Maternal and neonatal outcomes following cesarean myomectomy: a comparison between fibroid-associated and fibroid-free cesarean deliveries

Çağla Bahar Bülbül[1], Volkan Karataş[2], Simge Tezel Yozgat[2]
[1]Clinic of Obstetrics and Gynecology, İzmir Medical Park Hospital, İzmir, Türkiye
[2]Clinic of Obstetrics and Gynecology, University of Health Sciences Türkiye, Balıkesir Atatürk City Hospital, Balıkesir, Türkiye

Abstract

Objective: To compare maternal and neonatal outcomes among women undergoing cesarean section (CS) with concomitant myomectomy, women with uterine fibroids managed conservatively at cesarean delivery, and women without uterine fibroids.

Material and Methods: This retrospective cohort study included women who delivered by CS between May 2017 and December 2024. Patients were classified into three groups: CS with myomectomy (Group 1), CS with fibroids without myomectomy (Group 2), and CS without fibroids (Group 3). Maternal outcomes included perioperative changes in hemoglobin, hematocrit, and platelet counts, transfusion requirement, and length of hospital stay. Neonatal outcomes included birth weight, birth length, and Apgar scores. Appropriate parametric and non-parametric statistical tests were used for group comparisons.

Results: The study cohort numbered 682 with 252 (36.95%), 178 (26.1%) and 252 (36.95%) women in Groups 1, 2 and 3, respectively. Postoperative hemoglobin, hematocrit, and platelet levels differed significantly among the three groups (all $p<0.05$). However, hemoglobin deficit did not differ significantly between Group 1 and Group 2 ($p=0.346$), while both groups showed greater hemoglobin deficit than Group 3 ($p<0.05$). Transfusion rates and hospitalization duration differed significantly between groups ($p<0.05$), with longer hospital stay observed in transfused patients regardless of group. Maximum myoma volume was higher in Group 1, whereas myoma count was greater in Group 2 and total myoma volume was comparable between these groups ($p=0.09$). Neonatal birth weight was significantly lower in Group 2 compared with Groups 1 and 3 ($p<0.05$), while no difference was observed between Groups 1 and 3 ($p=0.956$). Other neonatal outcomes were similar.

Conclusion: Cesarean myomectomy was associated with larger changes in hematologic parameters and transfusion rates; however, hemoglobin deficit appears related to fibroid presence rather than myomectomy itself. Neonatal outcomes were not adversely affected by cesarean myomectomy, whereas untreated fibroids appeared to be associated with lower birth weight. [J Turk Ger Gynecol Assoc. 2026; 27(3): 187-95]

Keywords: Cesarean myomectomy, uterine fibroids, maternal outcomes, neonatal outcomes

Received: December 25, 2025 **Accepted:** July 1, 2026 **Publication Date:** September 04, 2026

Address for Correspondence: *Çağla Bahar Bülbül*
e-mail: *drcaglahanedar@gmail.com* ***ORCID:*** *orcid.org/0000-0002-4128-499X*

DOI: *10.4274/jtgga.galenos.2026.2025-12-17*

Cite this article as: *Bülbül ÇB, Karataş V, Tezel Yozgat S. Maternal and neonatal outcomes following cesarean myomectomy: a comparison between fibroid-associated and fibroid-free cesarean deliveries. J Turk Ger Gynecol Assoc. 2026; 27(3): 187-95*

Introduction

Uterine leiomyomas (fibroids) are the most common benign tumors of the female reproductive system and frequently coexist with pregnancy (1). Although the overall prevalence of fibroids in pregnancy varies widely depending on diagnostic modality and population characteristics, recent studies estimate rates ranging from approximately 2% to 12% in pregnant women, with higher prevalence reported in advanced maternal age and multiparous populations (2,3). Fibroids originate from monoclonal proliferation of smooth muscle cells within the myometrium and exhibit heterogeneous growth patterns influenced by hormonal, genetic, and vascular factors. Given their high prevalence, fibroids represent a frequent clinical challenge in obstetric practice.

While many fibroids remain asymptomatic during pregnancy, their presence has been associated with a spectrum of obstetric complications, including malpresentation, preterm birth, placental abruption, cesarean delivery, and postpartum hemorrhage (4,5). Fibroid size, number, and location, and in particularly large intramural or lower-segment myomas that may obstruct the uterine incision site or alter placental perfusion, appear to play an important role in determining obstetric risk. In addition to maternal morbidity, fibroid-related alterations in uterine architecture and perfusion may influence fetal growth and neonatal outcomes, although findings remain inconsistent across studies (6-8).

Management of uterine fibroids at the time of cesarean section (CS) represents one of the most debated topics in contemporary obstetric surgery. Historically, cesarean myomectomy was discouraged due to concerns regarding uncontrollable hemorrhage, prolonged operative time, and increased risk of peripartum hysterectomy (9,10). Consequently, fibroid removal during cesarean delivery was traditionally limited to pedunculated or easily accessible subserosal lesions. However, advances in surgical techniques, anesthesia, hemostatic strategies, and perioperative blood management have prompted renewed interest in the safety and feasibility of cesarean myomectomy.

In recent years, multiple observational studies and meta-analyses have reported comparable maternal outcomes between cesarean myomectomy and cesarean delivery without myomectomy in selected patient populations, particularly when procedures are performed by experienced surgeons. Reported outcomes suggest that although cesarean myomectomy may be associated with increased operative complexity, rates of transfusion, severe hemorrhage, and hysterectomy are not consistently higher than those observed in patients with fibroids who do not undergo myomectomy. Nevertheless, heterogeneity in study design, patient selection, fibroid characteristics, perioperative management and outcome definitions have limited the generalizability of existing evidence, and current international guidelines remain cautious, emphasizing individualized decision-making rather than universal recommendations (11).

