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Sezaryen Doğumlarda Çapraz Bacaklı ve Geleneksel Oturma Pozisyonlarının Karşılaştırılması: Teknik Başarı ve Fetal İyilik Üzerine Etkileri

Cross-Legged vs. Traditional Sitting Position in Cesarean Deliveries: Effects on Technical Success and Fetal Well-Being

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ÖZ

Giriş: Sezaryen doğumlarda başarılı spinal anestezi uygulaması için optimal hasta pozisyonlaması kritik öneme sahiptir. Çapraz bacaklı oturma pozisyonu (ÇBOP), lomber fleksiyonu artırarak girişim başarısını iyileştirebilir; ancak bu pozisyonun maternal hemodinamikler ve yenidoğan sonuçları üzerindeki etkisi yeterince araştırılmamıştır.

Yöntem: Bu retrospektif kohort çalışmada, spinal anestezi altında elektif sezaryen uygulanan toplam 138 gebe değerlendirildi. Olgular, ÇBOP (n=63) veya geleneksel oturma pozisyonu (GOP) (n=75) ile spinal anestezi uygulanmasına göre gruplandırıldı. Demografik ve obstetrik veriler, ilk girişim başarısı, genel anesteziye geçiş oranı, intraoperatif hipotansiyon, efedrin kullanımı ve umbilikal arter kan gazı parametreleri karşılaştırıldı.

Bulgular: İlk girişimde başarı oranı ÇBOP grubunda anlamlı şekilde daha yüksekti (100% vs 89,3%, p=0,018). Genel anesteziye geçiş yalnızca GOP grubunda gözlendi (%2,7). Hipotansiyon oranları (%34,9 vs %37,3) ve efedrin kullanımı (%30,1 vs %32,0) gruplar arasında benzerdi (p>0,05). Yenidoğana ait Apgar skorları ile umbilikal arter pH ve laktat düzeyleri açısından anlamlı fark saptanmadı.

Sonuç: ÇBOP, ilk girişimde başarıyı artırarak prosedürel bir avantaj sağlamakta ve maternal hemodinamik stabiliteyi veya yenidoğan sonuçlarını olumsuz etkilememektedir. Maternal konfor objektif olarak değerlendirilmemiş olsa da, genel anesteziye geçişin görülmemesi ve teknik başarının yüksek olması, ÇBOP'un daha sorunsuz bir anestezi deneyimi sağlayabileceğini düşündürmektedir. Bu bulgular, obstetrik pratikte spinal anestezi başarısını artırmak amacıyla ÇBOP'un uygulanabilir bir alternatif olarak değerlendirilmesini desteklemektedir. Bu potansiyel faydaları doğrulamak için maternal memnuniyet ve girişim ergonomisini değerlendiren ileriye dönük çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: sezaryen doğum, spinal anestezi, hasta pozisyonlandırması, kan gazı analizi, obstetrik anestezi

ABSTRACT

Objective: Optimal patient positioning is critical for successful spinal anesthesia in cesarean deliveries. The cross-legged sitting position (CLSP) may enhance lumbar flexion and procedural success, yet its impact on maternal hemodynamics and neonatal outcomes remains underexplored.

Method: This retrospective cohort study evaluated 138 parturients who underwent elective cesarean section under spinal anesthesia in either CLSP (n=63) or traditional sitting position (TSP) (n=75). Demographic and obstetric variables, first-attempt success rate, conversion to general anesthesia, intraoperative hypotension, ephedrine use, and umbilical artery blood gas parameters were compared.

Results: The first-attempt success rate was significantly higher in the CLSP group (100% vs 89.3%, p=0.018). Conversion to general anesthesia was observed only in the TSP group (2.7%). Rates of hypotension (34.9% vs 37.3%) and ephedrine use (30.1% vs 32.0%) were comparable (p>0.05). Neonatal Apgar scores and umbilical artery pH and lactate levels showed no significant differences between groups.

Conclusion: The CLSP offers a procedural advantage by improving first-attempt success without compromising maternal hemodynamic stability or neonatal outcomes. Although maternal comfort was not objectively assessed, the lack of conversion to general anesthesia and higher technical success suggest that CLSP may provide a smoother anesthetic experience. These findings support the consideration of CLSP as a feasible alternative for enhancing spinal anesthesia success in obstetric practice. Further prospective studies evaluating maternal satisfaction and procedural ergonomics are warranted to confirm these benefits.

