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Research Article

Demographic, Clinical Characteristics and Maternal-Neonatal Outcomes in Patients Undergoing Cesarean Myomectomy

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Abstract

Background: Having clinical information on maternal and neonatal outcomes in pregnant women with uterine fibroids (UFs) undergoing cesarean section (CS) can significantly enhance clinical management and disease prevention strategies.

Objectives: The present study aimed to assess the demographic and clinical characteristics of patients undergoing cesarean myomectomy (CM) and to examine maternal and neonatal outcomes associated with CM.

Methods: In this cross-sectional study, pregnant women undergoing CM at Imam Khomeini Hospital in Ahvaz from March 2021 to March 2024 were included through census sampling. The UF characteristics (type, number, and size) along with maternal and neonatal complications following CM, such as blood transfusion, post-partum hemorrhage (PPH), and neonatal intensive care unit (NICU) hospitalization admission, were measured.

Results: In total, 60 pregnant women with a mean (standard deviation) age of 34.17 (5.77) were enrolled in the study. The most common comorbidities among them were hypertension (15%) and gestational diabetes (11.7%). Intramural fibroids were the most common type of UF (47%), 45% of UF were < 5 cm, and 72% were single UF. The proportions of blood transfusions and PPH were 13% and 7%, respectively. The proportion of NICU hospitalization and growth below the 3rd percentile were observed in 32% and 12% of cases, respectively. There was a statistically significant correlation between myoma size and the rates of blood transfusion (P = 0.04).

Conclusions: The results of this study indicate that the incidence of unfavorable maternal and neonatal outcomes following CM is considerable, necessitating careful management and the implementation of effective therapeutic strategies to mitigate such complications.

Keywords: Uterine Fibroids, Cesarean Myomectomy, Obstetrical Complications, Maternal-Neonatal Outcomes

1. Background

Uterine fibroids (UFs), also called uterine leiomyomas (ULs) or myomas, are the most common solid pelvic tumors (1, 2). The UF occur when muscular cells in the uterine wall proliferate and grow, eventually forming a fibroid. These growths can alter the shape or size of the uterus and, in some cases, even affect the cervix (3, 4).

The International Federation of Gynecology and Obstetrics (FIGO) classifies fibroids based on their location within the uterus into three categories: (1) Intramural myomas, which develop within the uterine wall; (2) submucosal myomas, which grow beneath the lining of the uterine cavity; and (3) subserosal myomas, which form on the outer surface of the uterus (5).

Comprehensive data on the burden of UF is scarce; however, previous studies emphasize that its incidence and prevalence vary depending on the population studied and the diagnostic methods used. Reported incidence rates range from 217 to 3,745 per 100,000 women, while prevalence rates vary between 4.5% and 68.6% (5). Studies conducted in the United States have shown that the prevalence of UF is higher among

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African American women compared to white women (6). Research in European countries has reported a prevalence of UF ranging from 12% to 24% (7). Nonetheless, it is expected that UF occurs in 20 to 30 percent of fertile women (8).

The etiology of UF is multifactorial, encompassing a wide range of contributing factors. Genetic predispositions, and reproductive and endocrinological factors such as parity, early menarche, and obesity are significant contributors. Lifestyle factors, including dietary habits, alcohol consumption, and smoking, have also been implicated. Growth factors with mitogenic activity may also play a role in the development of ULs (9-12). Nonetheless, most UF are asymptomatic, and symptoms appear gradually (3).

The clinical manifestations of UF vary significantly depending on the size, number, and location of the tumors. Most UF-related symptoms include abnormal uterine bleeding, anemia, pelvic pressure and pain, urinary frequency, and reproductive complications (2). Outcomes of pregnancies with UF include first-trimester bleeding, placental abruption, prolonged labor, spontaneous pregnancy loss, and preterm birth (13-15). Pregnant women with UF are six times more likely to require cesarean delivery (14).

