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# Analysis of modified sitting positions for subarachnoid block: A prospective observational study

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## ABSTRACT

**Background:** Neuraxial block is one of the most common anesthetic modalities for a wide range of surgical procedures. Conventionally, it is mostly performed in classical sitting position (CSP), however, a few modifications of sitting position have been described in literature since patient positioning is by far the most crucial factor for a successful subarachnoid block (SAB). Proper positioning of the patients reduces lumbar lordosis and facilitates easy palpation of the landmarks. **Aims and Objectives:** Comparison of three different sitting positions including classical sitting position (CSP), hamstring stretch position (HSP), and riders sitting position (RSP), for SAB. **Materials and Methods:** A total of 207 patients, divided equally into three groups (CSP, HSP and RSP) with 69 patients in each group. Spinal anesthesia was given in three different sitting positions, and the parameters were recorded with respect to time taken for intrathecal placement of the needle, number of punctures, ease of palpation of space, patient comfort, and anesthesiologists' satisfaction. **Results:** Confirmation of subarachnoid placement of needle required the least time in RSP group (P = 0.003), majority of patients in RSP required a single skin puncture (P = 0.0237), clarity of the bony landmarks was similar in all the three positions (P = 0.108), patients' satisfaction score was highest in CSP group (P = 0.012); however, anesthesiologists' reported higher satisfaction levels in RSP group, although results were statistically non-significant (P = 0.739). **Conclusion:** From the anesthetist's standpoint, RSP was the most favorable position for spinal anesthesia, however, the majority of patients reported better comfort levels with CSP.

**Key words:** Subarachnoid block; Spinal anesthesia; Patient positioning, classical sitting position; Hamstring stretch position; Riders sitting position

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## INTRODUCTION

Lumbar spinal anesthesia is commonly used in various surgeries to provide both anesthesia and post-operative analgesia.[1] Successful administration of spinal anesthesia is essential for many surgical procedures. Spinal anesthesia success rate is affected by several factors, including the accuracy of the injection landmark, anesthesiologist's expertise, the patient's positioning, the degree of lumbar flexion, and the depth between the skin and the subarachnoid space.[2]

Patient positioning is by far the most critical factor in the success of spinal anesthesia. Reduced lumbar lordosis achieved through proper positioning facilitates the palpation of vertebral spinous processes and identification of intervertebral distance.[1] The quality of positioning is defined as good or poor according to the ability to flex the

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spine adequately. Inadequate positioning often results in multiple attempts to complete the procedure due to needle-bone contact, which can lead to back pain, hematoma, and paresthesia.[3]

Textbooks outline two standard patient positions, namely, the lateral decubitus position and the sitting position. The traditional sitting position is the most common position for spinal or epidural anesthesia where the patient sits on the operating table, with both feet placed on a stool, and both hips and knees maximally flexed. Tashayod and Tamadon[4] described a modified sitting position named as hamstring stretch position (HSP) and Manggala et al.,[2] described crossed leg sitting position in Asian population. The hamstring position involves maximum extension of the knees, adduction of the hips, and forward bending.[5,6] In addition to these positions described in the literature, another sitting position, rider's sitting position (RSP) is being applied during spinal epidural anesthesia, in which the patient is positioned on the table with the knees flexed 90°, hips abducted and the feet swinging freely.[1] The goal of these modified sitting positions is the same across studies; to achieve optimal flexed position, to reduce the lumbar lordosis and widen the intervertebral space, to achieve an easier access to the intervertebral space while lumbar flexion pushes the theca sac into a more superficial position.[6]

Although there is sufficient radiological evidence regarding the ease of visualization of different spinal structures depending on the patient positioning, however, the current literature lacks adequate clinical data about the ease of administration of a neuraxial block and patient satisfaction with different sitting positions during spinal anesthesia.[7]

### Aims and objectives

Comparison of three different sitting positions including classical sitting position (CSP), hamstring stretch position (HSP), and riders sitting position (RSP) for subarachnoid block.