Keywords: cesarean section, spinal anesthesia, patient positioning, blood gas analysis, obstetric anesthesia

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INTRODUCTION

Spinal anesthesia is among the most frequently employed techniques for cesarean delivery worldwide, owing to its rapid onset, reliable analgesia, and favorable safety profile for both mother and newborn [1]. By avoiding airway manipulation, it reduces anesthesia-related risks and contributes to lowering maternal morbidity and mortality—an enduring priority in obstetric anesthesia.Success of this technique is influenced by several factors, including the provider's experience, the patient's anatomical features, hemodynamic stability, and,espicially, the positioning of the patient during the procedure [2].

For parturients with adequate mobility, the sitting position is commonly preferred, while the lateral decubitus position is reserved for those unable to sit. Modified sitting positions—most notably the cross-legged sitting position (CLSP)—have gained attention for their potential to improve technical success rates [3,4]. Anatomically, CLSP reduces lumbar lordosis, enlarges the interspinous space, and may shorten the distance from skin to spinous process, thereby facilitating easier needle placement [4].

Ultrasound-based investigations have shown that positional adjustments, such as the CLSP, create a broader acoustic window for neuraxial needle placement and promote relaxation of the paraspinal muscles [5]. These anatomical adaptations may be particularly beneficial in pregnant or obese patients, where increased lumbar curvature, soft-tissue edema, and adipose tissue can complicate spinal access [4–6]. Beyond their technical role, positioning methods may enhance procedural success, potentially reducing intraoperative anxiety by minimizing the need for multiple needle attempts, thereby improving patient cooperation and anesthetic outcomes. In cesarean delivery, reduced procedural challenges may contribute to stable intraoperative hemodynamics and support favorable postoperative recovery [7].

From the fetal standpoint, objective indicators such as Apgar scores and umbilical cord blood gas values provide critical insights into neonatal adaptation and the impact of intraoperative maternal factors, such as hemodynamic stability [8,9]. While ultrasound studies have demonstrated the anatomical advantages of the CLSP for neuraxial anesthesia [5], evidence on its clinical performance—particularly regarding first-attempt success rates, maternal hemodynamic stability, and neonatal outcomes—remains limited. This study addresses this gap by evaluating these parameters simultaneously in a real-world obstetric population, exploring whether CLSP's enhanced procedural success may reduce intraoperative maternal stress and improve clinical outcomes.

Therefore, this study compares CLSP with TSP for spinal anesthesia in elective cesarean delivery, focusing on first-attempt success rates, maternal hemodynamic stability, and neonatal outcomes assessed by Apgar scores and umbilical cord blood gas analysis. We hypothesized that CLSP would achieve higher first-attempt success rates, potentially reducing intraoperative maternal stress, without compromising maternal or neonatal safety.

MATERIALS AND METHODS

Patient Selection

Medical records of all parturients who underwent elective cesarean delivery under spinal anesthesia between January 2021 and December 2022 were retrospectively reviewed. Exclusion criteria were:

- Multiple pregnancy
- Missing umbilical cord blood gas data
- Incomplete perioperative records
- Lack of precise positioning details in the anesthesia record

These exclusions occurred in both groups without a systematic pattern, minimizing the likelihood of selection bias.

During the study period, obstetric anesthesia services were routinely provided by three experienced anesthesiologists. The choice of patient positioning—either CLSP or TSP—was determined at the discretion of the attending anesthesiologist, based on clinical judgment, patient comfort, and anticipated ease of neuraxial access.

Positioning Technique

In the CLSP, patients sat on the operating table with legs crossed at the ankles, knees flexed, and hips flexed to promote lumbar flexion and widen the interspinous space. In the TSP, patients sat with feet supported on a stool, hips and knees flexed at approximately 90°, and feet shoulder-width apart. Both positions were applied under sterile conditions, with verbal instruction and gentle physical guidance provided by the attending anesthesiologist.

Data Collection

Data were extracted from standardized anesthesia and delivery records and included:

- Maternal demographics: age, height, weight, body mass index (BMI), gravidity, parity
- Intraoperative parameters: baseline systolic and diastolic blood pressure, heart rate, incidence of hypotension, total intraoperative ephedrine dose, and first-attempt success of spinal anesthesia. Hypotension was defined as a ≥20% reduction in systolic blood pressure from baseline or an absolute value <90 mmHg. Ephedrine was administered in 5–10 mg intravenous boluses if these thresholds were met.
- Neonatal outcomes: 1-min and 5-min Apgar scores, umbilical artery pH, lactate, and base excess.