Although cesarean myomectomy (CM) is a surgical procedure performed to remove fibroids during a cesarean section (CS), its value and optimal management remain controversial (16, 17). The maternal and neonatal outcomes of CM are significant topics in the field of obstetrics that require thorough investigation (18). A range of obstetric complications has been reported, including uterine rupture, post-partum hemorrhage (PPH), hysterectomy, transfusion, pulmonary embolism, maternal infection, and even death (18, 19). Preterm labor and abnormal presentation have also been reported in previous studies (20). This controversy arises from the balance between potential benefits, such as avoiding a second surgery, and risks like increased blood loss and serious maternal complications, making careful case selection and further research essential. Having clinical information on maternal and neonatal outcomes in pregnant women with UF undergoing CS can significantly enhance clinical management and disease prevention strategies. This information enables healthcare providers to develop appropriate treatment plans based on a more comprehensive understanding of patients' demographic and clinical characteristics.

2. Objectives

Given the scarcity of data on this subject in Ahvaz, southwestern Iran, the present study determined the demographic patterns, clinical characteristics, and maternal-neonatal outcomes in women undergoing CM.

3. Methods

This cross-sectional (descriptive-analytic) study included all pregnant women aged 15 - 45 years with ULs in the third trimester of pregnancy who underwent CM at Imam Khomeini Hospital in Ahvaz during 2021 - 2024. Participants were enrolled via census sampling. Data on maternal, neonatal, and fibroid characteristics were extracted from medical records. Inclusion criteria were: Age 15 - 45 years, diagnosis of UL in the third trimester, and CM. Exclusion criteria included coagulation disorders, recent anticoagulant use (within 12 hours pre-operation), first/second-trimester pregnancy termination, sickle cell anemia or other specific anemias, placental adhesion, chorioamnionitis, and uterine atony.

The study was approved by the Ethics Committee of Ahvaz University of Medical Sciences. Demographic and clinical data included maternal age, Body Mass Index (BMI), comorbidities (e.g., gestational diabetes, preeclampsia), fibroid size, location, and number. Maternal outcomes assessed postoperative hemoglobin drop, blood transfusion requirements, infection rates, peripartum hysterectomy, intrauterine balloon placement, and PPH. Neonatal outcomes included birth weight, gestational age at delivery, neonatal intensive care unit (NICU) admission, and fetal weight percentile. Data were recorded using a researcher-made checklist.

Statistical analysis was performed using SPSS version 22. The chi-square test analyzed associations between categorical variables (e.g., fibroid location/size and maternal-neonatal outcomes). A P-value of < 0.05 was considered statistically significant.

4. Results

Table 1 provides an overview of the demographic and clinical characteristics of 60 patients who underwent CM. The mean age of participants was 34.17 ± 5.77 years. The average BMI was 31.03 ± 5.12 kg/m^2 [3 patients (5%) had normal weight, 22 patients (36.67%) were overweight, and 35 patients (58.33%) were obese]. The mean neonate weight was 2645.33 ± 771.82 grams, suggesting a wide range of birth weights, including some very low birth weight infants. The average gestational age at birth was 35.58 ± 3.33 weeks (Table 1). Out of 60 patients, 18 patients (30%) had pregnancy-related medical management. One patient (1.67%)

experienced death, and three patients (5%) developed preeclampsia.

Table 1. The Demographic and Clinical Characteristics of Patients Who Underwent Cesarean Myomectomy

Variables	Mean ± SD	Range
Age (y)	34.17 ± 5.77	18 - 46
BMI (kg/m ^{2})	31.03 ± 5.12	22.5 - 54
Neonate weight (g)	2645.33 ± 771.82	600 - 3800
Gestational age at birth (wk)	35.58 ± 3.33	24 - 39.5

Abbreviation: BMI, Body Mass Index.

Out of the total women studied who underwent CM, 9 cases (15%) had hypertension, representing the most common comorbidity. Gestational diabetes was the second most prevalent condition, affecting 7 cases (11.67%). Other comorbidities included diabetes in 3 cases (5%), hypothyroidism in 2 cases (3.33%), and single cases of tumor (1.67%) and lupus.

