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Outcomes of cesarean myomectomy in Singleton compared with twin pregnancies: a 10-year retrospective cohort study

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Abstract

Background To evaluate and compare the pregnancy outcomes after cesarean myomectomy in singleton and twin pregnancies.

Methods We retrospectively reviewed 100 pregnant women diagnosed with myoma who underwent cesarean myomectomy at Chungnam National University Hospital between January 2012 and July 2022. Of them, 77 were singleton pregnancies and 23 were twin pregnancies. Maternal characteristics, largest myoma size, number of myomas, and surgical outcomes were compared between two groups. Myomas were further categorized based on their size; large myomas were defined as lesions measuring ≥ 5 cm in diameter. Maternal characteristics, preoperative and postoperative hemoglobin levels, operative time, and length of hospital stay were compared between the two subgroups. Continuous variables were compared using the Mann–Whitney U test, and categorical variables were assessed using the chi-square test.

Results No significant differences were observed in the maternal characteristics, largest myoma size, number of myomas, or surgical outcomes between singleton and twin pregnancies. However, subgroup analysis based on the largest myoma size (≥ 5 vs. <5 cm) revealed significant differences in operative time (95.5 vs. 122.0 min, $p < 0.001$) and the need for transfusion (15.6% vs. 36.1%, $p = 0.026$). Otherwise, no significant differences were noted in the preoperative and postoperative hemoglobin levels or the need for massive transfusion ($p > 0.999$). No patient required interventions, such as the insertion of an intrauterine Foley balloon, uterine artery embolization, or hysterectomy.

Conclusions Cesarean myomectomy is safe and effective in both singleton and twin pregnancies, even in patients with large myomas.

Keywords Cesarean myomectomy, Cesarean section, Myoma, Twin pregnancy

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Background

Leiomyomas are the most common benign uterine neoplasms, with a prevalence of 20% and higher incidence in women of advanced maternal age [1, 2]. With the rising trend in delayed childbearing in women, the incidence of pregnancies complicated by uterine fibroids has increased [3]. Additionally, since the rate of cesarean deliveries is rising, the number of myomas cases encountered by surgeons has escalated [4]. Uterine leiomyomas complicate pregnancy by increasing the risk of miscarriage, second-trimester loss, preterm birth, fetal malpresentation, and cesarean delivery [5]. Moreover, approximately 25% of women diagnosed with myomas experience symptoms requiring medical or surgical treatment. Myomas can increase in size and undergo sarcomatous changes, even after menopause [6]. Despite the growing prevalence of myomas among pregnant women, no specific indications for cesarean myomectomy exist and its utility remains controversial [7].

Historically, performing myomectomy during cesarean delivery has been discouraged owing to the risks of severe bleeding and the potential need for subsequent hysterectomy. It is commonly recommended to schedule myomectomy for a separate surgical session, ideally deferring it until 3–6 months after delivery. This delay allows for uterine involution, myoma shrinkage, and reduction in both operative time and blood loss [8].

Contemporary practices among gynecologists favor the concurrent removal of myomas during cesarean delivery. This shift is justified by evidence suggesting a minimal increase in operative time, few to no complications, avoidance of a second surgery, and reduced surgical costs associated with myoma treatment [9, 10]. Recent meta-analyses have suggested that cesarean myomectomy is associated with clinically insignificant increases in operative time, blood loss, transfusion rate and hospital stay, particularly in cases involving multiple and large-sized myomas [11, 12]. Cesarean myomectomy may be safe and feasible in selected patients with myomas, irrespective of size and location [12]. Furthermore, cesarean myomectomy should be preferred over cesarean section alone, particularly when performed by experienced surgeons using appropriate hemostatic techniques in tertiary care centers [11]. Performing cesarean myomectomy may alleviate patient symptoms and reduce the need for repetitive surgical interventions, leading to a surge in the popularity of this procedure [13].