Umbilical cord blood samples were collected immediately after delivery by clamping a 10 cm segment of the cord, placing it in a heparinized syringe, and analyzing within 10 minutes using the same blood gas analyzer (ABL800 Flex , Radiometer Medical ApS, Copenhagen, Denmark) for all cases.

In accordance with institutional policy, cord blood gas analysis was not performed for all deliveries but was ordered by the attending neonatologist when deemed clinically indicated. This policy contributed to the proportion of missing cord blood gas data noted above.

Anesthesia Technique

All patients received standard monitoring, including non-invasive blood pressure, electrocardiography, and pulse oximetry. Spinal anesthesia was performed at the L3–L4 or L4–L5 interspace using a 26G Quincke spinal needle. A dose of 10–12 mg of 0.5% hyperbaric bupivacaine was

administered, with the exact amount determined by patient height and weight. Oxygen at 2 L/min was delivered via nasal cannula. All procedures were performed by anesthesiologists with at least five years of clinical experience, using a consistent protocol for positioning, needle insertion, and drug administration. Hypotension was treated according to the same departmental protocol in all cases.

Sample Size and Statistical Analysis

All eligible cases meeting the inclusion criteria within the study period were included; no a priori sample size calculation was performed due to the retrospective design. However, the final sample size was comparable to or larger than that of similar published studies. The Shapiro–Wilk test was used to assess normality. Continuous variables are expressed as mean ± standard deviation (SD) or median (interquartile range, IQR), and categorical variables as counts and percentages. Group comparisons used the independent-samples t-test for normally distributed data, the Mann–Whitney U test for non-normally distributed data, and the chi-square or Fisher's exact test for categorical variables. A p-value <0.05 was considered statistically significant. Statistical analyses were performed with SPSS version 26 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 212 parturients underwent elective cesarean delivery under spinal anesthesia during the study period. Of these, 96 were initially positioned in CLSP and 116 in TSP. Complete perioperative datasets, including positioning details, hemodynamic measurements, and umbilical cord blood gas values, were available for 63 patients in the CLSP group (65.6%) and 75 patients in the TSP group (64.7%). The primary reasons for missing data were the absence of umbilical cord blood gas analysis when not clinically indicated by the attending neonatologist, missing documentation of exact positioning in the anesthesia record. The distribution of missing data was similar between groups.

Baseline maternal characteristics, including age, body mass index (BMI), and gestational age, were comparable between the two groups (Table 1).

The first-attempt success rate was significantly higher in the CLSP group compared with the TSP group. In the CLSP group, all included procedures were completed successfully on the first attempt without the need for repositioning or needle redirection, whereas the TSP group demonstrated a lower first-pass success rate ($p < 0.05$). No cases in the CLSP group required conversion to general anesthesia, while a small number of conversions occurred in the TSP group; this difference did not reach statistical significance.

Intraoperative hypotension occurred at similar rates in both groups, and there was no statistically significant difference in the proportion of patients requiring ephedrine ($p > 0.05$). Median ephedrine doses were also comparable between groups (Table 2).

Neonatal outcomes, including Apgar scores at 1 and 5 minutes, umbilical artery pH, lactate, and base excess, showed no significant differences between groups. All median Apgar scores were within the normal range, and no cases of severe neonatal acidosis (pH < 7.00) were recorded in either group (Table 3,Figure 1).

Table 1. Demographic and Obstetric Characteristics of the Study Groups.

Parameter	CLSP (n = 63)	TSP (n = 75)	p-value
Age (years)	29.4 ± 4.8	29.8 ± 5.1	0.64
BMI (kg/m²)	29.7 ± 3.9	30.1 ± 4.1	0.58
Gestational age (weeks)	38.4 ± 1.1	38.3 ± 1.2	0.71
Gravida (median, IQR)	2 (1–3)	2 (1–3)	0.95
Parity (median, IQR)	1 (0–2)	1 (0–2)	0.89

Values are expressed as mean ± standard deviation (SD) for normally distributed variables or median (interquartile range, IQR) for non-normally distributed variables, unless otherwise stated. BMI: body mass index. p-values were calculated using the independent samples t-test or Mann–Whitney U test for continuous variables and the chi-square test for categorical variables.