Importantly, many prior studies have focused primarily on comparisons between cesarean myomectomy and cesarean delivery without fibroids, potentially confounding the effects of fibroid presence with those of surgical intervention (10,12). Fewer investigations have incorporated a three-group comparative framework that separately evaluates patients undergoing cesarean myomectomy, patients with fibroids managed conservatively at cesarean delivery, and patients without fibroids. Such a design is essential to disentangle the contribution of fibroid burden itself from the incremental impact of myomectomy on maternal hematologic parameters, transfusion requirements, and postoperative recovery. This limitation hampers accurate risk stratification and may lead to overly conservative or inconsistent surgical decision-making in contemporary obstetric practice.

Therefore, the aim of the present study was to comprehensively compare maternal and neonatal outcomes among three distinct groups and to disentangle the impact of fibroid burden itself from the incremental effects of myomectomy at the time of cesarean delivery. The primary outcomes included perioperative changes in hemoglobin and hematocrit levels, transfusion requirement, and length of hospital stay. Secondary outcomes focused on neonatal parameters, including birth weight, birth length , and Apgar scores. By employing a three-group analytical approach, it was hoped to provide clinically relevant evidence to inform surgical decision-making regarding cesarean myomectomy.

Material and Methods

This retrospective cohort study was conducted between May 2017 and December 2024. The study included pregnant women who delivered via CS. Approval from the University of Health Sciences Türkiye, Balıkesir Atatürk City Hospital Ethics Committee was sought prior to the study and it conforms to the provisions of the Declaration of Helsinki (approval no: 2025/02/20, date: 20.02.2025). As this was a retrospective study, informed consent was waived. Inclusion criteria consisted of women aged 18 years or older with no additional comorbidities. This approach was adopted to minimize confounding effects of systemic comorbidities on perioperative and neonatal outcomes. Exclusion criteria included patients with ovarian cysts, any malignancy, diabetes, hypertension, other chronic diseases, and multiple pregnancies.

Demographic and clinical data were retrospectively extracted from the hospital's electronic medical record system. Maternal variables included age, gestational age at delivery, body mass index (BMI), gravidity, parity, and abortion history. BMI was calculated as weight (kg) divided by height squared (m^2). Laboratory parameters included preoperative and postoperative hemoglobin, hematocrit, platelet count, neutrophil count, and lymphocyte count. Additional variables included transfusion requirement, length of hospital stay, and myoma-related characteristics (number of myomas, total myoma volume, and maximum myoma volume). Neonatal outcomes included birth weight, birth length , and Apgar scores at 1 and 5 minutes.

Myoma volume was calculated using the ellipsoid formula ($V = \pi/6 \times \text{length} \times \text{width} \times \text{depth}$). Total myoma volume (total V) was defined as the sum of volumes of all detected myomas, and the largest individual myoma volume was defined as maximum myoma volume (max V). Laboratory analyses were performed using AU5800 (Beckman Coulter, California, USA) and pocH-100i (Sysmex Corporation, Japan). The same reagent kits and internal quality control procedures were used throughout the study period. None of the fibroids included in the study were submucosal. The majority of lesions were subserosal or intramural-subserosal fibroids.

Patients were categorized into three groups: Group 1, CS with concomitant myomectomy; Group 2, CS in the presence of uterine myomas without myomectomy; and Group 3, CS without uterine myomas. Group 3 was selected to match the sample size of the cesarean myomectomy group, allowing balanced three-group comparisons. A post-hoc power analysis was performed assuming an 80% power, a 95% confidence level, and a 5% margin of error. Myomectomy in Group 1 was performed during CS by experienced obstetric surgeons. Hemostasis during cesarean myomectomy was achieved using electrocautery, uterine compression sutures, and routine oxytocin infusion. No additional vasoconstrictive agents, such as vasopressin, were used, and uterine artery ligation or balloon tamponade was not routinely performed. Group 3 patients were consecutively selected from women without uterine myomas who underwent CS during the same study period.

Statistical analysis

All statistical analyses were performed using Stata version 17 (StataCorp, USA). Normality of continuous variables was assessed using the Shapiro-Wilk test. Normally distributed variables were analyzed using one-way analysis of variance (ANOVA), while non-normally distributed variables were analyzed using the Kruskal-Wallis test. Post-hoc pairwise comparisons were performed using Tukey's test for ANOVA and Dunn's test with Bonferroni correction for Kruskal-Wallis analyses. Two-group comparisons were conducted using the independent samples t-test or the Mann-Whitney U test, as appropriate. Categorical variables were analyzed using the chi-square test or Fisher's exact test.

Exploratory binary logistic regression analyses were performed to evaluate factors associated with transfusion requirement and group discrimination. Given the observational design, these models were intended for hypothesis generation rather than causal inference. The discriminative performance of these models was assessed using receiver operating characteristic (ROC) curve analysis and area under the curve (AUC) values. To evaluate sample adequacy, a post-hoc power analysis was conducted using one-way ANOVA with three groups. Assuming a medium effect size (Cohen's $f = 0.25$), an alpha level of 0.05, and the observed group sizes, the calculated statistical power was 0.9999. This analysis was performed to confirm sample adequacy rather than to guide study design. A p-value <0.05 was considered statistically significant.

