

Spinal Anaesthesia For Caesarean Section: A Comparative Study of Legs Parallel and Crossed Sitting Positions

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ABSTRACT

Aim: To study the effectiveness of the legs parallel and crossed sitting position in spinal anaesthesia induction.

Materials and Methods: A current prospective observational study was carried out in the Operation Theatre Complex of Yenepoya Medical College Hospital, Mangalore, Karnataka during July 2025 to July 2026. In total, 104 patients aged 18 to 40 years having ASA physical status I to III for elective caesarean delivery under spinal anesthesia were enrolled to CLSP group (n=52) and PLSP group (n=52) by the decision of the anaesthesiologist. The scores for landmark palpation, attempts to make the right needle puncture, patient satisfaction, and anaesthesiologist satisfaction were recorded in a proforma and compared between the two groups using Mann Whitney U test.

Results: There was no statistically significant difference for landmark palpation scores (p=0.795) and the number of times it took to achieve a successful placement of the needle (p=0.33) among the CLSP and PLSP groups. Satisfaction scores for patients and the anaesthesiologists were significantly higher for the CLSP group (p<0.001, p=0.002).

Conclusion: Spinal needle insertion between CLSP and PLSP Showed comparable technical ease, However, CLSP is more comfortable for both the patient and anaesthesiologist. The results obtained above suggest that CLSP may be considered a comfortable alternative sitting position for spinal anaesthesia for caesarean section.

Keywords: Spinal anaesthesia; Crossed-leg sitting position; Parallel-leg sitting position; Caesarean section; Patient satisfaction

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INTRODUCTION:

Spinal anaesthesia is one of the commonly used techniques in regional anaesthesia for surgeries of lower abdomen and lower limbs including Caesarean section.⁽¹⁾

It is very important to know about patient positioning while doing spinal anaesthesia as far as the insertion of the needle is concerned. There are mainly two different postures assumed by the patient while doing spinal anaesthesia. They are sitting or lateral posture. Sitting posture is usually done by obese patients as it helps in recognizing the landmarks of the spine. It is easy to do spinal anaesthesia because sitting posture helps in decreasing the lumbar lordosis that arises due to pregnancy. One of the most recent discoveries is about the crossed leg sitting position (CLSP). It is very comfortable to do this posture for pregnant females. Here the hip joint and knee joint are flexed with increased

lumbar flexion and spinal anaesthesia becomes easier to perform.⁽²⁾

The various postures that can be used in spinal anaesthesia include Traditional Sitting Position (TSP), Crossed Leg Sitting Position (CLSP), Parallel Leg Sitting Position (PLSP), which is the normal anaesthesia position, in which the patient's legs are kept in a stool at the edge of the operating table.^[3] The posture in the PLSP technique is mostly extended, where the body is reclined on the table. In the crossed leg sitting position (CLSP), the patient sits in a position where he is placed in a flexed hip and knee posture on the table. Such positioning makes the spinal anaesthesia easy.⁽³⁾

In the present study, the purpose was to compare the ease of carrying out subarachnoid block among the participants sitting in parallel legs (PLSP) and sitting in crossed legs (CLSP) positions on the table. A number of

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variables play a role in the success of spinal anaesthesia, including both patients and procedural characteristics. Within these factors, patient positioning is one of the most important, which has a direct effect on the ease of spinal needle insertion and success of spinal anaesthesia. Proper patient positioning increases lumbar lordosis, facilitates the localization of anatomical landmarks, expands interspinous and interlaminar spaces and improves access to the subarachnoid space.