Numerous studies conducted worldwide have investigated cesarean myomectomy and reported on its safety outcomes. Most studies have focused on comparing the surgical outcomes of cesarean myomectomies based on factors such as myoma size, location, and number [1, 2, 4, 9, 11–13]. However, these studies have excluded outcomes related to twin pregnancies. As the incidence of twin pregnancies has been rapidly increasing in recent decades owing to the continued advancement in assisted reproductive technology techniques [14], studies investigating cesarean myomectomy in twin pregnancies are required. Although studies on twin pregnancies and cesarean myomectomy are limited, one study reported that the presence of myomas or a history of myomectomy in twin pregnancies is not associated with adverse pregnancy outcomes or obstetric complications [15]. Furthermore, another study concluded that intramural myoma removal is safe and feasible during cesarean section for twin pregnancies when performed by experienced obstetricians [16]. However, the proportion of multiple pregnancies has exceeded 3% owing to the increasing use of assisted reproductive technology [17, 18]. Therefore, this study aimed to compare the surgical outcomes of cesarean myomectomies between singleton and twin pregnancies.

Methods

Patients and procedures

All patients diagnosed with leiomyoma during pregnancy and scheduled to undergo cesarean section for maternal or fetal indications were counseled preoperatively regarding the possibility of undergoing cesarean myomectomy. This procedure was offered to all eligible women and performed for those who provided consent.

In this retrospective cohort study, we analyzed the data of 100 women who underwent cesarean myomectomy at Chungnam National University Hospital between January 2012 and July 2022. The inclusion criterion was all patients who underwent cesarean myomectomy, as documented in the medical records of our hospital over a 10-year period. The exclusion criteria were patients with underlying conditions unrelated to surgery or pregnancy as well as those who experienced complications. The study protocol was approved by the Institutional Review Board of Chungnam National University Hospital (CNUH 2023-06-061). The need to obtain informed consent from the study participants was waived owing to the retrospective nature of this study.

For this study, data on maternal characteristics, including the patient's age, parity, medical history, largest myoma size, total number of myomas, and surgical outcomes, were obtained from the electronic medical records. Myomas were classified according to size, where lesions ≥ 5 cm in diameter were categorized as large, which are associated with a higher risk of postpartum bleeding, and blood transfusion, compared with small or no myomas [2, 19]. We compared maternal characteristics, preoperative and postoperative hemoglobin levels, operative duration, and length of hospital stay between the singleton and twin pregnancy groups. Preoperative hemoglobin levels were assessed within a period ranging from 3 months before delivery to 1 h before the operation, depending on the urgency of the case. Postoperative hemoglobin levels were measured on the second day after delivery. The decision to perform transfusion was based on two criteria, viz. the postoperative hemoglobin level dropped by ≥ 5 g/dL relative to the preoperative level and when the estimated blood loss exceeded 1,000 mL. In accordance with our hospital policy, preoperative blood tests are performed prior to anesthesia. These tests may be conducted immediately before emergency cesarean section, while for elective surgeries, they are often performed more than a week prior to delivery. Typically, postoperative hemoglobin values were measured on postoperative day 2. However, when necessary, we also perform arterial blood gas analysis during surgery or hemoglobin measurements on the day of surgery or postoperative day 1. For the purposes of this study, the postoperative hemoglobin values included in the analysis represent the earliest hemoglobin measurement obtained following the completion of the cesarean section. Any analysis of the relationship between blood loss and postoperative hemoglobin levels must account for blood loss occurring both during and after the cesarean section. Massive transfusion was defined as the administration of ≥ 10 units of red blood cells within 24 h, which approximates the total blood volume of an average adult patient [20]. The size and count of the myomas were determined after extraction. Vasoconstrictor agents and barbed sutures were used at the surgeon's discretion. The duration of the operation was calculated by the anesthesiologist as the time from anesthesia induction to the patient's exit from the operating room. The length of hospital stay was recorded as the period between the day of surgery and the day of discharge. These standardized data collection procedures were designed to ensure consistency and facilitate accurate comparisons between women with singleton and twin pregnancies undergoing cesarean myomectomy.