Results

Baseline characteristics

The study cohort numbered 682 with 252 (36.95%), 178 (26.1%) and 252 (36.95%) women in Groups 1, 2 and 3, respectively. Baseline demographic and obstetric characteristics are presented in Table 1. Statistically significant differences were observed between the three groups with respect to maternal age, gestational age at delivery, number of previous abortions, systolic blood pressure, diastolic blood pressure, and neonatal birth weight (all $p<0.05$). BMI, gravidity, parity, and neonatal birth length were comparable across groups ($p>0.05$).

Preoperative hemoglobin level, hematocrit, platelet count, neutrophil count, and lymphocyte count did not differ significantly between the groups (Table 2). In contrast, postoperative hemoglobin level, hematocrit, and platelet count differed significantly among the three groups (Table 2).

Pairwise comparisons demonstrated no statistically significant difference in hemoglobin deficit between Group 1 and Group 2 ($p=0.346$). However, hemoglobin deficit was significantly greater in both Group 1 and Group 2 compared with Group 3 ($p<0.05$ for both comparisons) (Figure 1). Hematocrit deficit was significantly greater in Group 1 than in Group 2 and Group 3 ($p<0.05$ for both comparisons). Similarly, change in platelet count was significantly greater in Group 1 compared with both Group 2 and Group 3 ($p<0.05$) (Figure 2).

The rate of blood transfusion requirement differed significantly between the three groups ($p<0.05$), with the highest transfusion rate observed in Group 1. Length of hospital stay also differed significantly between groups ($p<0.05$). When analyzed according to transfusion status, patients who received transfusions had significantly longer hospital stays compared with those who did not in all three groups (all $p<0.05$). Group-specific hospitalization data stratified by transfusion status are presented in Table 3.

Neonatal outcomes are summarized in Table 4. A significant difference was observed in birth weight between the three

Table 1. Demographic comparison of three groups

Variable	Group 1 (mean ± SD)	Group 2 (mean ± SD)	Group 3 (mean ± SD)	p-value
Age (years)	31.16±4.37	32.42±5.78	31.18±6.08	p<0.05
Gestational age (weeks)	37.79±1.72	37.72±1.20	37.78±1.12	p<0.05
BMI (kg/m^2)	30.32±2.96	30.98±3.51	30.75±3.36	0.3076
Gravidity	1.73±0.90	1.58±0.77	1.56±0.77	0.0833
Parity	0.57±0.69	0.52±0.74	0.48±0.73	0.1343
Abortion	0.16±0.47	0.06±0.23	0.07±0.25	p<0.05
SBP (mmHg)	115.73±8.22	110.98±15.01	111.83±14.89	p<0.05
DBP (mmHg)	70.30±6.33	67.50±9.48	68.15±8.77	p<0.05
Birth weight (gr)	3130.15±642.09	3000.96±441.61	3157.90±481.60	p<0.05
Birth length (cm)	49.47±2.72	49.76±1.44	49.79±1.34	0.9852

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, SD: Standard deviation, BMI: Body mass index. p-values were obtained using the Kruskal-Wallis test

Table 2. Preoperative and postoperative laboratory values among study groups

Variable	Group 1 (mean ± SD)	Group 2 (mean ± SD)	Group 3 (mean ± SD)	p-value
Pre-HGB	12.11±0.07	12.03±0.08	11.96±0.09	0.443
Pre-HCT	36.11±0.21	36.08±0.24	35.9±0.27	0.804
Pre-PLT	249.81±3.921	259.06±4.822	258.31±5.331	0.212
Pre-NEU	7.02±0.11	7.18±0.12	7.31±0.14	0.191
Pre-LYM	1.99±0.03	1.99±0.03	1.96±0.04	0.850
Post-HGB	10.83±0.08	11.46±0.07	10.77±0.08	p<0.05
Post-HCT	32.82±0.21	34.09±0.21	34.02±0.24	p<0.05
Post-PLT	206.5±3.91	233.22±4.48	232.4±4.91	p<0.05
Post-NEU	11.13±0.19	11.31±0.17	11.43±0.21	0.287
Post-LYM	3.05±1.36	3.07±1.35	3.64±1.92	0.835

HGB: Hemoglobin, HCT: Hematocrit, PLT: Platelet, NEU: Neutrophil, LYM: Lymphocyte, SD: Standard deviation

groups ($p<0.05$). Pairwise comparisons revealed that birth weight was significantly lower in Group 2 compared with Group 1 ($p<0.05$) and Group 3 ($p<0.05$), whereas no significant difference was observed between Group 1 and Group 3 ($p=0.956$) (Table 5). No statistically significant differences were found between the groups with respect to neonatal birth length or Apgar scores at 1 and 5 minutes (all $p>0.05$).

Among patients with uterine fibroids (Groups 1 and 2), myoma-related characteristics differed significantly between groups. Maximum myoma volume was significantly higher in Group 1, whereas myoma count was significantly higher in Group 2 (both $p<0.05$). Total myoma volume did not differ significantly between the two groups ($p=0.09$).

Subgroup analyses based on myoma number demonstrated that patients with multiple fibroids had significantly higher total myoma volume and maximum myoma volume compared with patients with a single fibroid (both $p<0.05$). In contrast, change in hemoglobin level, transfusion requirement rate, and length of hospital stay did not differ significantly between patients with single or multiple fibroids (all $p>0.05$). Neonatal outcomes, including birth weight and Apgar scores, were also comparable between the two subgroups (Supplementary Table 1).

