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Anesthetic experiences in cesarean surgery: A retrospective study

Sezaryen cerrahisinde anestezi deneyimlerimiz: Retrospektif çalışma

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ABSTRACT

Aim: To evaluate the anesthetic techniques used for cesarean deliveries and their perioperative outcomes at Zonguldak Bülent Ecevit University Hospital.

Material and Methods: This retrospective study included 1,229 women who underwent cesarean delivery between January 2018 and September 2019 at Zonguldak Bülent Ecevit University Hospital. Demographic characteristics, anesthesia type, 1- and 5-minute APGAR (activity, pulse, grimace, appearance, respiration) scores, and perioperative complications were assessed.

Results: Spinal anesthesia was performed in 58.4% of the cases, while general anesthesia was used in 41.3%. The APGAR scores at 1 and 5 minutes were significantly higher in the spinal group ($p < 0.001$). The requirement for ephedrine was significantly higher in the spinal anesthesia group (36.9%) compared to the general anesthesia group (3.7%). The duration of anesthesia was shorter in the spinal group ($p < 0.001$), whereas the length of hospital stay did not differ significantly between the groups ($p = 0.086$).

Conclusion: Spinal anesthesia represents a safe and effective technique for cesarean delivery, demonstrating improved neonatal outcomes. Nevertheless, the increased incidence of hypotension and the need for vasopressor support necessitate vigilant hemodynamic monitoring.

Keywords: Cesarean section, spinal anesthesia, general anesthesia, APGAR score, hypotension

ÖZ

Amaç: Bu çalışmanın amacı, Zonguldak Bülent Ecevit Üniversitesi Hastanesi'nde gerçekleştirilen sezaryen ameliyatlarında tercih edilen anestezi yöntemlerini ve bu yöntemlere bağlı perioperatif bulguları değerlendirmektir.

Gereç ve Yöntemler: Ocak 2018–Eylül 2019 tarihleri arasında Zonguldak Bülent Ecevit Üniversitesi Hastanesi'nde sezaryen operasyonu geçiren 1229 hastanın dosyaları retrospektif olarak incelendi. Demografik özellikler, anestezi tipi, yenidoğanın 1. ve 5. dakika APGAR skorları ile intraoperatif ve postoperatif komplikasyonlar kaydedildi.

Bulgular: Olguların %58,4'üne spinal, %41,3'üne genel anestezi uygulandı. Spinal anestezi grubunda 1. ve 5. dakika APGAR (aktivite, nabız, refleks yanıtı, görünüm ve solunum) skorları anlamlı olarak daha yüksek bulundu ($p<0.001$). Spinal anestezide ephedrin gereksinimi (%36.9) genel anesteziye (%3.7) kıyasla belirgin derecede fazlaydı. Anestezi süresi spinal grupta daha kısa ($p<0.001$), ancak hastanede kalış süresi açısından fark yoktu ($p=0.086$).

Sonuç: Sezaryen ameliyatlarında spinal anestezi, maternal ve neonatal sonuçlar açısından güvenli ve etkili bir yöntemdir. Ancak hipotansiyon ve ephedrin gereksinimi daha sık görüldüğünden hemodinamik stabilitenin yakından izlenmesi gereklidir.

Anahtar Kelimeler: Sezaryen, spinal anestezi, genel anestezi, APGAR skoru, hipotansiyon

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Highlights

- Spinal anesthesia resulted in higher 1- and 5-minute APGAR scores, indicating better neonatal outcomes.
- Spinal anesthesia showed a higher incidence of hypotension and ephedrine use, requiring careful hemodynamic monitoring.
- Total anesthesia duration was shorter under spinal anesthesia, likely due to faster postoperative recovery and the absence of airway manipulation or emergence from general anesthetics.

INTRODUCTION

Cesarean delivery represents a cornerstone of modern obstetric practice and carries potential perioperative risks for both the mother and the fetus. The selection of anesthetic technique is determined by multiple factors, such as the urgency of the surgery, maternal health status, coexisting obstetric conditions, and fetal well-being. Both general and regional anesthesia approaches (spinal, epidural, and combined spinal-epidural) have distinct benefits and limitations (1,2).

Regional anesthesia provides several advantages, such as facilitating early maternal-infant bonding, minimizing fetal depressant effects, and allowing maternal awareness during delivery. However, it is not without drawbacks, as hypotension, excessively high block levels, and block failure can occur (3,4). In contrast, general anesthesia is typically reserved for emergency cesarean deliveries requiring rapid induction, for patients with coagulopathies, or when regional anesthesia is contraindicated or cannot be safely administered. Yet, this approach carries its own risks, notably airway management difficulties and the potential for aspiration (3,5).