Table 2 summarizes the distribution of fibroid characteristics, including location, size, and number among women undergoing CM. Regarding location, intramural fibroids were the most common (46.67%, 28 cases), followed by submucosal fibroids (40.00%, 24 cases), while pedunculated (8.33%, 5 cases) and subserous (5.00%, 3 cases) fibroids were less frequent. In terms of size, most fibroids measured < 5 cm (45.00%, 27 cases), followed by 5 - 10 cm (41.67%, 25 cases), with larger fibroids (> 10 cm) accounting for 13.33% (8 cases). Regarding the number of fibroids, single fibroids predominated (71.67%, 43 cases), while multiple fibroids included < 3 fibroids (18.33%, 11 cases), 3 - 5 fibroids (5.00%, 3 cases), and myomatoid clusters (5.00%, 3 cases).

Table 2. Characteristics of Myoma Location, Size, and Number in Women Undergoing Cesarean Myomectomy [a]

Variables	Values
Myoma (fibroid) location	
Subserous	3 (5.00)
Submucosal	24 (40.00)
Pedunculated	5 (8.33)
Intramural	28 (46.67)
Myoma size	
< 5	27 (45.00)
5 - 10	25 (41.67)
> 10	8 (13.33)
Myoma number	
Single	43 (71.67)
< 3	11 (18.33)
3 - 5	3 (5.00)
Myamotoze	3 (5.00)

[a] Values are expressed No. (%).

The majority of patients (86.67%, 52 cases) did not require a blood transfusion, with only 13.33% (8 cases) needing it. The PPH occurred in just 6.67% (4 cases) of patients. The NICU hospitalization was necessary for 31.67% of neonates (19 cases), while 68.33% (41 cases) did not require such care. Among the 19 neonates admitted to the NICU, the main reasons were prematurity (52.6%) and low birth weight (26.3%). A smaller proportion were admitted due to respiratory distress/asphyxia (10.5%) or other complications such as suspected sepsis or feeding problems (10.5%). Neonatal growth percentiles varied, with the largest group (46.67%, 28 cases) falling between the 3rd and 10th percentiles, 33.33% (20 cases) in the 10th to 50th percentile range, and smaller proportions in the < 3rd percentile (11.67%, 7 cases) and 50th to 90th percentile range (8.33%, 5 cases; Table 3). None of the patients reported post-surgical infection or the need for balloon tamponade.

Table 3. Maternal and Neonatal Outcomes in Women Undergoing Cesarean Myomectomy [a]

Variables	Values
Blood transfusion	
No	52 (86.67)
Yes	8 (13.33)
PPH	
No	56 (93.33)
Yes	4 (6.67)
NICU hospitalization	
No	41 (68.33)
Yes	19 (31.67)
Growth percentile (%)	
< 3	7 (11.67)
3 - 10	28 (46.67)
10 - 50	20 (33.33)
50 - 90	5 (8.33)

Abbreviations: PPH, post-partum hemorrhage; NICU, neonatal intensive care unit.

[a] Values are expressed No. (%).

The analysis of myoma characteristics and their association with maternal-neonatal outcomes is presented in Table 4. Blood transfusion rates were highest in submucosal fibroids (20.83%) and larger fibroids > 10 cm (37.5%), with a statistically significant association between myoma size and transfusion rates (P = 0.04). No significant associations were found between UF type or number and the incidence of blood transfusion, PPH, or NICU hospitalization. Blood transfusion rates across fibroid locations ranged from 0% in subserous and pedunculated to 20.83% in

Table 4. Association Between Myoma Characteristics and Maternal-Neonatal Outcomes in Cesarean Myomectomy [a]