The relationship between myoma count and perioperative outcomes is illustrated in Figure 3. Higher median hemoglobin change and longer hospital stay were observed across increasing myoma count categories. Transfusion rates also varied according to myoma count categories. Descriptive trends across myoma count groups are presented without formal statistical comparison.

When transfusion status was evaluated according to myoma burden, patients who received transfusions had higher total myoma volume and maximum myoma volume compared with those who did not. However, these differences did not reach statistical significance in pairwise analyses (Group 1: p=0.082; Group 2: p=0.210) (Table 6).

ROC analyses comparing patient groups demonstrated variable discriminative performance. The comparison between patients who underwent cesarean myomectomy and patients with fibroids who did not undergo myomectomy (Group 1 vs. Group 2) showed excellent discrimination (AUC =0.92). Comparisons between Group 1 and fibroid-free controls (Group 3) and between Group 2 and Group 3 demonstrated good discriminative performance, with AUC values of 0.81 and 0.82, respectively (Figure 4).

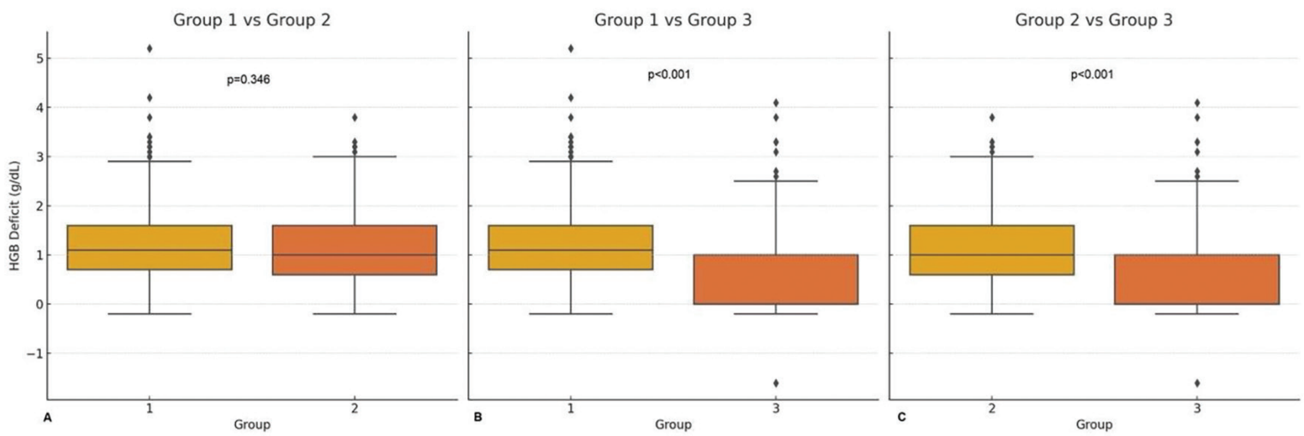

Figure 1. The boxplot comparison of pre-post hemoglobin (HGB) deficit among the three study groups. (A) There was no statistically significant difference in HGB deficit between Group 1 and Group 2. (B) A statistically significant difference was observed between Group 1 and Group 3. (C) A statistically significant difference was observed between Group 2 and Group 3. Mann-Whitney U test