Previous studies have demonstrated notable differences in maternal, fetal, and perinatal outcomes according to the anesthetic technique used during cesarean delivery. Specifically, APGAR (activity, pulse, grimace, appearance, respiration) scores, the incidence of intraoperative hypotension, and block failure rates have been shown to vary between regional and general anesthesia (6,7). Therefore, this study aimed to evaluate the anesthesia techniques preferred for cesarean deliveries in our institution and to investigate the perioperative findings associated with each technique.

MATERIAL and METHODS

This retrospective study was carried out in the Department of Anesthesiology and Reanimation at Zonguldak Bülent Ecevit University Hospital after obtaining approval from the Local Ethics Committee (Decision No: 2025/16-8; Date: 17/09/2025). Medical records of patients who underwent cesarean delivery between January 2018 and September 2019 were evaluated through the hospital's electronic database.

Data recorded included demographic characteristics (age, American Society of Anesthesiologists physical status, gravidity, parity), maternal medical history and comorbidities, urgency of surgery (emergency or elective), anesthetic technique, neonatal 1- and 5-minute APGAR scores, and intraoperative or postnatal maternal and neonatal complications. Cases with incomplete data were excluded.

Statistical Analysis

Data were analyzed using the SPSS 25.0 software. Categorical variables were presented as numbers and percentages, while continuous variables were expressed as mean ± standard deviation and median values. The Kolmogorov-Smirnov test was used to assess the conformity to normal distribution. For comparisons between groups, the chi-square test, Fisher's exact test, and the Mann-Whitney U test (for non-normally distributed data) were applied. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 1,308 cesarean delivery cases were evaluated. After excluding 79 patients with incomplete data, 1,229 cases were analyzed. Demographic characteristics, surgical data, and comorbidities are summarized in Table 1. The mean 1- and 5-minute APGAR scores were 8.44 ± 1.13 and 9.59

Table 1: Demographic and surgical data, comorbidities

Age (years)#	30.10 ± 5.81
ASA PS (II/III/IV)*	1103/121/5
Gravity (1/2/3/4/5+)*	408/382/219/120/100
Parity (0/1/2/3/4+)*	493/455/203/63/15
Diabetes mellitus*	78 (6.3)
Hypertension*	27 (2.1)
Hypothyroidism*	146 (11.8)
Preeclampsia*	156 (12.6)
Emergency/elective surgery*	486/743
Duration of anesthesia (min) #	65.48 ± *20.91*

ASA PS: American Society of Anesthesiologists Physical Status, **C/S**: cesarean section **#:** Mean ± Standard Deviation, *: n (%)

± 0.82, respectively. Additional neonatal findings are presented in Table 2.

General anesthesia was administered to 41.3% (n = 507) of all patients. Spinal anesthesia was attempted in 64.1% (n = 788) of the cases; however, the procedure failed in 8.9% (n = 70), resulting in 58.4% (n = 718) ultimately undergoing surgery under spinal anesthesia. General anesthesia was administered to all patients in whom spinal anesthesia was failed. Epidural anesthesia alone was administered to 0.3% (n = 4) of the patients. Among the 486 emergency cases, 310 (63.8%) were performed under neuraxial anesthesia, while 176 (36.2%) were performed under general anesthesia. During the intraoperative period, 5.6% (n = 69) of the patients received red blood cell transfusions, and 0.7% (n = 8) received fresh frozen plasma transfusions. Comparative analyses between the general and spinal anesthesia groups are presented in Tables 3 and 4. In all four patients who received epidural anesthesia, the operation proceeded uneventfully, with no complications and no conversion to general anesthesia.

Intraoperatively, tranexamic acid was administered to 29.7% (n = 365), methylergometrine to 14.1% (n = 173), ephedrine to 23.2% (n = 285), and atropine to 3.8% (n = 47) of patients. Ephedrine was required in 19 patients (3.7%) under general anesthesia and in 265 patients (36.9%) in the spinal anesthesia group. Additionally, total abdominal hysterectomy was performed in 0.2% (n = 3), and bilateral tubal ligation in 19.3% (n = 237) of the cases.

In the postoperative period, 1.1% (n = 14) of patients were admitted to the intensive care unit (ICU). Postoperative complications included hypertension in 0.7% (n = 9), tach-

Table 2: Neonatal characteristics and perioperative findings

Newborns admitted to NICU*	365 (29.6)
Neonatal CPR*	14 (1.1)
Neonatal exitus*	8 (0.6)
IUGR*	90 (7.3)
Macrosomia*	53 (4.3)
Meconium aspiration*	12 (0.9)

NICU: Neonatal intensive care unit**, CPR:** Cardiopulmonary Resuscitation, **IUGR:** Intrauterine growth restriction *: n (%)