Statistical analyses

Continuous variables were analyzed using the Mann–Whitney U test, while categorical variables were assessed using the chi-square test. Fisher's exact test was used for cases where the frequency was less than 5 or the sample size of any variable exceeded 20% of the total sample size. Using the analysis of covariance in R version 4.4.1 (R Foundation for Statistical Computing, Vienna, Austria), the effect of singleton pregnancy versus twin pregnancies on the surgical outcomes was analyzed, after adjusting for five confounding factors. The surgical outcome measures included operative time, postoperative fever, estimated blood loss, need for massive transfusion, and length of hospital stay. The analysis was adjusted for confounding factors such as maternal age, parity, presence of gestational hypertension, presence of placenta previa or placenta accreta spectrum, and emergency surgery status. A post-hoc power analysis was conducted using the "pwr" package in R. The effect size obtained from ANCOVA was converted to Cohen's f^2 and used to estimate statistical power. Statistical significance was set at $p < 0.05$. All other statistical analyses were conducted using SPSS version 26 (IBM SPSS Inc., Armonk, NY, USA) and R version 4.4.1.

Results

Overall, 100 women underwent cesarean myomectomy during the study period. Among them, 77 women had singleton pregnancies and 23 had twin pregnancies. Table 1 shows the demographic characteristics and surgical outcomes of the study population. Patient characteristics, including parity, gestational age, emergency operation, number of myomas, weight of the largest myoma, and surgical outcomes including operative time, and estimated blood loss, did not differ significantly between the singleton and twin groups. No patient required re-laparotomy or uterine embolization.

Patients were categorized into two groups based on the size of the largest myoma: those with myomas < 5 cm ($n = 53$) and those with myomas ≥ 5 cm ($n = 47$) (Table 2). No significant differences were noted between the groups in terms of gestational age at the time of surgery, emergency surgery, or transfusion. However, a significant difference was observed in the operative time between myomas measuring < 5 cm and those measuring ≥ 5 cm. Additionally, estimated blood loss and hospital stay were higher in patients with myomas ≥ 5 cm than in those with myomas < 5 cm (Table 2). The analysis revealed that the 95% confidence interval for operative time in the singleton group was [102.86, 126.10], while that for the twin group was [89.21, 106.69]. Similarly, the 95% confidence interval for estimated blood loss in the singleton group was [1,000.25, 1,085.92] versus [929.48, 1,018.64] for the twin group.

Analysis of covariance (ANCOVA) was conducted to identify factors independently associated with operation time (Optime), and the results are presented in Table 3. Among the variables analyzed, surgical type (ST), maternal age, and the presence of gestational hypertension (GHTN) were significantly associated with operation time ($p = 0.0331$, $p = 0.0455$, and $p = 0.0261$, respectively). These variables each demonstrated a moderate effect size (partial $\eta^2 \approx 0.05$). In contrast, primiparity, presence of placenta previa with accreta spectrum (PPAS), and emergency surgery (Em) were not significantly associated with operation time ($p > 0.05$). Post hoc power analysis revealed moderate statistical power for the significant variables, while the non-significant variables showed insufficient power.

Table 1 Comparison of clinical characteristics between the Singleton and twin groups