## MATERIALS AND METHODS

This prospective observational study was conducted at the Department of Anaesthesiology, Sher-I-Kashmir Institute of Medical Sciences, Soura, Srinagar, which is a tertiary care hospital in North India. The study population included 207 patients, scheduled for elective surgery under spinal anesthesia, the study was conducted over a period of 2 years from 2022 to 2024. A written and informed consent was taken from all subjects and the study was conducted after obtaining ethical clearance from the Institutional Ethics Committee of SKIMS; IEC/SKIMS Protocol # RP 224/2022.

### Inclusion criteria

The inclusion criteria were as follows: Adult Patients of either gender, age >18 years, American Society of Anesthesiologists (ASA) Class I and II, scheduled for elective surgery ASA I and II, who consented for the study were enrolled.

### Exclusion criteria

The exclusion criteria were as follows: Pregnant ladies, patients who refused spinal anesthesia, those with a previous history of lumbar vertebral surgery or other contraindications for spinal anesthesia, patients with BMI >30, and patients who refused to consent were excluded from the study.

The patients were allocated into one of the following three groups, and allocation was done by drawing chits.

1. Classic sitting position (CSP)
2. HSP, and
3. RSP.

Patients were positioned on the operation table in one of the three different positions as per their group allocation.

The first group of patients was positioned in CSP, knees flexed approximately 90°, hip in abduction, and feet over a stool support. The second group of patients was positioned in HSP, seated with legs totally supported by the operating table, knees in extension, and hips adducted. The third group of patients was positioned in RSP; with knees flexed 90°, hips abducted, and feet swinging freely on each side of the table.

Using a standardized anesthetic technique a 27-gauge Quincke's spinal needle was inserted through a midline approach into the L3-L4 intervertebral space. The length of time taken until successful needle placement was measured. This was defined as the time in seconds from the final positioning of the patient until the free flow of cerebrospinal fluid (CSF). Number of skin punctures required to successfully complete the procedure and satisfaction reported by the anesthesiologist was recorded subjectively as satisfied and dissatisfied. Clarity in palpation of the bony landmarks for identification of the intervertebral space was noted as clear or unclear.

The patient comfort was recorded using Likert score

1. Very uncomfortable
2. Uncomfortable
3. Neutral
4. Comfortable.

Number of skin punctures was the total count of all the skin punctures excluding local anesthetic infiltration. Anesthesia was established with a single bolus of a mixture

**Table 1: Patient characteristics**

| Parameter | CSP n=69 | HSP n=69 | RSP n=69 | P-value |
|---|---|---|---|---|
| Age in years | | | | |
| Mean (range) | 35 (18–65) | 32 (18–65) | 34 (18–65) | NS |
| Gender M/F (percent) | 49/20 (71/29) | 40/29 (58/42) | 47/22 (68.1/31.9) | NS |
| ASA I/II (percent) | 36/33 (52.2/47.8) | 41/28 (59.4/40.6) | 37/32 (53.6/46.4) | NS |
| BMI (kg/m$^2$) | | | | |
| Mean (Range) | 26.6 (19.4–28.6) | 26.1 (20.2–28) | 26.4 (19.6–28.4) | NS |

CSP: Classical sitting position, HSP: Hamstring stretch position, RSP: Riders sitting position, ASA: American Society of anesthesiologists, BMI: Body mass index

**Table 2: Comparison of the three groups with respect to observed parameters**

| Parameter | CSP n=69 | HSP n=69 | RSP n=69 | P-value |
|---|---|---|---|---|
| Clarity in palpation of bony landmarks clear (percent) | 43 (62.3) | 36 (52.2) | 48 (69.6) | 0.108 |
| Time taken (seconds) 0–30/30–60/60–90/>90 (percent) | 0/37/28/4 (0/53.6/40.6/5.8) | 1/14/54/0 (1.4/20.3/78.3/0) | 0/47/22/0 (0/68.1/31.9/0) | 0.003 |

**Table 3: Technical feasibility of the three sitting positions as reported by Anesthesiologist**

| Anesthesiologist's experience | CSP | | HSP | | RSP | | P-value |
|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | |
| Relatively easy access for SAB* (satisfied) | 48 | 69.6 | 47 | 68.1 | 51 | 73.9 | >0.05 |
| Relatively difficult access for SAB* (not-satisfied) | 21 | 30.4 | 22 | 31.9 | 18 | 26.1 | >0.05 |
| Total | 69 | 100.0 | 69 | 100.0 | 69 | 100.0 | |

*Subarachnoid block, CSP: Classical sitting position, HSP: Hamstring stretch position, RSP: Riders sitting position

of 2.5 mL 0.5% hyperbaric bupivacaine with 0.5 mL of fentanyl (25 mcg). The patient was immediately placed in supine position.

