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Is Straight Back a Good Alternative to the Flexed Back for Spinal Anaesthesia?

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Dr. Udit Girdhar,
Senior Resident, Department of Anaesthesiology, Faculty of Medicine & Health Sciences, SGT University, Gurugram, Haryana, India

Dr. Pallavi Sangwan,
Postgraduate Student, Department of Anaesthesiology, Faculty of Medicine & Health Sciences, SGT University, Gurugram, Haryana, India

Dr. Ranjeet Singh,
Postgraduate Student, Department of Anaesthesiology, Faculty of Medicine & Health Sciences, SGT University, Gurugram, Haryana, India

Dr. Kshitij Yadhav,
Postgraduate Student, Department of Anaesthesiology, Faculty of Medicine & Health Sciences, SGT University, Gurugram, Haryana, India

Dr. Shikha Gupta,
Senior Resident, Department of Anaesthesiology, Faculty of Medicine & Health Sciences, SGT University, Gurugram, Haryana, India

Dr. Baljit Singh,
Professor & Head, Department of Anaesthesiology, Faculty of Medicine & Health Sciences, SGT University, Gurugram, Haryana, India

Corresponding author: Dr Baljit Singh,
Professor and Head Anaesthesiology, Faculty of Medicine & Health Sciences, SGT University, Gurugram, Haryana, India

Key words:
Spinal anaesthesia, straight back, flexed back, posture, neuraxial block,

Abstract:

Background: Spinal anaesthesia is generally performed with the patient's back in flexed position so that the intervertebral spaces open up and the needle gets to the subarachnoid space without hitting the bone. However, in patient with lower limb fracture or orthopaedic disorders, it may not be possible to bend the back. Due to the ambiguity in literature with regard to the straight back as an alternative to the flexed back, the present study was conducted. Methods: 100 patients ASA grade I and II in the age group of 20-50 years scheduled for surgery under spinal anaesthesia were randomly allocated to straight back (SS group) and flexed back (SF) groups. The patients were informed that they would be placed in both flexed and straight postures before being placed in the final performing position, and both postures were explained to them to gauge their preference. The patient's level of comfort during the delivery of spinal anesthesia was rated as follows: There is no discomfort in Grade I, mild discomfort in Grade II, and severe discomfort in Grade III that requires changing positions. Ease of administration was assessed by quality of surface landmarks and number of bone contacts. Results: Spinal tap was successful on first attempt in 42 (84%) and 36 (72%) in group SF and SS respectively. Second attempt success was achieved in 8 (16%) and 14 (28%) in SF and SS group respectively. The quality of landmarks was grade 1 in 39 (78.0%), grade II in 11 (22%) patients in SF group. It was grade II in 11 (22%) in SF group and 21 (42%) patients in SS group. No patient in SS group had any discomfort while in SF group 40 (80%) had grade I and 10 (20%) had grade II discomfort. In SF group 40 (80%) preferred flexed posture while 10 (20%) preferred straight posture. In SS group no patient preferred flexed posture. Conclusions: Successful spinal anaesthesia is possible in patients irrespective of sitting straight or sitting flexed posture but more number of patients require second attempt with straight back. Though majority of patients preferred to sit straight, spinal anaesthesia is technically easier in patients having their back flexed during the procedure.

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1. Introduction:

Spinal anaesthesia expands anaesthesiologists' armamentarium by providing an alternative to general anaesthesia for lower abdomen and lower limb surgeries. "Its success rate ranges from 83 to 99% and depends on a number of variables, including the ability of the anesthesiologist, the positioning of the patient, identification of bony landmarks and the distance between the skin and the subarachnoid space" [1,2,3]

The patient's posture is the single most crucial aspect in determining whether the spinal needle is successfully inserted into the subarachnoid area. When performing a subarachnoid block (SAB), patients are typically positioned with their backs flexed[4] · In addition to causing patient discomfort, poor posture may result in repeated bone impacts that increase the risk of back pain, epidural hemorrhage, and brain injuries.[5]

Flexion of the back is necessary for subarachnoid block as it opens up the interspinous spaces. This position though provides easy access to subarachnoid space, it may be uncomfortable for the patients with pain due to various problems like lower limb fracture or vertebral pathology and even in obstetric patients due to abdominal bulge. Keeping the back straight may be comfortable for such a patient but is presumably a suboptimal position for administering subarachnoid block. There is paucity of literature on comparison of straight back versus flexed back posture for the subarachnoid block with regard to patient preference and success rate. Therefore, the present study was designed to compare straight back versus flexed back position for spinal anaesthesia in non-problematic patients so that the findings can be extrapolated to patients with difficulty in flexion of back.