	Singleton group (*n* = 77)	Twin group (*n* = 23)	*p*-value
Age (years)	35 (28–45)	36 (30–42)	0.167
Primipara	70 (90.9)	15 (65.2)	0.006
Gestational hypertension	4 (5.2)	1 (4.3)	> 0.999
Placenta previa or accreta spectrum	9 (11.7)	0 (0)	0.113
Emergency operation	27 (35.1)	11 (47.8)	0.330
Gestational age at delivery (weeks)	37.9 (16.9–40.6)	35.9 (25.1–38.0)	< 0.001
… Preterm birth (< 37 weeks)	25 (32.5)	18 (78.3)	< 0.001
Hb before delivery	12.4 (7.4–14.7)	11.8 (7.7–14.7)	0.131
Hb after delivery	10.3 (7.6–13.5)	10.5 (7.7–12.8)	0.260
Largest myoma size	4.0 (1.0–15.0)	4.5 (1.0–10.0)	0.499
…Largest size ≥ 5 cm	36 (46.8)	11 (47.8)	> 0.999
Myoma number	2 (1–10)	2 (1–8)	0.809
…Myoma number ≥ 3	18 (23.4)	3 (13.0)	0.388
Myoma type[a]			
…Subserosal	20/39 (51.3)	9/14 (64.3)	0.535
…Intramural	10/39 (25.6)	4/14 (28.6)	> 0.999
…Submucosal	0/39 (0)	1/14 (7.1)	0.264
…Multiple	8/39 (20.5)	2/14 (14.3)	> 0.999
Myoma location			
…Anterior wall	53 (68.8)	12 (52.2)	0.142
…Posterior wall	7 (9.1)	5 (21.7)	0.140
…Multiple	17 (22.1)	6 (26.1)	0.688
Highest myoma weight (g)	45 (4–1104)	83 (14–425)	0.367
…Highest myoma weight ≥ 80 g	21/55 (38.2)	9/17 (52.9)	0.399
Vasopressin use	22 (28.6)	1 (4.3)	0.021
Barbed suture	18/74 (24.3)	2 (8.7)	0.143
Operative time (min)	105 (64–165)	97 (65–136)	0.071
Post-operative fever	37.8 (37.1–39.7)	37.7 (37.0–38.5)	0.767
Estimated blood loss	1,000 (500–2,000)	1,000 (700–1,700)	0.550
Transfusion	15 (19.5)	8 (34.8)	0.159
… pRBC units	0 (0–16)	1 (0–8)	0.300
… massive transfusion ≥ 10 units	2 (2.6)	0 (0)	> 0.999
Length of hospital stay (days)	4 (3–8)	4 (3–5)	0.777

Hb, hemoglobin; pRBC, packed red blood cell

Values are expressed as the median or percentage (n/N)

[a] Data on myoma type were available for only 53 of 100 women, as the surgical records did not document myoma type prior to the adoption of the FIGO classification system. Consequently, information on myoma type could not be recorded for the remaining 47 women

Table 2 Comparison of the clinical characteristics according to the largest Myoma size

	Biggest size < 5 cm (*n* = 53)	Biggest size ≥ 5 cm (*n* = 47)	*p*-value
Age (years)	35 (28–45)	35 (30–44)	0.251
Primipara	45 (84.9)	40 (85.1)	> 0.999
Gestational hypertension	3 (5.7)	2 (4.3)	> 0.999
Placenta previa or accreta spectrum	8 (15.1)	1 (2.1)	0.034
Emergency operation	20 (37.7)	18 (38.3)	> 0.999
Twin pregnancy	12 (22.6)	11 (23.4)	> 0.999
Gestational age at delivery (weeks)	37.3 (16.9–40.4)	37.6 (25.1–40.6)	0.407
… Preterm birth (< 37 weeks)	25 (47.2)	18 (38.3)	0.422
Hb before delivery	12.3 (7.4–14.7)	12.5 (7.7–14.7)	0.583
Hb after delivery	10.5 (7.6–13.5)	10.2 (7.8–12.8)	0.397
Myoma number	1 (1–4)	2 (1–10)	0.004
…Myoma number ≥ 3	5 (9.4)	16 (34.0)	0.003
Myoma type[a]			
…Subserosal	22/31 (71.0)	7/22 (31.8)	0.005
…Intramural	8/31 (25.8)	6/22 (27.3)	0.905
…Submucosal	1/31 (3.2)	0/22 (0)	> 0.999
…Multiple	2/31 (6.5)	8/22 (36.4)	0.011
Myoma location			
…Anterior wall	36 (67.9)	29 (61.7)	0.515
…Posterior wall	9 (17.0)	3 (6.4)	0.130
…Multiple	8 (15.1)	15 (31.9)	0.046
Highest myoma weight (g)	18 (4–93)	158 (12–1104)	< 0.001
…Highest myoma weight ≥ 80 g	1/30 (3.3)	29/42 (69.0)	< 0.001
Vasopressin use	4 (7.5)	19 (40.4)	< 0.001
Barbed suture	5/50 (10.0)	15 (31.9)	0.011
Operative time (min)	94 (64–152)	112 (71–165)	< 0.001
Post-operative fever	37.7 (37.0–38.7)	37.9 (37.2–39.7)	0.008
Estimated blood loss	1,000 (500–2,000)	1,200 (500–2,000)	0.022
Transfusion	10 (18.9)	13 (27.7)	0.346
… pRBC units	0 (0–8)	0 (0–16)	0.119
… Massive transfusion ≥ 10 units	0 (0)	1 (2.1)	> 0.999
Length of hospital stay (days)	4 (3–7)	4 (4–8)	0.016