## RESULTS

As shown in Table 1, the patient characteristics, namely, age, gender, ASA status, and body mass index were similar between the groups, ensuring comparability for evaluation.

Table 2 depicts that, the RSP group showed a greater ease in identification of intervertebral space, followed by the CSP group. Time taken to perform the spinal anesthesia was 30–60 s in maximum patients from the RSP group, while majority of the patients in the HSP group took 60–90 s. About 73.9% of patients in the RSP group required a single puncture, followed by 56.5% of patients from the CSP group and 46.4% of patients in the HSP group.

As shown in Figure 1, the patients' comfort level during the subarachnoid block was evaluated as per the Likert score (1-very uncomfortable, 2-uncomfortable, 3- neutral, and 4-comfortable). In our study, it was observed that 71% of patients were comfortable in CSP while only 56.5% of patients were comfortable in the HSP group. The RSP group had the lowest percentage of patients (26.1%) who were comfortable. About 24.6% of patients in the RSP group reported as being very uncomfortable during

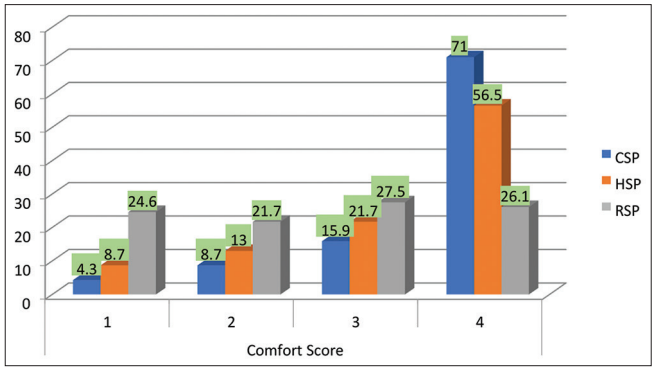


**Figure 1:** Comparison of patient comfort scores

positioning which was the highest among the three groups, the results were in favor of CSP for all 4 scores (P<0.05).

Table 3 represents the anesthesiologist's overall experience based on the technical feasibility and access achieved to administer the block with each position, Anesthesiologist reported easy access while giving spinal in 73.9% of patients in RSP group, in 68.1% of patients in HSP and 69.1% of patients in the CSP group, the difference in was statistically nonsignificant (P>0.05).

## DISCUSSION

Lumbar puncture and administration of spinal anesthesia are common procedures performed in the operating

room. The success rate of spinal needle placement in subarachnoid space is influenced to a greater extent by the appropriate patient positioning and the experience of anesthesiologist.[8,9] The classical sitting and lateral decubitus positions are most regularly used. The HSP and the RSP are comparatively newer positions utilized for administration of spinal anesthesia.[1,4] We planned to study these three positions for spinal anesthesia and compare them with respect to time taken for successful spinal tap, number of skin punctures, ease of identification of bony landmarks, number of intervertebral spaces punctured, anesthetist's satisfaction and patient comfort achieved.

We observed in our study that most of the patients in the CSP, HSP, and RSP were between 31 years and 40 years of age. The difference in the age distribution between these groups was statistically non-significant (P=0.059). The above frequency distribution could be explained by the exclusion of ≥ASA III group of patients. These findings were in unison with the study conducted by Singh et al.,[10] who observed that the mean age of participants in their study was 30.06±4.29 years.