2. Material and methods:

This prospective randomised observational study was conducted in the "Department of Anaesthesiology and Critical Care at SGT Medical College Hospital and Research Institute, Gurugram, over a period of two years from December 2018 to October 2020". After Institutional Ethical Committee approval and written informed consent from the patients, one hundred healthy adult patients aged between 20-50 years with BMI < 30kg m^{-2} of either sex belonging to American Society of Anesthesiologists (ASA) physical status I and II, scheduled for elective surgery under spinal anaesthesia were included in the study.

Study participants who had a deformed spine, infection at the injection site, coagulopathy, pregnancy, an allergy to local anesthetics, elevated intracranial tension, a history of back injuries, or any other typical contraindication to spinal anesthesia were excluded. The night before and the morning of surgery, all of the patients received oral alprazolam 0.25 mg with a sip of water as a premedication. After midnight, they were kept nil per oral. Standard monitoring, including as non-invasive blood pressure (NIBP), an ECG, and pulse oximetry, were established as soon as the patient entered the operating room. An 18 G venous cannula was used to secure the intravenous line.

Using the sealed envelope method, the patients were separated into two groups of 50 each. In groups SS and SF, spinal anesthesia was provided while the subjects were seated with their backs straight. Both the proposed postures were explained to the patients before the procedure. "They were instructed that before putting them into the final performing position, they would be placed in both flexed and straight postures to gauge their preference. A non-performing posture (straight for the flexed group and vice versa) was to be maintained for 2 minutes". After the procedure was finished, they were prompted to state their preferred posture.

Patients were instructed to cross their hands over their own thighs with their elbows flexed in order to maintain a straight back posture. By maintaining their positions in their respective mid axillary planes, both arms avoided leaning forward or backward. Normal back flexion from sitting posture, if any, was accepted. Patients were instructed to maintain a straight back and bend their necks forward as much as possible while sitting with their arms resting on a pillow on their lap.[6] The patient's posture was helped to stay in place by an assistance in front of them.

A 25 G, 3.5 inch-long Quincke spinal needle (B. Braun, Melsungen AG, Germany) was used to administer a subarachnoid block under all aseptic circumstances and using conventional procedures. To preserve the interspinous space at the performer's eye level, the height of the operating table and the performer's stool were also changed. L3-L4 interspinous spaces and L2-L3 interspinous spaces were regarded as the first and second preferred spaces, respectively.

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A modest cephalad orientation was used to inject the needle at the initial chosen location, and its placement in the subarachnoid area was determined by tactile feeling. After CSF appeared at the needle's hub upon stylet withdrawal, free flow was confirmed. After determining that the needle had been successfully inserted, 15 mg of 0.5% heavy bupivacaine was administered into the CSF. The following maneuvers were carried out if it appeared from the tactile feeling that the needle positioning was accurate. The needle was spun clockwise 90 degrees, and if there was no increase in CSF flow after waiting for 5 seconds, the rotation sequence was repeated three more times for a total of 360 degrees, with a 5-second delay between each revolution. Despite this, the needle was advanced an additional 2 mm if there was no CSF present or no free flow. After this maneuver failed to produce CSF or allow it to flow freely, the needle was withdrew by 2 mm. After performing all of these maneuvers, the absence of CSF or its unrestricted flow was regarded as a failed initial effort.

After the initial attempt failed, the needle was fully removed. Additionally, the midline was reevaluated, and a second attempt was made by reintroducing the needle in the same first preferred space. Free flow of CSF was sought once it had been successfully positioned in the subarachnoid space, as determined by tactile sensation, and if it had been attained, it was considered a success. The aforementioned maneuvers were repeated in the absence of CSF or its free flow in order to either successfully put the needle or to consider it a failed second attempt. In the event that the second effort failed, the third and final attempt—which included all of the aforementioned maneuvers—was taken into consideration in the second preferred space in L2-L3. "However, a midline assessment for the second preferred space was not repeated for a subsequent attempt after the third failed attempt, and the spinal procedure was abandoned in favor of general anesthesia".