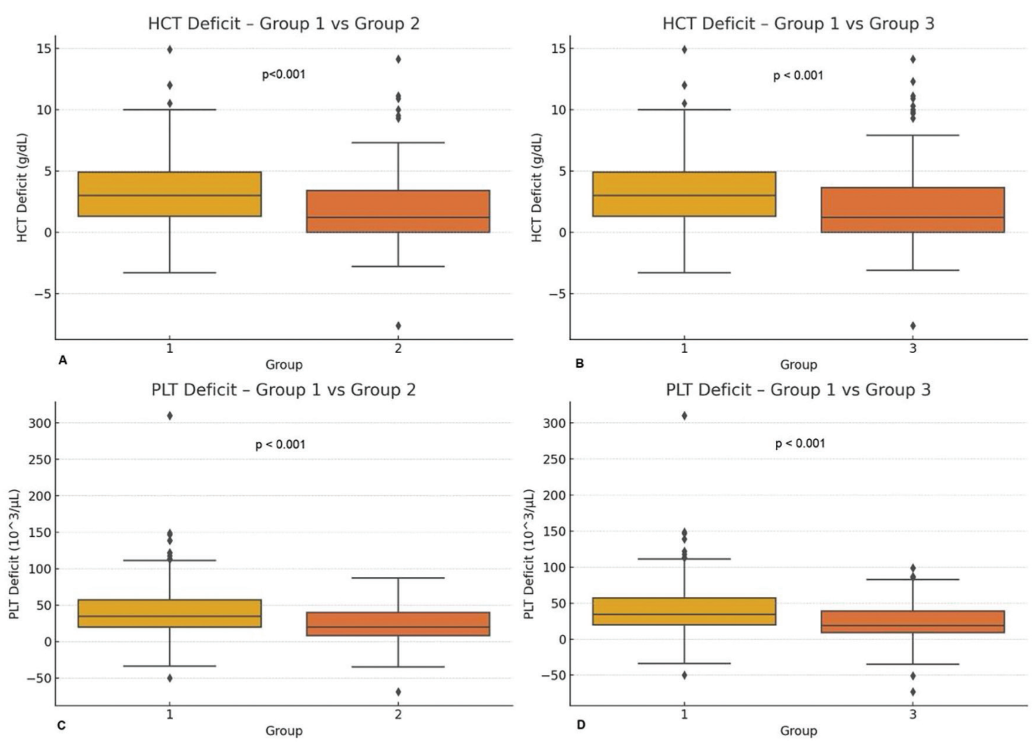

Figure 2. The boxplot comparison of pre-post hemoglobin, hematocrit (HCT) and platelet (PLT) deficit in pairwise group comparisons. (A) Group 1 had significantly greater HCT deficit than Group 2. (B) HCT deficit was significantly higher in Group 1 compared to Group 3. (C) PLT counts showed a significantly greater deficit in Group 1 compared to Group 2. (D) Group 1 demonstrated significantly higher PLT deficit compared to Group 3

In a separate exploratory logistic regression model evaluating factors associated with the decision to perform myomectomy, limited discriminative ability was observed (AUC =0.602). The corresponding ROC curve is presented in Figure 5.

Discussion

The present study set out to provide a comprehensive comparison of maternal and neonatal outcomes among women undergoing CS with concomitant myomectomy, women with uterine fibroids managed conservatively at cesarean delivery, and women without fibroids. By employing a three-group design of 682 patients, our findings allow differentiation between the effects attributable to fibroid burden itself and those related specifically to the myomectomy procedure. Uterine fibroids may undergo variable changes in size during pregnancy. Recent evidence indicates that most fibroids either remain stable or increase only modestly in volume, particularly during the first trimester. Rapid fibroid enlargement is relatively uncommon and is often followed by stabilization or even regression later in pregnancy, likely due to changes in uterine blood flow and fibroid degeneration (4,13).

Consistent with prior observational studies (10,14), cesarean myomectomy in our cohort was associated with a greater magnitude of perioperative hematologic changes and higher transfusion rates compared with cesarean delivery in women without fibroids. However, a key finding of this study was that hemoglobin deficit did not differ significantly between patients undergoing cesarean myomectomy and those with fibroids who did not undergo myomectomy ($p=0.346$). This observation suggests that the presence of uterine fibroids, rather than the act of myomectomy itself, represents the dominant contributor to perioperative blood loss. This finding may partially be explained by impaired uterine contractility associated with fibroid-containing uteri. Fibroids can disrupt normal myometrial architecture and interfere with effective uterine contraction after delivery, thereby contributing to increased perioperative blood loss independent of myomectomy itself. In contrast, changes in hematocrit and platelet values were more pronounced in the cesarean myomectomy group. These findings likely reflect increased surgical manipulation and local hemostatic consumption associated with fibroid enucleation. Importantly, however, these laboratory differences did not translate into disproportionately higher rates of severe maternal morbidity, supporting the notion that cesarean myomectomy imposes an increased but clinically manageable hematologic burden when performed in appropriately selected patients.

The higher transfusion rate observed in the cesarean myomectomy group aligns with previous reports (6,14), yet our subgroup analyses further clarify this relationship. Transfusion requirement was more closely related to postoperative hemoglobin levels and platelet counts than to fibroid number or total fibroid volume alone. On the other hand, some studies reported no significant difference in blood transfusion rates between women who underwent cesarean myomectomy and those who had cesarean delivery without myomectomy (15,16). These findings suggest that, in appropriately selected patients and in experienced centers, cesarean myomectomy does not confer an additional transfusion risk compared with CS alone. In our study, hospitalization duration was significantly prolonged in transfused patients across all groups, underscoring transfusion status as a marker of postoperative recovery rather than a procedure-specific complication.

Table 3. Hospitalization duration by transfusion status

Group	Transfusion	Mean ± SD	Count
Group 1	No	1.94±0.43	241
Group 1	Yes	2.82±0.40	11
Group 2	No	1.86±0.49	170
Group 2	Yes	2.62±0.74	8
Group 3	No	1.92±0.46	241
Group 3	Yes	2.73±0.65	11

$p<0.05$ for comparisons between transfusion and non-transfusion subgroups within each study group (Mann-Whitney U test). SD: Standard deviation

Table 4. Neonatal outcomes-group comparisons

Parameter	Test	p-value
Birth weight	Kruskal-Wallis	p<0.05
Birth length	Kruskal-Wallis	0.9852
Apgar 1	Kruskal-Wallis	0.9958
Apgar 5	Kruskal-Wallis	0.9958

Kruskal-Wallis test (3-group comparison)

Table 5. Pairwise Mann-Whitney U tests (birth weight)

Comparison	Test	p-value
Group 1 vs. Group 2	Mann-Whitney U	p<0.05
Group 1 vs. Group 3	Mann-Whitney U	0.9558
Group 2 vs. Group 3	Mann-Whitney U	p<0.05

Table 6. Association between myoma burden and transfusion requirement

Group	Mean total V (transfusion)	Mean total V (no transfusion)	p-value
Group 1	68.911	17.004	0.082
Group 2	15.969	13.584	0.21

total V: Total myoma volume

Collectively, these findings further support the notion that perioperative blood loss is strongly influenced by the presence of uterine fibroids rather than the myomectomy procedure itself. Although cesarean myomectomy was associated with greater hematocrit and platelet changes, these likely reflect increased surgical manipulation and localized hemostatic consumption rather than uncontrolled hemorrhage. Importantly, no major myomectomy-related perioperative or postoperative complications, including puerperal sepsis or secondary postpartum hemorrhage, were observed in our cohort.