Table 2. Procedural Success Rates and İntraoperative Hemodynamic Parameters.

Parameter	CLSP (n = 63)	TSP (n = 75)	p-value
First-attempt success (%)	100%	89.3%	0.018
General anesthesia conversion (%)	0%	2.7%	0.21
Hypotension (%)	34.9%	37.3%	0.78
Ephedrine use (%)	30.1%	32.0%	0.81
Ephedrine döşe (mg, median IQR)	10 (10–15)	10 (10–15)	0.94

Values are presented as percentage (%) for categorical variables and as median (interquartile range, IQR) for continuous variables, unless otherwise stated. p-values for categorical variables were calculated using the chi-square test or Fisher's exact test, and for continuous variables using the Mann–Whitney U test. CLSP: cross-legged sitting position; TSP: traditional sitting position.

Table 3. Neonatal Outcomes Based on Apgar Scores and Umbilical Artery Blood Gas Analysis.

Parameter	CLSP (n = 63)	TSP (n = 75)	p-value
Apgar score at 1 min (IQR)	8 (8–9)	8 (8–9)	0.87
Apgar score at 5 min (median IQR)	9 (9–10)	9 (9–10)	0.92
Umbilical blood gas pH(median± SD)	7.28 ± 0.05	7.27 ± 0.06	0.49
Lactate (mmol/L) (median± SD)	3.2 ± 0.7	3.3 ± 0.8	0.52
Base excess (mmol/L) (median± SD)	-3.1 ± 1.4	-3.3 ± 1.5	0.58

Values are expressed as median (interquartile range, IQR) for non-normally distributed variables and as mean ± standard deviation (SD) for normally distributed variables. p-values were calculated using the Mann–Whitney U test for non-normally distributed data and the independent samples t-test for normally distributed data. CLSP: cross-legged sitting position; TSP: traditional sitting position

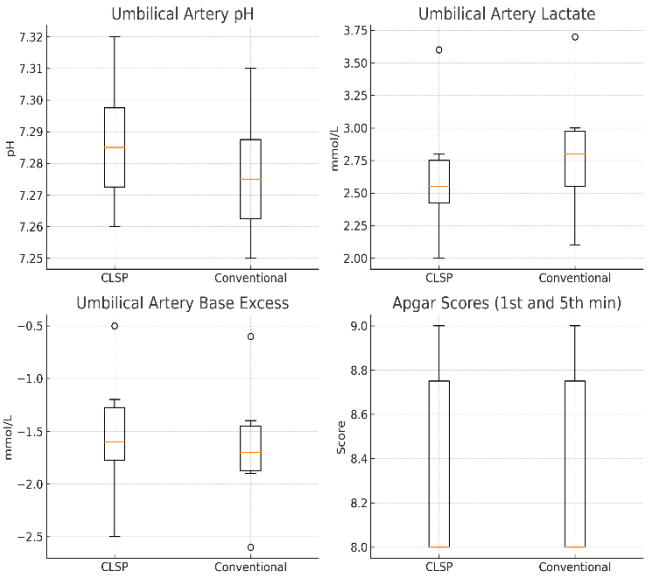

Figure 1. Comparison of neonatal outcomes between cross-legged sitting position (CLSP) and traditional sitting position (TSP).

DISCUSSION

In this retrospective observational study, we compared CLSP and TSP for spinal anesthesia in elective cesarean deliveries, focusing on first-attempt success, maternal hemodynamic stability, and neonatal outcomes. Our results demonstrated that CLSP was associated with a significantly higher first-attempt success rate, without significant differences in conversion to general anesthesia, incidence of hypotension, ephedrine requirements, or neonatal acid–base status.

The superior first-attempt success rate with CLSP supports prior evidence that patient positioning plays a key role in optimizing the technical performance of spinal anesthesia [10]. Anatomically, CLSP reduces lumbar lordosis and widens the interspinous space, facilitating easier entry into the subarachnoid space and potentially reducing needle–bone contact [5]. Pregnancy-related anatomical changes, including increased lumbar curvature, soft-tissue edema, and fat deposition, are known to complicate neuraxial access [11], and CLSP may help mitigate these challenges. The absence of conversions to general anesthesia in the CLSP group, compared with a small number in the TSP group, suggests a potential clinical advantage, though statistical significance was not reached. Avoiding general anesthesia in obstetric patients remains important, as it reduces airway manipulation and limits fetal exposure to systemic anesthetics [12].