In case bone was discovered after any of the efforts, the needle was removed just deep enough to reach skin level before being reinserted with a stronger cephalad angulation. When a bone touched persistently more than twice at the same depth, the needle was withdrawn since it was believed to have deviated off the midline. A needle was inserted into the same region after reconfirming the midline, and in cases of bone contacts, a direction shift was made as necessary. The maximum number of times the needle was redirected during each attempt was two. Even after establishing the midline, more than two encounters with the bone were regarded as a failure in that particular attempt.

A patient with traumatic tap was put in flexed position and another needle placement attempt was made in the next best location. After the initial unpleasant tap on the patient in the flexed group, the operation was tried in the next best location. If there was a traumatic tap even in the second space, the treatment was stopped.

Systolic blood pressure less than 90 mm Hg, a systolic blood pressure decline of more than 30 mm Hg, or a drop in mean arterial pressure of more than 20% from baseline were all considered to be signs of hypotension. A 6 mg bolus of intravenous mephentermine was used to treat this. Bradycardia was treated with 0.3 mg of intravenous atropine and was defined as HR fewer than 50 beats per minute.

"'Loss of cold sensation' to cotton wool soaked in ethyl alcohol was used to measure sensory block. BROMAGE score (0 = no motor paralysis; 1 = unable to lift extended legs but able to flex knees and ankles; 2 = unable to raise extended legs and flex knees but able to move feet; 3 = unable to flex ankles and feet) was used to evaluate motor block".[7]

The patient's level of comfort during the delivery of spinal anesthesia was rated as:

Grade I: No discomfort

Grade II: Mild discomfort

Grade III: severe discomfort necessitating a posture change.

An experienced anesthesiologist with at least five years of practical experience in the field evaluated the ease of administering spinal anesthesia using the quality of surface landmarks and the number of bone contacts.

Quality of landmarks was graded as follows [8]

1. Easy to palpate
2. Difficult to palpate
3. Impossible to palpate

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The parameters which were recorded for data analysis include: patient comfort, number of attempts, procedural success with or without any manipulation of needle. By asking the patient which posture he would prefer more, the preference of the position was evaluated.

3. Results:

Mean age (36.18 and 37.44 years), BMI Index (24.24+2.04 and 23.75+1.58) and sex (31:19 and 33:17; male: female) were comparable in Group SF and SS) respectively.

Number of attempts:

In SF group, successful spinal tap was possible in first attempt in 42 (84.0%) while eight (16.0%) patients required second attempt. In SS group successful tap on first attempt was possible in 36 (72.0%) patients and 14 (28%) patients required second attempt. No patient required third attempt in any of the groups. Statistically, the difference in the two groups was not significant.

The distribution of Needle Bone redirection was significantly different between the two groups (p =< 0.001; table 1).

Needle Bone Redirection	Group			
	SF	SS	Total	P Value
Yes	20 (40.0%)	38 (76.0%)	58 (58.0%)	< 0.001
No	30 (60.0%)	12 (24.0%)	42 (42.0%)	
Total	50 (100.0%)	50 (100.0%)	100 (100.0%)	

Table 1: Needle Bone redirection required in two groups:

Quality of landmarks:

The quality of landmarks was grade 1 in 39 (78.0%) patients in SF group and 29 (58%) in SS group. 11 (22.0%) patients had 'Grade 2' quality of landmarks in SF group and 21 (42.0%) had 'Grade 2' quality of landmarks. None of the patients had Grade 3 quality of landmarks. The difference in the two groups was statistically significant (p value 0.032).

