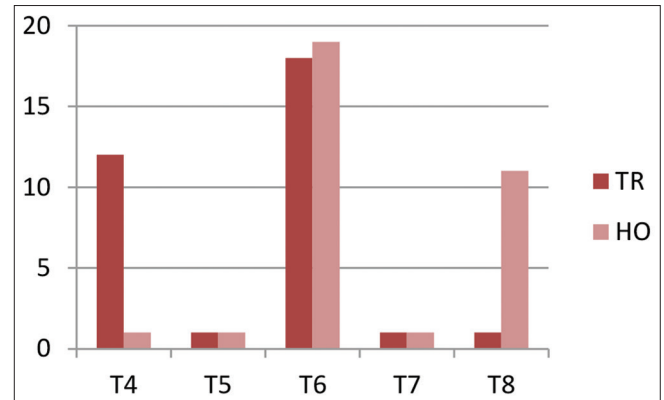


Figure 4: Level of sensory block at 15 min

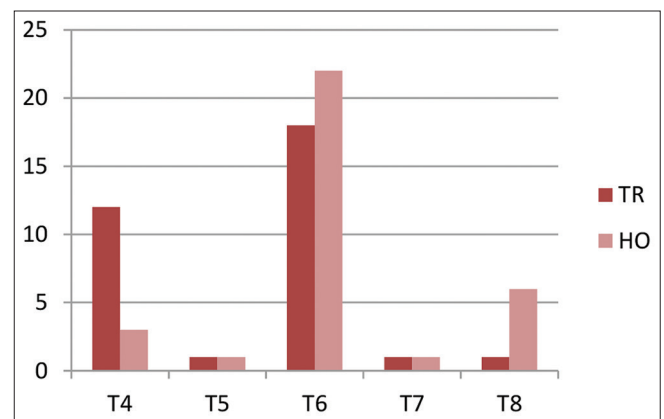


Figure 5: Level of sensory block at 20 min

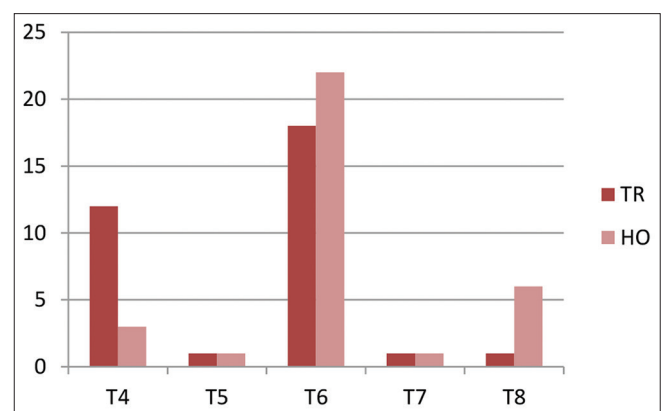


Figure 6: Level of sensory block at 25 min

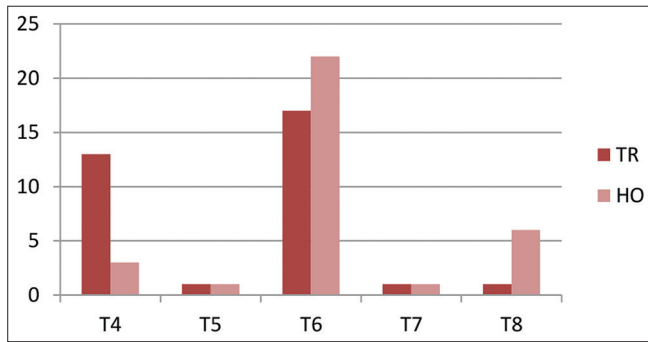


Figure 7: Level of sensory block at 30 min

Figure 7 shows the level of sensory block at 30 min. The P value comes to be 0.033 and is therefore statistically significant.

DISCUSSION

Spinal anesthesia is a better alternative as compared to General anesthesia for infraumbilical surgery. It does not require airway manipulation and small volume of drug is needed for spinal anesthesia and that drug is devoid of systemic pharmacological effect and produce sensory anesthesia. Various surgeries require different levels of sensory block. The level of sensory block depends on a variety of factors such as drug dose, baricity, volume and concentration. Patient factor include CSF volume, which in turn is related to age. CSF volume decreases in advanced age, and this is the most important patient factor. CSF volume also decreases with increased abdominal mass in obese patients and increased epidural fat content.