Spinal anaesthesia has become the method of preference in providing anaesthesia for elective caesarean section because of its numerous benefits over general anaesthesia, which include rapid onset of sensory and motor block, good intraoperative analgesia, good muscle relaxation, absence of toxic dose of anaesthesia drugs, less maternal hemorrhage, no need for airway manipulation and risk of aspiration, instant communication between mother and infant and proper post operative pain relief. All these benefits have helped make spinal anaesthesia the best option for caesarean delivery worldwide. However, regardless of these many benefits, spinal anaesthesia remains technically challenging for some patients because of individual differences in the structure of the spine, obesity, physiological changes in pregnancy and difficulty in attaining the appropriate positioning in spinal anaesthesia.^(1,2)

Physiological changes due to pregnancy have several effects on the administration of neuraxial block anaesthesia. With growth in the size of the pregnant uterus, there is forward shift in the center of gravity resulting in exaggerated lumbar lordosis and anterior tilting of the pelvis. Simultaneously, because of increased weight of the mother and enlargement of the breast, there is tissue edema and stiffness in the spine, which make identification of the bony landmarks of the lumbar vertebrae difficult. This results in difficulty in identifying the spinous processes and hence reduced space for inserting the needles. In such a case, repeated attempts will be required to gain entry into the subarachnoid space. Needless to say, this results in increased time consumption and anxiety for the patient.⁽²⁾

Conventional use of spinal anaesthesia may involve either of the lateral decubitus or sitting position. Both the positions have their own advantages and disadvantages depending upon the nature of the patient. The lateral position provides stability to the patient and may be employed in sedated, anxious, and poorly built patients who are not able to sit. However, the spinal landmarks may be hard to locate in obese and pregnant patients due to compression and displacement of the spine. Conversely, the sitting position facilitates better localization of the spine and palpation of the landmarks. The latter makes the sitting position the commoner approach for spinal anaesthesia in obstetric patients, especially obese patients or those with non-palpable spinal landmarks.⁽¹⁾

While the conventional sitting position is widely accepted, there have been other sitting positions created to promote better lumbar flexion and facilitate needle insertion. There have been different variations of the conventional sitting position like traditional sitting position (TSP), parallel leg sitting position (PLSP), crossed leg sitting position (CLSP) and pendant position. All these sitting positions aim to modify the angle of the pelvis and lumbar lordosis in order to increase the space between the two spinous processes for easy needle entry into the subarachnoid space. Therefore, the choice of an appropriate sitting position is crucial in the success of neuraxial anaesthesia procedure.^(3,4)

In order to facilitate patient comfort and positioning, several researchers have recommended various modifications of the standard sitting posture. One of such modified sitting postures is the parallel leg sitting position, in which the patient is allowed to sit on the table in such a way that both the legs are kept extended parallel to the body. The position does not require the usage of external foot support and provides more stability to the patient during the procedure. In this particular position, the patient will be adequately supported by the operating table and hence, any kind of movements of the patient during spinal puncture will be avoided. But knee extension will cause a posterior pelvic tilt and therefore prevent lumbar flexion compared to hip and knee flexion.^(2,5)

One of the earliest research studies done to investigate the effectiveness of the parallel leg sitting position in spinal anaesthesia is that of Afolayan et al. In their experiment, the researchers conducted an investigation into the effect of keeping the legs of the patients lying down on the operation table and compared it to the conventional sitting position where the legs of the patients are kept on a stool. It was found that despite similar effectiveness of spinal anaesthesia in both cases, the patients in the modified position experienced more comfort than those in the conventional sitting position.⁽⁵⁾

The crossed-leg sitting position doesn't require additional equipment and may be achieved by most pregnant women. Therefore, this position is considered to be a simple and cost-effective variant of the traditional sitting position.^(2,3)

RESULTS:

The total number of participants who had undergone elective cesarean section under spinal anaesthesia was 104, and

these participants were categorized into the crossed-leg sitting position or the parallel-leg sitting position, where each

category had 52 participants. The enrolled participants were involved in the study and included in the statistical analysis as shown in Figure 4.1 below

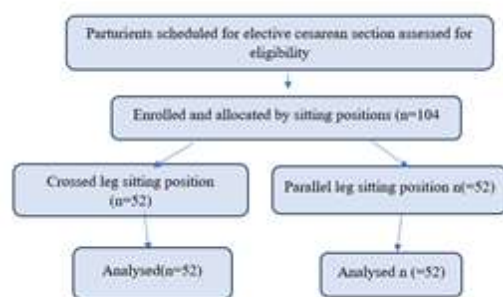


Figure: Flow diagram showing distribution of study participants

DESCRIPTIVE STATISTICS

Table presents the baseline demographic and clinical characteristics of participants in the crossed leg, parallel, and sitting positions .