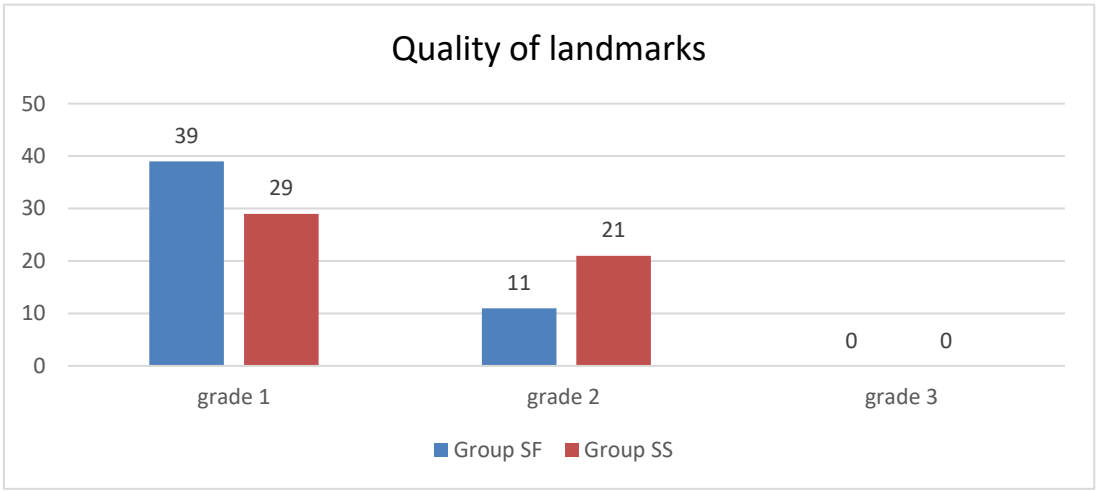

Figure 1 Diagram showing quality of landmarks in two groups:

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Bromage Score:

Bromage score was (100.0%) in all the patients in both the groups.

Patient comfort:

None of the patients in the SS group had any discomfort during the procedure while 40 patients (80%) in SF group experienced Grade I discomfort. The difference in the two groups was highly significant (p value < 0.001). 10 (20%) patients had grade II discomfort in SF group. No patient in either of the groups experienced grade III discomfort (Table 2).

Patient discomfort	Group			
	SF	SS	Total	P Value
Grade I	40 (80.0%)	50 (100.0%)	90 (90.0%)	< 0.001
Grade II	10 (20.0%)	0 (0.0%)	10 (10.0%)	
Grade III	0	0	0	
Total	50 (100.0%)	50 (100.0%)	100 (100.0%)	

Table 2: Level of patient discomfort in two groups

Preference of posture:

40 (80.0%) patients in the SF group preferred flexed posture while 10 (20.0%) patients preferred straight posture. None of the patients in the SS group preferred flexed posture (Table 3).

Patient preference	Group			
	SF	SS	Total	P Value
Flexed	40 (80.0%)	0 (0.0%)	40 (40.0%)	< 0.001
Straight	10 (20.0%)	50 (100.0%)	60 (60.0%)	
Total	50 (100.0%)	50 (100.0%)	100 (100.0%)	

Table 3: Showing patient preference in two groups

4. Discussion:

The classic teaching in relation to the institution of subarachnoid block is to position the patient with his back in flexed position whether he is in sitting or lateral decubitus posture. Flexed posture not only opens up the interspinous space but the interlaminar hiatus also through which the needle has to pass before puncturing dura and arachnoid mater to get into the subarachnoid region. Most often, the needle hits posterior aspect of upper border of the lamina of the vertebra below or lower border of the lamina of the vertebra above. The needle tip can also hit the upper and lower articular processes on either side if it goes off the midline which may happen even if the point of insertion is on the midline. The increase in the longitudinal and transverse dimensions of the interlaminar hiatus is more important than the interspinous space as the spinous processes can

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be felt though with some difficulty in straight back but the smaller interlaminar space requires more precision of needle direction in this position. This study was aimed at determining the success of needle placement with patient's back in straight position as spinal may require to be performed without flexing the back in certain patients with orthopaedic pathology or fractures where flexion of the back cannot be achieved. The overall success of the subarachnoid block was reported to be 100% in both the straight and flexed groups, which is consistent with a previous study.[9] Though, 100% success in patients with flexed posture has been reported by Biswas et al, it was only 95% in patients with straight back posture.[10]

Successful spinal tap was possible in first attempt in 42 (84.0%) patients in the SF group and in 36 (72.0%) patients in SS group in the present study. More patients in the straight group required second attempt for successful spinal tap. No patient required third attempt in any of the groups. De Oliveira et al had first attempt success rate of only 61.5% which may be because they included all patients undergoing spinal anaesthesia whatsoever.[11] Higher success rate in the present study may be due to the adoption of strict exclusion criteria. "Results of the present study with regard to success are consistent with the previous studies".[9,10]