Table 3: Characteristics of patients according to the anesthetic method-I

	Anesthesia method				p
	General anesthesia (n=507)		Spinal anesthesia (n=718)		
	number	percentage	number	percentage	
ASA PS 2	425	83.8	674	93.9	**<0.001***
ASA PS 3	81	16	40	5.6	**<0.001***
ASA PS 4	1	0.2	4	0.6	**<0.001***
Diabetes mellitus	43	8.5	35	4.9	**0.011***
Preeclampsia	69	13.6	87	12.1	0.440
Hypertension	13	2.6	14	1.9	0.471
Hypothyroidism	47	9.3	98	13.6	**0.019***
ES	39	7.7	29	4	**0.046***
FFP	4	0.8	4	0.6	0.491
Admitted to ICU	9	1.8	5	0.7	0.080

ASA PS: American Society of Anesthesiologists Physical Status, **ES**: Erythrocyte suspension, **FFP**: fresh frozen plasma, **ICU:** intensive care unit. *p<0.05. All data were analyzed using the chi-square test.

Table 4: Characteristics of patients according to the anesthetic method-II

	Anesthesia method		p
	General anesthesia (n = 507)	Spinal anesthesia (n = 718)	
Age (years)#	30.67 ± 5.90	29.68 ± 5.71	**0.005***
1st min APGAR	8.10 ± 1.41	8.68 ± 0.79	**<0.001***
5th min APGAR	9.38 ± 1.06	9.75 ± 0.56	**<0.001***
Duration of anesthesia (min) #	72.75 ± 23.65	60.49 ± 17.02	**<0.001***
Length of hospital stay (day)#	2.24 ± 1.03	2.15 ± 0.96	0.086

#: Mean ± Standard Deviation, *p<0.05. All data were analyzed using the MannWhitney U test.

ycardia in 0.2% (n = 2), nausea and vomiting in 5.1% (n = 63), and allergic reactions in 2.5% (n = 31). Additionally, bronchospasm occurred in 1.9% (n = 23) and was managed with appropriate treatment. The mean length of hospital stay was 2.18 ± 0.99 days.

DISCUSSION

In the present study evaluating the preferred anesthesia methods and their associated perioperative findings in cesarean deliveries performed at our institution, spinal anesthesia was the most commonly used technique. The 1- and 5-minute APGAR scores were significantly higher in surgeries performed under spinal anesthesia compared with those performed under general anesthesia. Additionally, the duration of anesthesia was significantly shorter in the spinal group. However, patients who received spinal anesthesia required more ephedrine and showed greater hemodynamic variability. The choice of anesthesia technique did not significantly affect the length of hospital stay.

In cesarean delivery, the primary objective is to ensure a safe, comfortable, and rapid birth for both the mother and the fetus. To achieve this, either neuraxial or general anesthesia may be employed, each with its own advantages and disadvantages. Neuraxial anesthesia enhances maternal safety by eliminating the need for airway manipulation, thereby minimizing the risk of aspiration. Because the systemic absorption of local anesthetics is limited, fetal drug exposure remains minimal, thus reducing the risk of neonatal depression. However, hypotension is the most common complication associated with this technique, and the block may occasionally be inadequate, necessitating conversion to general anesthesia or additional analgesic interventions. Postdural puncture headache, particularly following spinal anesthesia, is another potential complication. General anesthesia, on the other hand, is the fastest technique to administer and allows for rapid fetal delivery, making it particularly advantageous in emergency cesarean sections. Complete control of the airway and ventilation is beneficial for patients with severe maternal hypoxia or a high risk of aspiration. Nevertheless, general anesthesia carries the risk of difficult intubation and aspiration during airway manipulation. Additionally, the mother is unable to witness the birth, and early maternal–neonatal contact is delayed (8–10). Taken together, these factors explain why neuraxial anesthesia is generally preferred in the absence of contraindications (10). Consistent with this, our study also found that spinal anesthesia was the predominant technique. However, conversion to general anesthesia was required in 70 patients due to block failure or inadequate anesthesia—known limitations of spinal anesthesia.

In emergency cesarean deliveries, the rate of general anesthesia has been reported to range between 40% and 80% (11–14). This variation is mainly attributed to the need for rapid fetal delivery, time constraints, failed neuraxial blocks, or maternal contraindications. In contrast, neuraxial anesthesia was used in approximately 65% of emergency cesarean deliveries in our center. This relatively high rate may be explained by the extensive experience of both the anesthesia and obstetrics teams, the well-structured organization of emergency operations, and the ability to achieve a prompt transition to spinal anesthesia. Moreover, prioritizing maternal safety and minimizing the risks of aspiration and difficult intubation in pregnant patients at risk of challenging airway management likely influenced this preference. The minimal transplacental drug transfer and the association of spinal anesthesia with higher neonatal APGAR scores also likely contributed to the obstetric team's support for this technique (13,15). Thus, the high proportion of spinal anesthesia observed in our study likely reflects the effective coordination between teams and a multidisciplinary approach centered on patient safety.