The gender distribution of our study participants was comparable and the difference was statistically non-significant (P=0.237). There was a predominance of male patients in our study. About 71% of CSP, 58% of HSP, and 68.1% of RSP group patients were male. These findings were similar to studies conducted by Korkmaz Toker et al.,[1] and Singh et al.,[10] who also reported a male preponderance, although this difference in gender distribution was statistically non-significant.

We noted in our study, that 52.2% of CSP, 59.4% of HSP, and 53.6% of patients in the RSP group were ASA I. The difference in ASA class among the three groups was statistically non-significant with a P=0.663. Korkmaz Toker et al.,[1] observed that 62% of the study participants were ASA Class II, 30% were ASA Class I and 8% were ASA Class III. The disparity in these findings and our observations is explained by demographic differences between these populations and exclusion of ASA III in our study.

We observed that bony landmarks were clearly palpated in the majority of patients in each of the three groups; 69.6% in RSP, 52.2% in HSP, and 62.3% in the CSP group with the difference between these groups being statistically non-significant. In a study conducted by Fisher et al.,[5] a comparison between CSP and the HSP showed that palpation of spinous processes was significantly easier in the CSP. Soltani Mohammadi et al.,[6] also reported that identification of intervertebral space was easier in the CSP in comparison with the HSP although the difference was non-significant. These findings align with the current study.[6] Increased intervertebral distance and reduced lumbar lordosis in CSP most likely explain an easier identification of the bony landmarks and intervertebral spaces.

We observed in our study that RSP patients had a favorable profile in terms of the number of punctures needed for successful tap of CSF. A total of 51 out of 69 patients in the RSP group achieved successful spinal tap in the first puncture only. Similarly, 39 out of 69 patients in the CSP group needed a single attempt to obtain free flow of CSF. However, 50.7% of patients in the HSP group needed two attempts and 2.9% required more than two attempts in our study. This difference was statistically significant among the groups. Afolayan et al.,[11] similar to our study observed that more patients in the legs on stool group recorded a successful needle placement in the first puncture as compared to the legs on table group, although the difference was non-significant.[11]

It was observed that patients in the RSP group recorded the shortest time to spinal tap with 68.1% of patients in this group taking 31–60 s to free flow of CSF while only 53.6% of patients in the CSP achieved a successful spinal tap in the same time interval. Patients in the HSP group recorded the longest time to spinal tap with 78.3% of patients taking 61–90 s. The difference between these groups was statistically significant (P=0.003). The shorter time with the RSP group may be explained by least number of punctures required and greater ease of palpation of bony landmarks.

Anesthesiologists administering spinal anesthesia reported greater satisfaction with the RSP as compared to the other two positions. Among the three positions, they were least satisfied with the HSP.

Patients in our study reported greater satisfaction with the CSP when compared with other two positions. The RSP was found to be the least comfortable with these differences being statistically significant. Similar to the current study, Singh et al.,[10] demonstrated significantly greater comfort scores with the CSP group and the RSP being the most uncomfortable. Least hip abduction and foot support provided in the classic sitting position could explain this finding.

From the analysis of the data, our study confirms that the alternative positions for administering spinal anesthesia (RSP and HSP) may be used instead of CSP in selected patient groups offering technical difficulty to the anesthesiologist with regard to proper space identification in the CSP, as these alternative positions offer greater technical relief to the anesthesiologist while performing the block. However, further studies are warranted in this regard.

### Limitations of the study

1. The study was observational in nature with limited sample size.
2. parameters such as the intervertebral distance, intrathecal distance and the distance from skin to ligamentum flavum may vary between different demographic populations.

## CONCLUSION

It can be concluded from our study that, the alternative positions for administering spinal anaesthesia (Riders sitting position and Hamstring Stretch Position) may be used instead of classical sitting position in selected patient groups, as these alternative postions offer greater technically less demanding for performing the block.

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**Authors' Contributions:**
**NC**- Definition of intellectual content, literature survey, prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation; **AR-** Concept, design, clinical protocol, manuscript preparation, preparation of figures, and manuscript revision; **RSS-** Design of study, statistical analysis, interpretation, coordination, submission of article; **MJ**- Editing and review manuscript; **RJ**- Manuscript preparation, and revision; **SAG**- Literature survey and manuscript revision.

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