Spread of local anesthetic within CSF is closely related to changes in lumbar lordosis. There is a close association between height of sensory blockade and length of the vertebral column. Among all the procedure-related factors, patient position is the most important. Intrathecal local anesthetic usually stops spreading 20–25 min post-injection; however, extreme change in position even up to 2 h may extend the height of blockade due to bulk flow of CSF.

In our study, we have included only those patients belonging to the age group between 18 and 55 years. The sensory block level at 2 min in Trendelenburg and horizontal position was comparable. The calculated “P” value comes to be 0.6243 which is statistically insignificant. Thus, we see that at the end of 2 min both in the horizontal and Trendelenburg groups, the height of sensory block achieved was more or less equal. At the end of 2 min, the highest level of sensory block was achieved T9. Most of them had blockade till T10-T11 (Table 1 and Figure 1).

At the end of 5 min, the maximum block height achieved was T6 and each of the groups had one patient with T6 blockade.

Most of the patients in the horizontal group had achieved a sensory block height of T10 whereas the Trendelenburg group had a block height of T8. Thereby, it shows that the rise in the height of block between 2-5 min was more in case of the Trendelenburg group. The P value calculated was 0.011109 and showed that it was statistically significant (Table 2 and Figure 2).

By the end of 10 min, the maximum level of block achieved in either group was T4. Five of the patient had achieved T4 level in the Trendelenburg position group as opposed to only one in the horizontal position group. Maximum patients had achieved T8 level of sensory block in the horizontal group while 22 of them had achieved so in the Trendelenburg group with $P=0.00003$ which is statistically significant (Table 3 and Figure 3).

By 15 min, we see that most patients in either group had achieved a block height of T6. The “P” value was 0.001 which was statistically significant. In the Trendelenburg group, 12 patients achieved T4 level while only one achieved T4 level in the horizontal group with $P=0.001433$ which is statistically significant (Table 4 and Figure 4).

At 20 min, almost half of the patients in the Trendelenburg group had achieved block height of T4 and the rest of them mostly had block height of T6. The “P” value was 0.05 which was statistically significant. Only 3 patients in the horizontal group achieved T4 level (Table 5 and Figure 5).

This level of sensory block remained more or less the same after 20 min in both the groups (Tables 6 and 7, Figures 6 and 7).

In one study by Kim et al.,⁷ performed on 49 males undergoing lower abdominal and lower limb surgery, it was seen that when after spinal block, the level of sensory block was not adequate, it could be used to extend cephalad by position with hip flexion as compared with only Trendelenburg position.

In contrary, a study conducted by Povey et al.,⁸ on 50 patients (divided into 5 groups), who remained sitting after spinal anesthesia for 5 different periods of time and then placed horizontal till the same level of analgesia was obtained. The patients were then placed in Trendelenburg position till maximum height was achieved. It was seen that changes in position did not have much effect on maximum block height after passing the three periods.

In another study by Miyabe and Namiki,³ conducted to determine the utility of 10° head-down tilt for hypotension after neuraxial blockade, it was concluded that head-down tilt after neuraxial blockade increases ABP for severe hypotension only but had no effect in maintaining BP.

In a similar study, the effect of Trendelenburg posture on sensory block level in spinal anesthesia with intrathecal hyperbaric bupivacaine for hernia repair by Shahriari et al.,⁵ which was conducted on 40 patients, showed that the Trendelenburg group had a significantly higher level of sensory block during the period of study as compared to the horizontal group.

Our study showed that the demographic parameters were not statistically significant. The level of sensory block at the end of 2 min was statistically insignificant and the same at 5, 10, 15, 20, 25, and 30 min was statistically significant.

Limitations of the study

Sample size is small. Obstetric patients and patients with extreme age (>60 Years) were excluded from the study.

CONCLUSION

From our current study, we can conclude that Trendelenburg position can be used to achieve a higher level of sensory block as compared to horizontal after successful neuraxial block.

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Authors' Contributions:

SGB- Definition of intellectual content, implementation of study protocol, and data collection; **SH**- Data collection and manuscript preparation; **AB**- Statistical analysis and interpretation; **UB**- Review manuscript, editing, and manuscript revision and submission of article.

Work attributed to:

Department of Anesthesiology, Calcutta Medical College, Kolkata, West Bengal, India.

Orcid ID:

Sarmila Guha Banerjee - <https://orcid.org/0009-0007-9091-3143>

Shantanu Hazra - <https://orcid.org/0009-0008-4700-5809>

Akashleena Banerjee - <https://orcid.org/0009-0009-7474-4073>

Ujjwal Bandyopadhyay - <https://orcid.org/0009-0004-1161-4689>

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