Hb, hemoglobin; pRBC, packed red blood cell

Values are expressed as the median or percentage (n/N)

[a] Data on myoma type were available for only 53 of 100 women, as the surgical records did not document myoma type prior to the adoption of the FIGO classification system. Consequently, information on myoma type could not be recorded for the remaining 47 women

Table 4 presents the outcomes of subsequent pregnancies and deliveries for the eight patients following cesarean myomectomy. Two of these eight patients subsequently experienced preterm births before 34 weeks of gestation, and delivery was performed via cesarean section. The remaining six patients delivered after 37 weeks, one of whom underwent two cesarean sections. Additionally, two of these patients were found to have myomas during a subsequent cesarean section.

Table 3 Results of the analysis of covariance (ANCOVA) for operative time

Source	Degree of freedom	Sum of squares	Partial η^2*	F	*p*-value	Post-hoc power
Singleton/Twin	1	2,501	0.05	4.679	0.0331**	0.5999
Age (years)	1	2,198	0.04	4.111	0.0455**	0.5036
Primipara	1	831	0.02	1.555	0.2156	0.2807
Gestational hypertension	1	2,734	0.05	5.114	0.0261**	0.5999
Placenta previa or accreta spectrum	1	10	0.000207	0.019	0.8899	0.0522
Emergency operation	1	187	0.00375	0.350	0.555	0.0910
Residuals	93	49,712				

The dependent variable was operative time

*Partial η^2 represents the effect size, indicating the relative effect of each independent variable on the dependent variable in the ANCOVA results. The "effect size" package in R was used for this analysis

**Statistical significance is indicated at the 0.05 alpha level

Table 4 Outcomes of seven patients with subsequent pregnancy and delivery outcomes following Cesarean myomectomy

Case No	Gestational age (weeks)		Largest myoma (cm)	Number of myomas	Use of vasopressin, barbed sutures	Subsequent pregnancy myoma	Remarks
	Cesarean myomectomy	Delivery after cesarean myomectomy					
1	39.9	38.3	3	2	x/x	X	
2	39.6	38.3	4	3	x/x	X	
3	36.3	37.9	6	2	x/x	O	Endometriosis
4	40.4	39.3	2	1	x/x	X	
5	37.4	30.1	6	2	x/x	O	The first pregnancy was a twin pregnancy
6	38.7	33.4	5	4	x/x	X	In a subsequent pregnancy, intra uterine fetal death occurred, followed by a vaginal birth after cesarean section
7	28.1	37.4	3	1	x/x	x	

Discussion

In this study, we demonstrated consistent surgical outcomes between cesarean myomectomies performed in women with singleton and twin pregnancies. Although patients with large myomas (≥5 cm) had longer operative times and greater blood loss compared with patients with smaller myomas, myoma size did not affect hemoglobin levels or the need for massive transfusions. Therefore, in cases of twin pregnancies where the mother had symptomatic myomas prior to pregnancy and the delivery mode was cesarean section, our findings suggest outcomes similar to those observed in singleton pregnancies. Additionally, previous studies demonstrating the safety of cesarean myomectomy in singleton pregnancies further support these results [11, 12]. We believe that the clinical implication of our study is the ability to provide this information during preoperative counseling and decision-making discussions with patients, offering reassurance based on evidence.