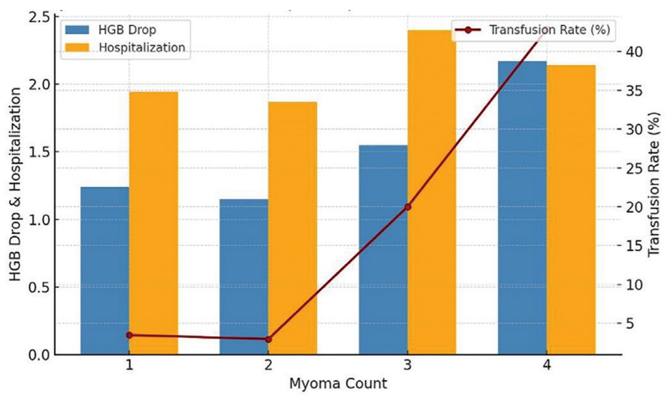

Figure 3. Distribution of perioperative outcomes according to myoma count. The figure demonstrates hemoglobin deficit, length of hospital stay, and transfusion rate across different myoma count categories. Values are presented descriptively to illustrate trends in perioperative outcomes according to myoma burden

HGB: Hemoglobin

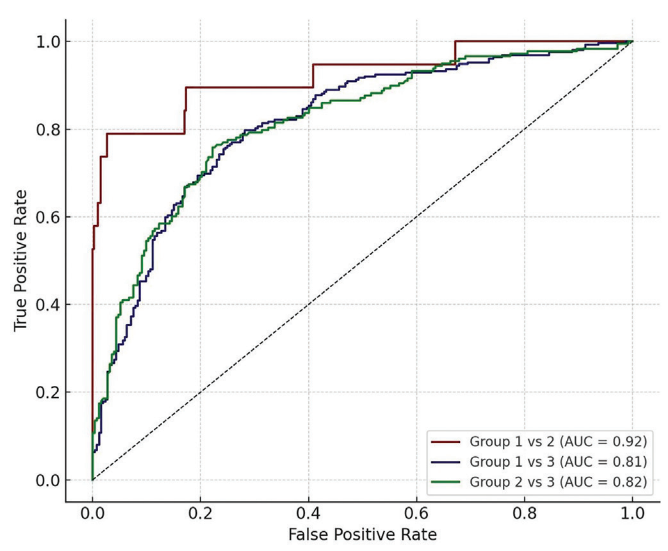

Figure 4. Logistic regression and receiver operating characteristic analyses for group discrimination

AUC: Area under the curve

An important contribution of this study is the detailed evaluation of fibroid characteristics and their relationship to surgical decision-making. Patients undergoing cesarean myomectomy tended to have larger maximum fibroid volumes, whereas patients with fibroids managed conservatively more frequently exhibited a higher number of smaller fibroids. However, total fibroid volume did not differ significantly between these groups, suggesting that surgeons may prioritize accessibility and dominant lesion size over cumulative fibroid burden when deciding whether to perform myomectomy at the time of cesarean delivery. This approach is consistent with previous reports indicating that fibroid size and localization, rather than total fibroid load, play a central role in determining the feasibility and safety of cesarean myomectomy. Several studies have emphasized that larger, subserosal or pedunculated fibroids are more frequently selected for removal during cesarean delivery, whereas multiple smaller or intramural fibroids are often managed conservatively due to concerns regarding bleeding and operative complexity (16-18). Collectively, these findings support the concept that dominant fibroid characteristics, particularly size and surgical accessibility, are key determinants of intraoperative decision-making in cesarean myomectomy.

Subgroup analyses comparing single versus multiple fibroids further support this interpretation. Although patients with multiple fibroids had significantly higher total and maximum fibroid volumes, hemoglobin deficit, transfusion rate, and length of hospital stay were comparable between single and multiple

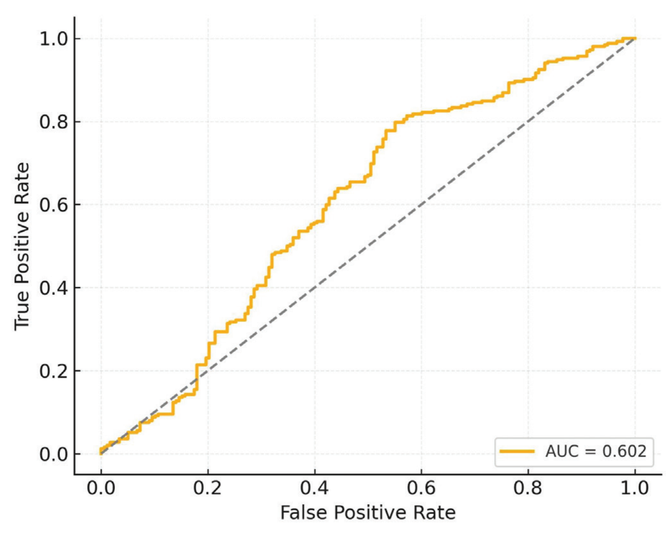

Figure 5. Receiver operating characteristic curve for the logistic regression model predicting myomectomy decision during cesarean section. The model includes predictors such as max V, myoma count, total V, BMI, age, and gestational age. AUC =0.602, indicating moderate predictive performance

AUC: Area under the curve, max V: Maximum myoma volume, total V: Total myoma volume, BMI: Body mass index

fibroid subgroups. These findings imply that fibroid number alone may be a poor predictor of perioperative risk and that surgical feasibility is likely influenced by fibroid location, accessibility, and surgeon experience rather than numeric burden.