Table: Comparison of baseline demographic characteristics between the study groups

Variable	Crossed-leg (n=52) Mean (SD)	Parallel-leg (n=52) Mean (SD)	Mann-Whitney U	p value
Age years	27.62 (5.06)	29.23 (5.37)	1112.0	0.119
Weight kg Weight (kg)	69.00 (11.51)	69.19 (8.79)	1363.0	0.945
Height (cm)	156.42 (5.19)	157.77 (6.79)	1297.5	0.724
Bmi BMI (kg/m2)	23.08 (3.23)	22.97 (3.17)	1419.0	0.665
Gestational age (weeks)	34.44 (2.44)	36.79 (2.55)	586.0	<0.001

Values are reported as means (standard deviations). Statistical significance was calculated using the Mann-Whitney U test. Differences were deemed statistically significant when the p value was < 0.05.

There were no statistically significant differences between the crossed-leg and parallel-leg groups regarding

age (p = 0.119), body weight (p = 0.945), body height (p = 0.724), or body mass index (BMI) (p = 0.665). The gestational age at the time of operation was significantly shorter in the crossed-leg group than that in the parallel-leg group (34.44 ± 2.44 weeks versus 36.79 ± 2.55 weeks; p < 0.001)

Table: Comparison of ASA physical status grade between the study groups

ASA grade	Crossed-leg (n=52) n (%)	Parallel-leg (n=52) n (%)	Chi-square	p value
I	0 (0.0%)	1 (1.9%)	8.667	0.013
II	52 (100.0%)	44 (84.6%)		
III	0 (0.0%)	7 (13.5%)		

Values are expressed in number (percentage).

The chi-square test was done for comparing the groups.

The distribution of the ASA physical status grade was significantly different in the two groups ($\chi^2 = 8.667$, p = 0.013). All 52 subjects in the crossed-leg group belonged to ASA grade II. In contrast, there was 1 subject of ASA

grade I, 44 subjects of ASA grade II, and 7 subjects of ASA grade III in the parallel-leg group.

EASE OF SPINAL NEEDLE INSERTION

Table shows the distribution of landmark palpation scores between the crossed-leg and parallel-leg sitting position groups.

Table : Distribution of landmark palpation score between the study groups

Category	Crossed-leg (n=52) n (%)	Parallel-leg (n=52) n (%)
1 – Hardly palpable	34 (65.4%)	33 (63.5%)
2 – Easily palpable	16 (30.8%)	16 (30.8%)
3 – Impalpable	2 (3.8%)	3 (5.8%)

Values are presented as number (percentage). Mean (SD) landmark palpation score: crossed-leg 1.385 (0.565), parallel-leg 1.423 (0.605); median (IQR) 1 (1) in both groups. Mann-Whitney U = 1318, p = 0.795.

The landmark palpation score was comparable between the two groups, with no statistically significant difference (p = 0.795).

Table show the number of attempts taken for successful subarachnoid needle placement in each group.

Table : Distribution of number of attempts for successful needle placement between the study groups

Category	Crossed-leg (n=52) n (%)	Parallel-leg (n=52) n (%)
0	0 (0.0%)	2 (3.8%)

1	24 (46.2%)	25 (48.1%)
2	19 (36.5%)	20 (38.5%)
3	8 (15.4%)	3 (5.8%)
>3	1 (1.9%)	2 (3.8%)

Values are presented as number (percentage). Mean (SD) number of attempts: crossed-leg 1.731 (0.795), parallel-leg 1.577 (0.825); median (IQR) 2 (1) crossed-leg, 1 (1) parallel-leg. Mann-Whitney U = 1214, p = 0.33. Two entries recorded as “0” attempts in the parallel-leg group reflect the data as submitted.

The number of attempts required for successful spinal needle placement did not differ significantly between the crossed-leg and parallel-leg groups (p = 0.33).

PATIENT AND ANAESTHESIOLOGIST SATISFACTION

Table and Figure show the distribution of patient satisfaction scores between the two groups.