Variables	Blood Transfusion		PPH		NICU Hospitalization	
	Yes	No	Yes	No	Yes	No
Myoma (fibroid) location						
Subserous	0 (0.00)	3 (100)	0 (0.00)	3 (100)	1 (33.33)	2 (66.67)
Submucosal	5 (20.83)	19 (79.17)	1 (4.17)	23 (95.83)	8 (33.33)	16 (66.67)
Pedunculated	0 (0.00)	5 (100)	0 (0.00)	5 (100)	1 (20.00)	4 (80.00)
Intramural	3 (10.71)	25 (89.29)	3 (10.71)	25 (89.29)	9 (32.14)	19 (67.86)
P-value	0.46		0.78		0.95	
Myoma size (cm)						
< 5	1 (3.70)	26 (96.30)	2 (7.41)	25 (92.59)	10 (37.04)	17 (62.96)
5 - 10	4 (16.00)	21 (84.00)	1 (4.00)	24 (96.00)	8 (32.00)	17 (68.00)
> 10	3 (37.50)	5 (62.50)	1 (12.50)	7 (87.50)	1 (12.50)	7 (87.50)
P-value	0.04		0.63		0.42	
Myoma number						
Single	6 (13.95)	37 (86.05)	2 (4.65)	41 (95.35)	12 (27.91)	31 (72.09)
< 3	2 (18.18)	9 (81.82)	1 (9.09)	10 (90.91)	6 (54.55)	5 (45.45)
3 - 5	0 (0.00)	3 (100)	0 (0.00)	3 (100)	0 (0.00)	3 (100)
Myamotoze	0 (0.00)	3 (100)	1 (33.33)	2 (66.67)	1 (33.33)	2 (66.67)
P-value	0.86		0.22		0.21	

Abbreviations: PPH, post-partum hemorrhage; NICU, neonatal intensive care unit.

[a] Values are expressed No. (%).

submucosal and 10.71% in intramural fibroids (P = 0.46). The PPH rates varied from 0% to 10.71% among locations (P = 0.78). The NICU hospitalization rates were similar across fibroid locations, ranging from 20% to 33.33% (P = 0.95). Regarding fibroid number, transfusion rates were 13.95% for single, 18.18% for fewer than three, and 0% for three or more fibroids (P = 0.86), while PPH rates ranged from 4.65% to 33.33% (P = 0.22). The NICU hospitalization rates varied from 27.91% for single fibroids to 54.55% for fewer than three, without statistical significance (P = 0.21).

5. Discussion

The findings of the study indicated that the most common type of UF was intramural (47%), with a size of less than 5 cm (45%), and the majority of UFs were single (72%). The prevalence of blood transfusion and PPH was 13% and 7%, respectively. Additionally, the rates of NICU hospitalization and growth percentile below the 3rd percentile were observed to be 32% and 12%, respectively. There was no significant relationship between the type and number of UFs and the outcomes of blood transfusion and PPH. However, with an increase in UF size, the proportion of blood transfusion increased, although UF size did not directly influence PPH.

The predominance of intramural fibroids (47%) and their small size (less than 5 cm in 45% of cases) may contribute to the relatively low incidence of PPH (7%) observed. Intramural fibroids grow within the uterine wall, which might reduce the risk of severe bleeding compared to other types like submucosal fibroids. The prevalence of blood transfusion (13%) suggests that while bleeding complications do occur, they are manageable with appropriate medical interventions. It should also be noted that with the introduction of new methods for selective devascularization and innovations in the field of anesthesia, today there is a preference for performing myomectomy along with CS to avoid the need for subsequent surgery and its associated complications and costs (21). The fact that in our study most UFs were single (72%) may also influence the severity of symptoms and complications, as multiple UFs often lead to more pronounced clinical manifestations. A potential confounding variable that could influence the results here is the history of myomectomy, which itself is an indication for CS. Patients with a prior myomectomy are more likely to have fewer or no UFs (20). Overall, these findings highlight the importance of considering UF characteristics in managing pregnancy-related complications (22).

In a study conducted by Zhao et al. (23) in China, only 0.9% of women who underwent CM experienced blood transfusion as a complication. Furthermore, although