The exploratory logistic regression model evaluating factors associated with the decision to perform myomectomy demonstrated limited discriminative ability, reinforcing the complexity and individualized nature of intraoperative decision-making. Taken together, these results emphasize that cesarean myomectomy is not governed by a single quantitative threshold but rather by a constellation of anatomical and clinical considerations. In our institution, the decision to perform cesarean myomectomy was individualized and based primarily on intraoperative surgical assessment, including fibroid accessibility, dominant lesion size, technical feasibility, and perceived hemorrhage risk rather than predefined standardized criteria.

One of the most clinically relevant findings of this study relates to neonatal outcomes. Neonates born to mothers with fibroids who did not undergo myomectomy exhibited significantly lower birth weight compared with both cesarean myomectomy patients and fibroid-free controls. In contrast, birth weight did not differ between the cesarean myomectomy group and women without fibroids. Apgar scores and neonatal length were comparable across all groups. The significantly lower birth weight observed in patients with untreated fibroids suggests that the persistence of fibroids during pregnancy may negatively influence fetal growth. In contrast, birth weight in the cesarean myomectomy group was comparable to that of fibroid-free controls. Potential mechanisms include mechanical distortion of the uterine cavity and compromised uteroplacental perfusion. Fibroid localization may also influence neonatal outcomes. In particular, fibroids located near the lower uterine segment or uterine incision site may interfere with placental implantation, uterine distensibility, and local perfusion, potentially exerting a greater impact on fetal growth. These findings likely reflect the biological and mechanical effects of fibroids during pregnancy rather than the effect of cesarean delivery itself. However, fibroids directly involving the uterine incision site were not present in our cohort. Moreover, detailed localization data were not uniformly available in this retrospective study, limiting further subgroup analyses according to fibroid location. Notably, neonatal outcomes in the cesarean myomectomy group were comparable to those of fibroid-free patients, supporting the neonatal safety of myomectomy when performed under controlled conditions. These findings are consistent with previous studies reporting an association between untreated uterine fibroids and reduced neonatal birth weight, particularly in cases involving larger or strategically located fibroids (19,20). Prior literature has suggested that fibroids may impair placental development and uteroplacental blood flow, thereby contributing to fetal growth restriction. Importantly, available evidence indicates that removal of selected fibroids at the time of cesarean delivery does not negatively affect neonatal outcomes, reinforcing the concept that cesarean myomectomy can mitigate fibroid-related growth impairment without compromising neonatal safety.

Recent systematic reviews and meta-analyses have increasingly challenged the traditional avoidance of cesarean myomectomy, reporting comparable rates of major maternal complications between cesarean myomectomy and cesarean delivery alone in selected populations. Our findings are concordant with this evolving body of evidence while adding nuance through the inclusion of a fibroid-positive non-myomectomy comparison group. This three-arm design highlights that fibroid presence itself constitutes a meaningful risk factor for both maternal hematological changes and neonatal growth restriction, independent of surgical intervention.

Study limitations

The strengths of this study include its large sample size, three-group comparative design, detailed assessment of hematological parameters, and comprehensive evaluation of fibroid characteristics. The inclusion of both maternal and neonatal outcomes provides a balanced assessment of perioperative safety and fetal well-being. Several limitations should be acknowledged. The retrospective nature of the study limits causal inference and introduces potential selection bias, particularly regarding the decision to perform myomectomy. Although major fibroid localization patterns were available, detailed standardized classification data for all fibroids, as well as surgeon-specific operative parameters including operative time and estimated blood loss, were not uniformly available. In addition, long-term maternal outcomes, such as fibroid recurrence and future fertility, could not be assessed. Finally, although neonatal outcomes were reassuring, long-term neonatal follow-up was beyond the scope of this analysis.

Despite these limitations, our findings contribute meaningful evidence to the ongoing debate surrounding cesarean myomectomy. Importantly, the heterogeneity of existing studies-particularly with respect to fibroid characteristics, surgeon experience, and institutional resources-has limited the development of universal guidelines. The results suggest that, in selected patients, cesarean myomectomy can be performed without compromising neonatal outcomes and without imposing disproportionate maternal risk beyond that associated with fibroid presence itself. These data support a shift from a uniformly conservative approach toward a more individualized, anatomy-driven surgical strategy. Our results support a more individualized approach, emphasizing patient selection, surgical expertise, and intraoperative assessment rather than categorical avoidance or endorsement of cesarean myomectomy.

Conclusion

Cesarean myomectomy appears to be a feasible and clinically acceptable option in selected patients when performed by experienced surgeons. The presence of uterine fibroids themselves may contribute more substantially to perioperative hematological changes and adverse neonatal growth outcomes than the myomectomy procedure itself. Future prospective studies with standardized reporting of fibroid characteristics, surgical techniques, and perioperative management are warranted to further refine patient selection criteria. Randomized trials may be challenging in this context but well-designed multicenter registries could provide high-quality evidence to guide clinical decision-making and inform guideline development.