Maternal volume and uterine blood flow are higher in twin pregnancies than in singleton pregnancies to support the uterine, placental, and fetal tissues [21]. A twin pregnancy leads to maternal hemodynamic changes, such as a 20% increase in cardiac output and 1–20% increase in plasma volume, compared with a singleton pregnancy. These changes lead to an increase in potential pregnancy complications, such as anemia, postpartum hemorrhage, gestational hypertension, and preeclampsia [22].

The uterine arteries of uteri with fibroids have increased blood flow, a lower resistance index, and a lower pulsatile index than those of uteri without fibroids. Myomas display ongoing blood flow during both systole and diastole and have a higher flow rate than that of the main uterine arteries, indicating a relentless vascular demand [21].

Performing cesarean delivery for a twin pregnancy along with myomectomy, both of which carry a high bleeding potential, may result in increased estimated blood loss, higher transfusion rate, and consequently, longer duration of hospitalization. However, we found no significant difference in these parameters between singleton and twin cesarean myomectomies.

The positive correlation between uterine blood flow rate and myoma size has been well-established [23]. This relationship also extends to cases of cesarean myomectomy. Numerous studies have reported the surgical outcomes of cesarean myomectomy in singleton pregnancies based on the size of the myoma and the location, type, and number of myomas involved. For example, Dedes et al. reported that a myoma measuring > 5 cm in diameter is a risk factor for increased blood loss [13]. Lee et al.

reported that larger and heavier myomas are associated with the postoperative outcomes, whereas the number or type of myoma is not [24]. Several studies have reported various cut-off standards for myoma size, such as 5, 8, and 10 cm, for the comparison of surgical outcomes [25–27]. For instance, Umezurike et al. reported that multiple myomas measuring > 10 cm are significantly associated with the need for blood transfusion and longer duration of surgery [25]. Although the results pertaining to the size of myomas remain consistent across various studies, opinions regarding the number, location, and type of myomas are equivocal. Lee et al. reported that the number or type of myoma is not associated with the postoperative outcomes [24]. Another study demonstrated that the location and type of myoma have a minimal impact on blood loss or postpartum hemorrhage [26]. Kwon et al. reported that large size and lower segmental position of leiomyomas are significant risk factors for intraoperative hemorrhage during cesarean myomectomy [27]. Song et al. suggested that intramural myomas present in the fundus, myomas located proximal to the fallopian tubes, and myomas located in the cornu are not good candidates for removal during cesarean delivery and may affect subsequent fertility [4]. In our study, a cut-off of 5 cm for myoma size was used in the subgroup analysis, as larger myomas are associated with a higher risk of postpartum bleeding, and need for blood transfusion compared to smaller or absent myomas [2, 19]. Our findings showed that although the size of the myoma did not affect the need for transfusion, the estimated blood loss and length of hospital stay differed significantly according to myoma size. Specifically, the group with larger myomas experienced significantly higher estimated blood loss, longer operative time, and extended hospital stay compared to the group with smaller myomas. Given the significant differences in operative time and estimated blood loss, it is essential to prepare for potential transfusion and other related measures when planning surgery for myomas larger than 5 cm. Additionally, in cases involving larger myomas, myomectomy should be avoided unless absolutely necessary, particularly in situations involving emergency surgery or when the patient's condition warrants a more conservative approach.