Maternal anxiety in the perioperative setting can be influenced by concerns about anesthesia failure and possible conversion to general anesthesia. Such anxiety has been linked to delayed recovery, increased analgesic requirements, and impaired maternal–infant bonding [7]. Therefore, a positioning method that consistently achieves high first-attempt success may indirectly benefit maternal psychological well-being and perioperative comfort.

In our study, the incidence of hypotension and the need for ephedrine were similar between groups, indicating that positioning may influence technical ease without significantly affecting sympathectomy-induced hemodynamic changes. Ephedrine remains a preferred agent for treating spinal-induced hypotension because it maintains uteroplacental blood flow; however, it readily crosses the placenta and may increase fetal lactate levels [13]. Importantly, we found no significant differences in neonatal lactate or base excess between groups, aligning with randomized trials showing that judicious ephedrine dosing is safe for the fetus [14,15].

Neonatal outcomes in both groups—assessed by Apgar scores, umbilical artery pH, lactate, and base excess—were within normal limits and showed no statistically significant differences. These results support previous reports that maternal positioning during neuraxial anesthesia, although relevant to technical success, is unlikely to directly affect fetal acid–base balance unless prolonged hypotension or excessive vasopressor use occurs [16].

Our findings also align with prior ultrasound-based investigations that have described the anatomical benefits of modified sitting positions. Dimaculangan et al. [17] reported that seated fetal variations—including positions similar to CLSP—can increase the interspinous gap opening and reduce skin-to-spinous process and subcutaneous tissue distances, potentially facilitating needle insertion, especially in pregnant or obese patients. Manggala et al. [6] demonstrated that CLSP is a feasible and safe alternative to TSP, maintaining comparable procedural success while offering potential ergonomic benefits for lumbar flexion. Zorrilla-Vaca et al. [18] suggested that certain positions, such as lateral decubitus, may reduce the incidence of postdural puncture headache, although their analysis primarily addressed complication risk rather than technical ease.

Additionally, previous studies have compared other modified sitting positions—such as the hamstring stretch and squatting positions—

reporting similar procedural success and needle–bone contact rates compared with TSP [19,20]. CLSP has also been shown to provide greater patient comfort without compromising the acoustic or anatomical access needed for neuraxial anesthesia [17]. The biomechanical effect of CLSP, which combines hip and knee flexion with pelvic rotation, may enhance lumbar flexion without causing undue patient strain.

From a psychological perspective, confidence in successful first-attempt spinal anesthesia may reduce patient concerns about procedural failure, potentially lowering intraoperative anxiety. Since perioperative anxiety has been associated with heightened postoperative pain perception and greater analgesic requirements [21], the procedural reliability of CLSP could have downstream benefits for both maternal recovery and newborn care.

Limitations

Several limitations of this study should be acknowledged.First,the retrospective design inherently carries a risk of selection bias; in our setting, positioning was determined by the clinical judgment of one of three experienced anesthesiologists. Additionally the relatively high rate of missing data, primarily due to the absence of umbilical cord blood gas analysis when not clinically indicated and the lack of precise positioning details in the anesthesia record, may limit the generalizability of our findings. However, the similar distribution of missing data between the CLSP and TSP groups minimizes the risk of systematic bias in the comparative analysis. Finally, although our sample size is comparable to similar studies, it may not be powered to detect small differences in rare outcomes, such as conversion to general anesthesia.In addition, no a priori power analysis was performed due to the retrospective design, which further limits the ability to evaluate rare events.

Future prospective trials with standardized positioning protocols and larger cohorts are warranted to validate these findings and further assess maternal comfort, procedural ease, and potential psychological benefits.

CONCLUSION

CLSP offers a clear technical advantage over TSP in spinal anesthesia for elective cesarean delivery by significantly increasing first-attempt success rates while maintaining comparable maternal hemodynamic stability and neonatal outcomes. Given its simplicity, ease of implementation, and potential to enhance maternal confidence in the anesthetic process, CLSP should be considered a valuable positioning option in obstetric anesthesia practice.Future prospective randomized studies are warranted to confirm these findings and further explore its benefits in patients with challenging anatomy or high procedural anxiety.

Ethics Committee Approval: The study protocol was approved by the Istinye University Human Research Ethics Committee (Ethics Committee approval number: 23-36, date: 02/02/2023).

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