Significantly, more number of patients in SS group (38; 60%) required needle redirection than in SF group (12; 24%). This is similar to the observations of Biswas et al. The most probable reasons for more number of patients requiring needle redirections in SS group can be an inadequate cephalad direction of the needle with respect to the long axis of the spinous process. Due to this, the needle's alignment was off and it was unable to enter the subarachnoid space without touching the lamina.[10]

Reduction of lumbar lordosis achieved during flexion of the spine opens up the intervertebral spaces which may facilitate identification of the tips of the spinous processes which are important landmarks. Easy identification of the landmarks and determining the midline would decrease the number of needle bone contact. According to reports, the interspinous space is the most reliable indicator of how easy or difficult spinal anesthesia would be.[12]

According to studies, the hamstring stretch position is more effective at reducing lumbar spine lordosis and making spinal puncture easier because it increases hamstring tension through passive knee extension, compensates for pelvic tilting with hip adduction, and reduces lumbar lordosis.[13]

Mohammadi et al. "compared squatting position and conventional sitting position for ease of spinal needle implantation". They noticed that there were fewer needle-bone interactions in the squatting posture than in the conventional sitting position. According to their theories, squatting reduces lumbar lordosis by tightening the hamstrings and lessening the amount of spinal needle interactions with the bone. However, both groups had the same ease of needle insertion or space identification.[14]

The quality of the patient's anatomical landmarks, the appropriateness of the patient placement, and the anesthesia provider's level of skill all affect the success of the neuraxial block. The position of the patient has a significant impact on how anatomical landmarks are perceived. In the current investigation, twenty-one patients (42%), who were seated in a straight position, had Grade 2 difficulties recognizing landmarks, compared to eleven patients (22%) who were flexed. Additionally, compared to the straight group, the landmarks in the flexed group were simpler to palpate. "Our observations in the flexed spine group are similar to those of Soltani et al who reported no statistical difference between the traditional sitting position (TSP), hamstring stretch position (HSP) and squatting position (SP) with regard to the number of needle bone contacts and the ease of finding the intervertebral space".[15] All these positions are akin to flexed (SF) group in the present study. Additionally, they proposed that each of these three positions could be used as a different way to sit when administering spinal anesthesia.

Some individuals may find it uncomfortable to adopt a flexed position for a variety of medical conditions, such as lower limb or pelvis fractures. However, most of the patients were comfortable in straight posture in the present study but experienced discomfort to the neck, pain in abdomen and knee joint in flexed posture. Furthermore, patients with higher BMI found straight posture more comfortable. Most of the patients in each group were able to express reason for their preferred posture but few patients could not. In terms of patient comfort, there was a significant difference between the two groups.

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There was a significant difference between the two groups regarding preference for posture. All patients in SS group preferred sitting straight posture and 20% of the patients in the flexed group preferred their non performing posture i.e. sitting straight. However, none of the patients in the SS group preferred flexed posture and all preferred straight posture in the present study. "This is similar to an earlier study in which the patients had preference for straight posture over flexed posture because of the discomfort associated with the latter".[10] Commenting on this study, Prakash highlighted the concern about preference of straight posture by the patients in flexed group. Prakash claims that due to the mistaken belief that the patient's neck must be flexed for the treatment to be successful, the assistant frequently applies significant pressure to the patient's neck. She added that the procedure for doing the intrathecal puncture at the L3-4/L4-5 interspace just requires the patient to arch his or her back somewhat like that of a crouching cat. The aid shouldn't put strain on the patient's neck and should support the patient at the shoulders. According to her, spinal anesthesia is still best performed with the spine flexible to reduce the need for repeated procedures and needle redirection.[7]

In conclusion, successful spinal anaesthesia is possible in patients irrespective of posture in sitting position; back flexed or straight but more number of patients require second attempt with back straight. Also, number of needle bone contacts requiring needle redirection is significantly more in straight back posture. Though majority of patients preferred to sit straight, spinal anaesthesia is technically easier in patients having their back flexed during the procedure.

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