Transfusion is necessary in cases of massive hemorrhage that can lead to postpartum anemia (hemoglobin level, 4.8–7.9 g/dL) [28]. Therefore, large myomas could increase perioperative hemorrhage, but not to the extent of causing postpartum anemia requiring transfusion.

Pregnancy after laparotomy myomectomy may increase the risk of intrauterine adhesions, miscarriage, preterm birth, abnormal placentation, cesarean section, and uterine rupture [30]. These potential complications should also be considered during pregnancy after cesarean myomectomy. Patients 3 and 5, who had the largest myomas measuring 6 cm, subsequently delivered at 37.9 and 30.1 weeks, respectively, without complications. Although further case studies are required, these cases provide evidence of safe pregnancies and deliveries subsequent to cesarian myomectomy.

Uterine contractility plays a pivotal role in preventing massive perioperative and postpartum hemorrhage. Myocyte contractility is enhanced by prostaglandins, myocyte-to-myocyte connectivity, and intracellular contractile mechanisms [30]. However, the presence of myomas may worsen uterine contraction and increase bleeding by interfering with myocyte-to-myocyte connectivity. Additionally, the extraction of myomas may introduce another source of bleeding. However, leveraging contractibility for compression at the myomectomy site may mitigate bleeding.

The limitations of our study include its retrospective design, which inherently carries the risk of selection bias and limits the ability to establish causal relationships. Additionally, the relatively small sample size for twin pregnancies reduces the study's statistical power, making it difficult to detect subtle differences or generalize the findings to a broader population. A post-hoc power analysis could help confirm whether the study was powered sufficiently to detect meaningful differences in the twin pregnancy subgroup. All the post-hoc power was below the threshold of 0.8. This suggests a limited ability to detect statistically significant difference due to the small sample size. Our findings offer preliminary insights that warrant further investigation with a larger cohort. This limitation also affects the robustness of the subgroup analyses. Although multiple comparisons were performed, no formal statistical correction was applied, increasing the risk of Type I errors. While the findings suggest that cesarean myomectomy is generally safe in both singleton and twin pregnancies, some borderline p-values may be false positives due to the lack of correction. Future studies should incorporate statistical methods such as Bonferroni correction or false discovery rate control to enhance the reliability of the results. Applying these corrections to larger datasets will provide more definitive conclusions regarding surgical outcomes. Moreover, the impact of missing data on the study results was not assessed. Future research should include sensitivity analyses to evaluate the robustness of the conclusions. Another significant limitation is the lack of long-term follow-up data, particularly regarding the outcomes of subsequent pregnancies. Only a small number of patients were monitored through future pregnancies, which precluded a comprehensive evaluation of the effect of cesarean myomectomy on reproductive outcomes and maternal health over time. Although neonatal outcomes did not significantly differ between singleton and twin pregnancies, further clarification of neonatal parameters strengthens clinical interpretation. Specifically, cases requiring forceps delivery in twin pregnancies warrant additional analysis. In this study, no significant differences in neonatal intensive care unit admission rates or Apgar scores were observed; however, detailed subgroup data on neonatal morbidity could provide more in-depth insights. Future studies should analyze specific neonatal outcomes, particularly in cases with prolonged operative times or higher estimated blood loss. Furthermore, the study was conducted at a tertiary-level university hospital equipped with specialized expertise and resources, which may not be representative of outcomes in lower-resource settings or smaller healthcare facilities lacking similar levels of expertise. This limits the external validity of our findings and raises questions about the feasibility and safety of cesarean myomectomy in less-equipped environments. Obstetrician expertise and resource availability are of paramount importance in cesarean myomectomy, particularly in cases of twin pregnancies and large myomas (≥ 5 cm). While this study provides important insights, its retrospective, single-center design limits its generalizability. External validation through prospective, multicenter studies is necessary to confirm the reproducibility of these results across different populations and healthcare settings. Conducting larger-scale research will be crucial to establishing best practices for cesarean myomectomy in twin pregnancies, particularly concerning maternal hemodynamics and surgical safety. Despite these limitations, this study contributes valuable insights by demonstrating that the safety of cesarean myomectomy in twin pregnancies is comparable to that in singleton pregnancies. This finding underscores the potential of cesarean myomectomy as a viable therapeutic option in twin pregnancies. The absence of significant differences in outcomes between singleton and twin pregnancies is clinically meaningful. Therefore, providing this information to patients during preoperative counseling should be considered. Nevertheless, future research should aim to address these limitations by conducting well-designed prospective studies to clearly delineate the indications for cesarean myomectomy and to assess its long-term outcomes. While this study provides important insights, prospective, multicenter studies are needed to validate these findings in diverse healthcare settings, examine the long-term outcomes of cesarean myomectomy, and establish robust evidence for broader clinical application. Although mini-incision techniques and refined suturing methods may provide aesthetic advantages, this study lacks direct patient-reported outcomes on scarring and postoperative discomfort. Future research should incorporate patient satisfaction surveys and longitudinal follow-ups assessing scar healing and quality-of-life metrics to validate these proposed benefits. Additionally, a more detailed description of surgical techniques, including suture methods, uterotonic use, and intraoperative hemostatic measures, would enhance reproducibility for future studies. By integrating these measures, clinicians can make more patient-centered decisions regarding surgical approaches to cesarean myomectomy. Clinicians should carefully consider patient selection criteria, including myoma size, patient health status, and surgical environment, when planning cesarean myomectomy. Additionally, preoperative preparation, such as ensuring the availability of blood products and experienced surgical teams, is essential to optimize patient outcomes and minimize risks. Such studies could provide more robust evidence to support the safety and efficacy of this surgical approach, particularly in diverse healthcare settings.