Neonates delivered under spinal anesthesia generally demonstrate higher APGAR scores than those delivered under general anesthesia. This finding has been attributed to the limited transplacental passage of anesthetic agents, better preservation of uteroplacental perfusion, shorter delivery-to-delivery interval, and greater maternal hemodynamic stability (16). Consistent with these reports, the 1- and 5-minute APGAR scores in our study were also significantly higher in the spinal anesthesia group compared with the general anesthesia group.

In cesarean delivery, total anesthesia duration is defined as the time from the initiation of induction or block placement to the patient's transfer from the operating room. Studies comparing neuraxial (particularly spinal) anesthesia with general anesthesia have reported that although the preparation phase may be longer because of the time required for block onset, overall surgical and total operating room times remain comparable (17,18). In our study, patients who underwent surgery under spinal anesthesia had significantly shorter anesthesia durations. This difference may be explained by the maintenance of spontaneous respiration and consciousness at the end of surgery, which allows immediate transfer without the need for extubation or emergence monitoring, thereby shortening the recovery period. Furthermore, the high level of experience among anesthesia personnel and strong team coordination may have contributed to a shorter spinal block application time.

In pregnant women, the risk of developing hypotension after spinal anesthesia is increased due to physiological and hormonal changes. Physiological and hormonal alterations during pregnancy, including vasodilation, elevated progesterone levels, and decreased angiotensin II concentrations, contribute to reduced blood pressure. Spinal anesthesia further induces sympathetic blockade, resulting in vasodilation, decreased systemic vascular resistance, and

impairment of the baroreceptor reflex. When the patient is positioned supine, the gravid uterus compresses the aorta and inferior vena cava (aortocaval compression), thereby reducing venous return to the heart, decreasing cardiac output, and ultimately causing hypotension. The combination of these factors considerably increases the risk of spinal anesthesia–induced hypotension in obstetric patients (19,20). In our study, 285 patients required ephedrine administration, approximately 93% of whom had received spinal anesthesia. This finding highlights the importance of being prepared to manage hypotension when performing neuraxial anesthesia in this predisposed patient population. The high rate of ephedrine requirement underscores the challenge of maintaining hemodynamic stability in obstetric patients. Therefore, implementing preemptive strategies and rapid response protocols to prevent and promptly manage hypotension is crucial for clinical success, particularly in cases where spinal anesthesia is planned.

Failed neuraxial block is not uncommon in cesarean deliveries, with reported rates reaching up to 12%. Although the timing of failure (e.g., before or after incision) is clinically important, there is currently no consensus on whether neuraxial techniques should be repeated or converted to general anesthesia (21). In our study, 8.9% of patients who underwent spinal anesthesia experienced block failure, and all were subsequently converted to general anesthesia. We believe that reluctance to reattempt neuraxial anesthesia may stem from concerns that repeating the block could cause excessive cephalad spread of the local anesthetic, leading to complications such as hypotension, bradycardia, respiratory depression, or high or total spinal block.

Studies comparing postoperative hospital stay after general and neuraxial anesthesia for cesarean delivery have consistently shown that neuraxial anesthesia is associated with faster recovery and shorter hospital stay (10,22,23). In our analysis, however, no statistically significant difference was found between general and spinal anesthesia. This discrepancy may be explained by methodological differences, as most studies assess hospital stay in hours, whereas our evaluation was conducted on a daily basis.

This study has several limitations. The retrospective design represents a major limitation. In addition, factors that may influence postoperative hospital stay—such as infection, surgical complications, blood loss, or socioeconomic status—were not analyzed in detail. Furthermore, neonatal postoperative variables, including blood gas values, duration of Neonatal ICU stay, and late neonatal complications, were not evaluated.

Conclusion

In cesarean surgeries performed at our institution, spinal anesthesia was identified as the most frequently preferred anesthetic technique. Neonates delivered under spinal anesthesia had higher 1- and 5-minute APGAR scores and shorter total anesthesia durations compared with those delivered under general anesthesia. However, no significant difference was observed in the length of hospital stay between the two groups. The more frequent occurrence of hypotension and the greater need for ephedrine during spinal anesthesia highlight the importance of vigilant hemodynamic monitoring when employing this technique.

Author Contributions

Study conception and design: **Çağdaş Baytar,** data collection: **Zeynep Koç, Özcan Pişkin,** analysis and interpretation of results: **Rahşan Dilek Okyay, Merve Sena Baytar,** draft manuscript preparation: **Çağdaş Baytar, Hilal Ayoğlu.** The author(s) reviewed the results and approved the final version of the article.

Conflicts of Interest

All authors declare no conflicts of interest.

Ethical Approval

The study was approved by the Clinical Researchers Ethics Committee of Zonguldak Bülent Ecevit University (Date: 17/09/2025 and, No:2025/16-8).

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