Ethics

Ethics Committee Approval: *Approval from the University of Health Sciences Türkiye, Balıkesir Atatürk City Hospital Ethics Committee was sought prior to the study and it conforms to the provisions of the Declaration of Helsinki (approval no: 2025/02/20, date: 20.02.2025).*

Informed Consent: *As this was a retrospective study, informed consent was waived.*

Footnotes

Author Contributions: *Surgical and Medical Practices: Ç.B.B., V.K., S.T.Y., Concept: Ç.B.B., Design: Ç.B.B., Data Collection or Processing: Ç.B.B., S.T.Y., Analysis or Interpretation: Ç.B.B., V.K., Literature Search: Ç.B.B., V.K., Writing: Ç.B.B.*

Conflict of Interest: *No conflict of interest is declared by the authors.*

Financial Disclosure: *The authors declared that this study received no financial support.*

Supplementary Table: *https://d2v96fxpocvxx.cloudfront.net/6548c443-00ef-4a8c-a306-c0848f02b51f/content-images/820e0afc-d7b2-4b59-bbf7-2a46ee834a5c.pdf*

References

1. Li B, Wang F, Chen L, Tong H. Global epidemiological characteristics of uterine fibroids. Arch Med Sci. 2023; 19: 1802-10.
2. Wang HM, Tian YC, Xue ZF, Zhang Y, Dai YM. Associations between uterine fibroids and obstetric outcomes in twin pregnancies. Int J Gynaecol Obstet. 2016; 135: 22-7.
3. Mitro SD, Peddada S, Chen Z, Buck Louis GM, Gleason JL, Zhang C, et al. Natural history of fibroids in pregnancy: National Institute of Child Health and Human Development Fetal Growth Studies - Singletons cohort. Fertil Steril. 2022; 118: 656-65.
4. Coutinho LM, Assis WA, Spagnuolo-Souza A, Reis FM. Uterine fibroids and pregnancy: how do they affect each other? Reprod Sci. 2022; 29: 2145-51.
5. Tîrnovanu MC, Lozneanu L, Tîrnovanu ȘD, Tîrnovanu VG, Onofriescu M, Ungureanu C, et al. Uterine fibroids and pregnancy: a review of the challenges from a romanian tertiary level institution. Healthcare (Basel). 2022; 10: 855.
6. Ramasauskaite D, Purandare N, Diaz I, Kvederaite-Budre G, Beyuo TK, Beyeza-Kashesya J, et al. Fibroids and pregnancy. Int J Gynaecol Obstet. 2026; 172: 51-8.
7. Li H, Hu Z, Fan Y, Hao Y. The influence of uterine fibroids on adverse outcomes in pregnant women: a meta-analysis. BMC Pregnancy Childbirth. 2024; 24: 345.
8. Al Sulaimani R, Machado L, Al Salmi M. Do large uterine fibroids impact pregnancy outcomes? Oman Med J. 2021; 36: e292.
9. Goyal M, Dawood AS, Elbohoty SB, Abbas AM, Singh P, Melana N, et al. Cesarean myomectomy in the last ten years; a true shift from contraindication to indication: a systematic review and meta-analysis. Eur J Obstet Gynecol Reprod Biol. 2021; 256: 145-57.
10. Youshanloie MM, Vaezi M, Pashazadeh F. Consequences of concurrent myomectomy and caesarean section versus caesarean section alone in the last two decades: systematic review and meta-analysis. Current Women's Health Reviews. 2023; 19: 14.
11. ACOG Practice Bulletin No. 228: Management of symptomatic uterine leiomyomas: correction. Obstet Gynecol. 2021; 138: 683.
12. Tinelli A, Nezhat CH, Likić-Ladjević I, Andjić M, Tomašević D, Papoutsis D, et al. Myomectomy during cesarean section or non-caesarean myomectomy in reproductive surgery: this is the dilemma. Clin Exp Obstet Gynecol. 2021; 48: 1250-8.
13. Vitagliano A, Noventa M, Di Spiezio Sardo A, Saccone G, Gizzo S, Borgato S, et al. Uterine fibroid size modifications during pregnancy and puerperium: evidence from the first systematic review of literature. Arch Gynecol Obstet. 2018; 297: 823-35.
14. Lee YE, Park S, Lee KY, Song JE. Risk factors based on myoma characteristics for predicting postoperative complications following cesarean myomectomy. PLoS One. 2023; 18: e0280953.
15. Pergialiotis V, Sinanidis I, Louloudis IE, Vichos T, Perrea DN, Doumouchtsis SK. Perioperative complications of cesarean delivery myomectomy: a meta-analysis. Obstet Gynecol. 2017; 130: 1295-303.
16. El-Refaie W, Hassan M, Abdelhafez MS. Myomectomy during cesarean section: a retrospective cohort study. J Gynecol Obstet Hum Reprod. 2020: 101900.
17. Akbas M, Mihmanli V, Bulut B, Temel Yuksel I, Karahisar G, Demirayak G. Myomectomy for intramural fibroids during caesarean section: a therapeutic dilemma. J Obstet Gynaecol. 2017; 37: 141-5.
18. Zhao R, Wang X, Zou L, Zhang W. Outcomes of myomectomy at the time of cesarean section among pregnant women with uterine fibroids: a retrospective cohort study. Biomed Res Int. 2019; 2019: 7576934.
19. Huang Y, Ming X, Li Z. Feasibility and safety of performing cesarean myomectomy: a systematic review and meta-analysis. J Matern Fetal Neonatal Med. 2022; 35: 2619-27.
20. Barati M, Saadati N, Jalili Z, Moramezi H. Demographic, clinical characteristics and maternal-neonatal outcomes in patients undergoing cesarean myomectomy. Shiraz E-Med J. 2025; 26: e163314.