Conclusion

Our findings suggest that cesarean myomectomy can be performed safely in carefully selected twin pregnancies with experienced surgical teams. However, larger, multicenter studies are required to confirm the results. Notably, cesarean myomectomy for larger myomas (≥ 5 cm) resulted in longer operative times and greater blood loss compared to cases of smaller myomas, though a larger lesion size did not increase the need for massive transfusions. These results suggest that cesarean myomectomy is a viable option even for patients with large myomas, provided that appropriate preoperative planning and surgical expertise are available. While this study provides important insights, external validation through prospective, multicenter studies is necessary to confirm the generalizability of findings and establish best practices for cesarean myomectomy in twin pregnancies. Future research should also assess patient-reported outcomes on aesthetic and functional recovery to better understand the long-term impact of cesarean myomectomy.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12893-025-02924-7.

Supplementary Material 1

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Author contributions

HN: Conceptualization, Data curation, Manuscript writing; KNL: Conceptualization, Data curation, Formal analysis, Manuscript writing, Review & editing; YK: Methodology, Data curation; MP: Data curation; BYK: Data curation; SYS: Formal analysis, Validation; HJY: Validation, Review & editing; YBK: Methodology, Formal analysis, Validation, Review & editing; ML: Methodology, Formal analysis, Validation, Review & editing; GWL: Formal analysis, Validation, Review & editing; BHK: Conceptualization, Data curation, Investigation, Project development, Formal analysis, Manuscript writing, Review & editing;

All authors contributed to editorial changes in the manuscript. All authors approved the final manuscript.

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Data availability
The data presented in this study are available from the corresponding author upon request. The data are not publicly available due to patients' privacy.

Declarations

Ethics approval and consent to participate
This study was approved by the Institutional Review Board of Chungnam National University Hospital (IRB file number CNUH 2023-06-061) and was conducted in accordance with the principles of the Declaration of Helsinki. As this study involved the use of existing data or documents involving human subjects, in accordance with Article 13, Paragraph 3 of the Enforcement Rule of the Bioethics and Safety Act of the Republic of Korea, the requirement to obtain informed consent was waived by the Institutional Review Board of Chungnam National University Hospital due to the retrospective nature of the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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