CM increases the risk of PPH ≥ 1000 mL by 60%, this increase was not statistically significant. To confirm the impact of CM on outcomes such as PPH and blood transfusion, it is necessary to include a comparison group, for example, women without CM, and to compare the incidence of these outcomes between the two groups. In a study conducted in Egypt, there was no difference in the amount of blood transfusion between women undergoing CM and those who did not undergo myomectomy (24). In another study, there was no difference in PPH and blood transfusion between women with and without CM (20). The results of a meta-analysis based on the findings of 19 studies showed that in women undergoing myomectomy, the risk of blood transfusions increases by approximately 40 percent significantly (25). In the present study, there was no difference between women who experienced PPH and blood transfusion in terms of the type, size, and number of UFs. Submucosal UF, which grow into the uterine cavity, are more likely to cause heavy menstrual bleeding and anemia, potentially necessitating blood transfusions (26). It has been demonstrated that larger and multiple UFs can lead to increased adverse outcomes of CM (19, 20). In one study, it was determined that with each one-unit increase in the diameter of UF, the odds of operative PPH significantly increased by 17% after adjusting for demographic characteristics and parameters of UF (27). Zhao et al. (23) showed that the presence of fibroids with a diameter greater than 5 cm can double the odds of PPH exceeding 1,000 mL. In the present study, the observed rate of NICU admission was approximately 32%. It has been shown that CM can lead to longer operative times and potentially more blood loss, which necessitates closer monitoring of newborns in the NICU. In a study from India, the NICU admission rate for women with fibroids was 20% (28).

This study has several limitations that should be considered when interpreting the results. First, the relatively small sample size (n = 60), although including all eligible cases during the study period, may limit the statistical power to detect significant associations, particularly for rare outcomes such as PPH by fibroid subtype. Another limitation is that this study was conducted in a single tertiary hospital, which may restrict the external validity of the findings. Furthermore, our exclusion of women with certain high-risk conditions (e.g., placental adhesion, coagulation disorders, or uterine atony) may have biased the results toward lower complication rates. Therefore, the reported frequencies of adverse maternal and neonatal outcomes should be interpreted as potentially conservative estimates. Additionally, the study may be influenced by unmeasured confounding variables, such as maternal comorbidities and socioeconomic factors, which could affect maternal and neonatal outcomes. Another important limitation of this study is the absence of a control group, such as women with fibroids undergoing CS without myomectomy. This limitation restricts our ability to draw strong causal inferences regarding the effect of CM on maternal and neonatal outcomes. Future studies employing prospective cohort or randomized controlled designs with appropriate comparison groups are recommended to address this gap and provide more robust evidence. Finally, unmeasured confounders such as differences in surgical technique, operator experience, anesthetic management, and perioperative care protocols may have influenced the outcomes. Due to the retrospective design and limited sample size, we were unable to adjust for these variables. Future studies should incorporate multivariable regression models or stratified analyses to better account for these potential confounding factors. Moreover, future studies should address these limitations by employing prospective designs, larger sample sizes, and multi-center recruitment strategies to enhance the robustness and generalizability of the findings.

This study highlighted that intramural and single fibroids are the most common types of UFs. The prevalence of blood transfusion and PPH was observed, along with notable rates of NICU hospitalization and growth restriction. Although the type and number of UFs were not significantly associated with PPH, larger UF size was associated with an increased need for blood transfusions. These findings emphasize the importance of thorough risk assessment and NICU preparedness for women with larger UFs. Although we found a statistically significant association between fibroid size > 10 cm and the need for blood transfusion (P = 0.04), this finding was based on only 8 cases in the large-fibroid subgroup. Therefore, the observed association should be interpreted with caution, as the small subgroup size may limit the reliability and generalizability of this result. Larger multicenter studies with a comparison group are recommended to assess the impact of CM on later clinical complications.

5.1. Conclusions

The results of this study indicate that the incidence of unfavorable maternal and neonatal outcomes following CM is considerable, necessitating careful management and the implementation of effective therapeutic strategies to mitigate such complications.

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Footnotes

Authors' Contribution: M. B. supervised the entire research process, designed the study, formulated the research plan, analyzed and interpreted the data, and drafted the initial manuscript. N. S. assisted with study design, contributed to data collection, and critically reviewed the manuscript for scientific content. Z. J. collaborated in data collection, performed statistical analysis, and helped prepare the initial draft. H. M. was responsible for data collection, drafting the initial manuscript, and managing correspondence.

Conflict of Interests Statement: The authors declare no conflict of interests.

Data Availability: The dataset is available on request from the corresponding author.

Ethical Approval: Ethical approval for the study was obtained from the Ethics Committee of Jundishapur University of Medical Sciences (IR.AJUMS.HGOLESTAN.REC.1403.119).

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