Table : Distribution of patient satisfaction score between the study groups

Category	Crossed-leg (n=52) n (%)	Parallel-leg (n=52) n (%)
0 – Not comfortable	6 (11.5%)	27 (51.9%)
1 – Comfortable	22 (42.3%)	21 (40.4%)
2 – Very comfortable	24 (46.2%)	4 (7.7%)

Values are presented as number (percentage). Mean (SD) patient satisfaction score: crossed-leg 1.346 (0.683), parallel-leg 0.558 (0.639); median (IQR) 1 (1) crossed-leg, 0 (1) parallel-leg. Mann-Whitney U = 598, p < 0.001.

Patient satisfaction was significantly higher in the crossed-leg group compared with the parallel-leg group

(p < 0.001). A greater proportion of participants in the crossed-leg group reported being “very comfortable” (46.2%) compared with the parallel-leg group (7.7%), while a greater proportion in the parallel-leg group reported being “not comfortable” (51.9%) compared with the crossed-leg group (11.5%).

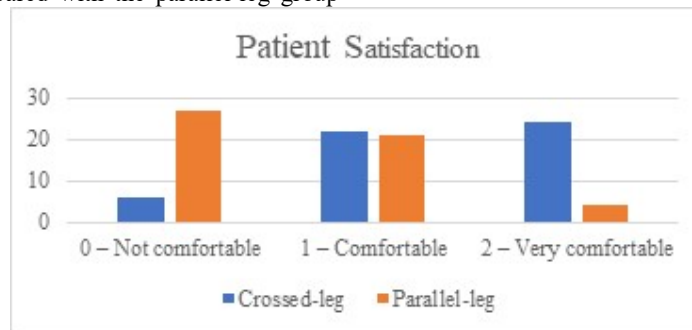


Figure: Bar chart showing distribution of patient satisfaction score by position

Table show the distribution of anaesthesiologist satisfaction scores between the two groups.

Table: Distribution of anaesthesiologist satisfaction score between the study groups

Category	Crossed-leg (n=52) n (%)	Parallel-leg (n=52) n (%)
0 – Not comfortable	8 (15.4%)	15 (28.8%)
1 – Comfortable	20 (38.5%)	29 (55.8%)
2 – Very comfortable	24 (46.2%)	8 (15.4%)

Values are presented as number (percentage). Mean (SD) anaesthesiologist satisfaction score: crossed-leg 1.308 (0.729), parallel-leg 0.865 (0.658); median (IQR) 1 (1) in both groups. Mann-Whitney U = 902, p = 0.002.

Anaesthesiologist satisfaction was significantly higher in the crossed-leg group compared with the parallel-leg

group (p = 0.002). Almost half of the crossed-leg group (46.2%) was rated “very comfortable” by the anaesthesiologist, compared with 15.4% in the parallel-leg group.

SUMMARY OF RESULTS

Table : Summary of Mann-Whitney U test results for all outcome variables

Outcome variable	Test statistic (U)	p value
Landmark palpation score	1318	0.795
Number of attempts	1214	0.33
Patient satisfaction	598	<0.001
Anaesthesiologists satisfaction	902	0.002

Of the four outcome variables assessed, landmark palpation score and number of attempts showed no statistically significant difference between the crossed-leg and parallel-leg sitting position groups. Patient satisfaction and anaesthesiologists' satisfaction were both significantly higher in the crossed-leg group.

DISCUSSION:

Overview

This prospective observational study compared the crossed-leg sitting position (CLSP) and the parallel-leg sitting position (PLSP) for ease of performing subarachnoid block in 104 parturients undergoing elective caesarean section, with 52 participants in each group. Of the four outcome variables assessed, landmark palpation score and number of attempts did not differ significantly between the groups, whereas both patient satisfaction and anaesthesiologist satisfaction were significantly higher with CLSP.

Baseline Characteristics

The two groups were comparable with respect to age, weight, height and body mass index (Table 4.1), indicating that the study population was reasonably well matched for these variables and that the observed differences in satisfaction scores are unlikely to be explained by these baseline factors. However, the gestational age at the time of surgery was significantly lower in the CLSP group than in the PLSP group (34.44 ± 2.44 weeks versus 36.79 ± 2.55 weeks; $p < 0.001$), and the distribution of ASA physical status grade also differed significantly between the groups, with the PLSP group including a greater proportion of ASA grade III participants. Since advancing gestation and higher ASA grade can independently influence spinal anatomy, positioning tolerance and procedural difficulty, these imbalances should be considered when interpreting the comparative findings of this study and are addressed further under limitations.

Ease of Landmark Palpation

In the present study, the landmark palpation score was comparable between the CLSP and PLSP groups, with the majority of participants in both groups rated as having landmarks that were hardly palpable (65.4% CLSP versus 63.5% PLSP; $p = 0.795$). This finding did not support the hypothesis that increased lumbar flexion in the crossed-leg position would translate into easier landmark identification in this population. This result contrasts with Puthenveetil et al., who reported significantly easier landmark palpation with CLSP compared with PLSP in a similar obstetric population undergoing caesarean section under spinal anaesthesia (2), and with Bhorania et al., who found landmark palpation to be easiest in CLSP (92%) compared with PLSP (64%) and TSP (84%) in a three-arm comparison (6). However, the absence of a significant difference in landmark palpability observed in this study. The study is consistent with the findings of Podder et al., who reported comparable landmark palpability between the traditional sitting and crossed-leg sitting positions (7), and with Manggala et al., who found

no significant difference in ease of landmark palpation between CLSP and TSP in patients undergoing urological surgery (8).

Number of Attempts for Successful Needle Placement

The number of attempts required for successful subarachnoid needle placement was also comparable between the two groups in this study (mean 1.731 ± 0.795 in CLSP versus 1.577 ± 0.825 in PLSP; $p = 0.33$) with a numerically higher mean number of attempts in the CLSP group, although this difference did not reach statistical significance. This finding aligns with Podder et al., who reported an equal number of attempts between the traditional sitting and crossed-leg sitting positions, with 60% of participants in both groups achieving first-attempt success ($p = 0.384$) (7), and with Manggala et al., who found no significant difference in first-attempt success rate between CLSP and TSP (62.9% versus 55.7%; $p > 0.05$) (8). This finding differs from Bhorania et al., who reported a significantly higher first-attempt success rate and fewer needle-bone contacts with CLSP compared with PLSP and TSP (6), and from the original comparison by Puthenveetil et al. between CLSP and PLSP for caesarean section, which favoured CLSP (2). A broadly similar principle was demonstrated by Soltani Mohammadi et al., who found that although the squatting position reduced the number of spinal needle-bone contacts compared with the traditional sitting position, the overall ease of needle insertion remained similar between the two positions, suggest that positional modifications aimed at increasing lumbar flexion do not consistently translate into fewer needle passes across all study populations.

Patient Satisfaction

Patient satisfaction was significantly higher in the CLSP group compared with the PLSP group in this study (mean 1.346 ± 0.683 versus 0.558 ± 0.639 ; $p < 0.001$), with 46.2% of participants in the CLSP group reporting that they were very comfortable compared with only 7.7% in the PLSP group, while 51.9% of the PLSP group reported being not comfortable compared with 11.5% of the CLSP group.

This finding is consistent with Puthenveetil et al., who reported greater patient comfort with CLSP compared with PLSP during caesarean section (2), with their earlier trial demonstrating improved comfort with CLSP compared with the traditional sitting position during epidural catheter insertion in labouring parturients (3), and with Bhorania et al., who similarly reported greater patient comfort with CLSP compared with PLSP and TSP (7). It contrasts with Podder et al., who found patient comfort to be comparable between the traditional sitting and crossed-leg sitting positions (10). The consistently higher comfort reported with CLSP across most of the available literature, including the present study, may be related to the familiarity of the cross-legged posture in everyday life, particularly in this region, making it easier for parturients to sustain during the procedure.

Anaesthesiologists Satisfaction

Anaesthesiologists' satisfaction was also significantly higher in the CLSP group in this study (mean 1.308 ± 0.729 versus 0.865 ± 0.658 ; $p=0.002$), with 46.2% of procedures in the CLSP group rated very comfortable by the anaesthesiologists compared with 15.4% in the PLSP group. This finding is in agreement with Puthenveetil et al., who reported higher anaesthesiologists' satisfaction with spinal needle insertion in the CLSP group compared with the PLSP group (2), and with Bhorania et al., who reported greater ease for the anaesthesiologists with CLSP compared with PLSP and TSP (7). Taken together with the patient satisfaction findings, this suggests that CLSP was perceived as the more favorable position by both parties in this study even though it did not translate into an objective difference in landmark palpability or number of needle attempts.

Position and the Broader Context of Spinal Anaesthesia

Patient position during spinal anaesthesia can also influence haemodynamic parameters and block onset, although these were not primary outcomes of the present study. Manouchehrian et al. found the lateral position to be associated with a lower frequency of hypotension and a faster onset of sensory block than the sitting position (9), while Achary et al. reported that the sitting position offered fewer attempts and greater haemodynamic stability than the lateral position (1). These findings indicate that positioning is a multidimensional variable with effects beyond technical ease of insertion, an aspect not captured by the present study (10).

Summary of the Study

This prospective observational study was undertaken at the Operation Theatre Complex of Yenepoya Medical College Hospital to compare the crossed-leg sitting position (CLSP) with the parallel-leg sitting position (PLSP) for the ease of spinal needle placement and the satisfaction of the parturient and the anaesthesiologists during induction of spinal anaesthesia for elective caesarean section. A total of 104 parturients aged 18 to 40 years, with ASA physical status I to III, were enrolled and allocated to the CLSP group ($n=52$) or the PLSP group ($n=52$). Landmark palpation score, number of attempts for successful needle placement, patient satisfaction and anaesthesiologists satisfaction was recorded using a standardised proforma and compared between the two groups.

FINDINGS OF THE STUDY

Landmark palpation score and the number of attempts required for successful subarachnoid needle placement were comparable between the CLSP and PLSP groups, with no statistically significant difference ($p=0.795$ and $p=0.33$, respectively). In contrast, both patient satisfaction and anaesthesiologists' satisfaction were significantly higher in the CLSP group compared with the PLSP group ($p<0.001$ and $p=0.002$, respectively). The two groups were comparable with respect to age, weight, height and body mass index, although gestational age and ASA physical status grade differed significantly between the groups.

Logical Analysis

As discussed in the preceding chapter, these findings indicate that although CLSP did not confer a measurable technical advantage over PLSP with respect to landmark identification or the number of needle attempts in this cohort, it was associated with a markedly more comfortable experience for both the parturient and the operator. This is broadly consistent with a

A substantial part of the existing literature favours CLSP for patient and operator comfort, while aligning with other studies that similarly found no significant difference in the technical ease of needle placement between crossed-leg and comparator sitting positions. The non-randomised, observational design of the study, in which the sitting position was assigned as per the anaesthesiologist's decision, may account in part for the baseline imbalance in gestational age and ASA grade between the groups, and should be borne in mind while interpreting the comparative satisfaction findings.

CONCLUSIONS AND LIMITATIONS

Based on these findings, it is concluded that CLSP and PLSP offer comparable technical ease of spinal needle placement in parturients undergoing elective caesarean section, but CLSP is associated with significantly greater comfort for both the parturient and the anaesthesiologists. As CLSP requires no additional equipment and can be adopted with minimal change to existing clinical practice, it may reasonably be considered as a preferred sitting position over PLSP for the induction of spinal anaesthesia in this population.

This study has certain limitations that should be considered while interpreting its findings. The observational, non-randomised design may have introduced allocation bias, as reflected in the significant baseline differences in gestational age and ASA physical status grade between the two groups. The study was conducted at a single center, and the assessments of landmark palpation, satisfaction and feasibility were based on subjective ordinal scoring rather than a validated visual-analogue instrument. Haemodynamic parameters and post-dural puncture complications, which may also be influenced by patient positioning, were not evaluated in this study.

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