The Trend in Cesarean Myomectomies and The Risk of Obstetrical Complications in Korea

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Research Article

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Abstract

Background

To evaluate the pregnancy outcomes and the risk of adverse obstetrical outcomes from cesarean myomectomy (CM) compared to cesarean section (CS)-only and to investigate the trend of surgeons in choosing CM.

Methods

A retrospective cohort study was done of all patients who underwent CS that was complicated with leiomyoma at two university hospitals from January 2010 to May 2020. All patients were categorized into the CM group or the CS-only group. We analyzed the demographic factors, obstetric factors, surgical outcomes, and possible risk factors for adverse outcomes between the two groups.

Results

A total of 438 women in the CS-only group and 341 women in the CM group were included. Women who underwent CS-only had significantly more history of a previous myomectomy and multiple leiomyomas compared to women who underwent CM. The gestational days at delivery and the pregnancy complications were significantly higher in the CS group. The mean size of the leiomyomas was larger in the CM group than in the CS only group (5.8 ± 3.2 cm vs 5.2 ± 3.1 cm, $P = 0.005$). Operation time and history of previous CS and preterm labor were higher in the CM group. It seems that preterm labor and abnormal presentation were relatively higher in the CM group than in the CS group due to the presence of leiomyoma. There were no significant differences in the pre and postoperative hemoglobin levels. The size of the leiomyoma (odds ratio [OR] = 1.162; 95% confidence interval [CI]: 1.07 – 1.25; $P < 0.001$) and operation time > 60 minutes (OR = 2.461; 95% CI: 1.45 – 4.15) were significant independent predictors of adverse outcomes after CM.

Conclusions

Cesarean myomectomy is a reliable and safe approach to prevent the need for another operation for remnant leiomyoma. In this study, surgeons seemed to perform CM when uterine leiomyomas were large, the subserosal type, or few in number. Standardized treatment guidelines for myomectomy during cesarean section in pregnant women with uterine fibroids should be established.

Background

Uterine leiomyomas are the most common benign tumor of female reproductive organs, with a prevalence of 20 – 25% [1]. In South Korea, the number of women who visited medical clinics due to

uterine leiomyomas increased from 340,191 in 2016 to 514,260 in 2020 [2]. The prevalence of leiomyoma during pregnancy has been reported to be 2–5% according to several studies [3–5]. Most leiomyomas are asymptomatic during pregnancy. Abdominal pain, pelvic pressure, and vaginal bleeding may occur in symptomatic pregnant women. Various obstetric complications such as preterm delivery, miscarriage, intrauterine growth retardation (IUGR), and failure of vaginal delivery may also occur in pregnant women with leiomyomas [3].

Leiomyoma encountered during a cesarean section poses a therapeutic dilemma. Myomectomy is a safe surgical option in women who desire pregnancy. Although uterine rupture related to myomectomy is extremely rare, the relationship between myomectomy in pregnancy and outcomes are very important in the management of pregnant women by obstetricians.

Issues regarding myomectomy during a cesarean section remain controversial. Generally, cesarean myomectomy (CM) has been discouraged because of the risk of postpartum complications such as hemorrhage, fever, and il [6]. However, when myomectomy is done concurrently with a cesarean section (CS), the burden of an additional surgery under general anesthesia is reduced. In recent decades, increasing studies have shown the safety and feasibility of CM [7, 8].

The objective of our study was to evaluate the outcomes of CM versus CS alone in women with uterine leiomyomas and evaluate the risk factors for adverse outcomes in women undergoing CM and analyze the reason for choosing CM by surgeons.

Methods

A retrospective cohort study was conducted on all cesarean deliveries that were complicated with leiomyoma at two university hospitals from January 2010 to May 2020. This study obtained ethical approval from the Institutional Review Board of the Catholic University of Korea for the use of anonymized patient data for medical research (XC20WIDI0093). Data were collected from our electronic health record database and the data used in our research acquired administrative permissions. The study was conducted in accord with the guidelines of the Declaration of Helsinki, and the rights of all participants were protected. The study included women who were diagnosed with leiomyoma detected by antenatal ultrasound or with a history of a previous myomectomy (Fig. 1).

The maternal demographic characteristics included maternal age, body mass index (BMI), parity, gestational days at delivery, multiple pregnancies, fetal presentation, and neonatal birth weight, Apgar score of the neonates, fetal presentation, IUGR, and assisted reproduction techniques. The leiomyoma characteristics were evaluated and included the history of a previous uterine myomectomy and preterm labor. The leiomyomas were categorized by size, type, and number. The size of the leiomyomas was obtained from the pathology report. If there was no pathology report, the size or type of leiomyoma was obtained from the operative notes or antenatal ultrasound.

We compared the outcomes of women who underwent CM to women who had a CS only without myomectomy. The measured outcome parameters included operation time, emergency operation, hemoglobin (Hgb) changes between preoperative and postoperative values, transfusion after surgery, and intraoperative and postoperative complications such as postpartum hemorrhage, intrauterine balloon tamponade insertion, and hysterectomy.

The possible risk factors for adverse outcomes for women with CM were analyzed by multivariate regression analysis. The evaluated factors were related to the location of the leiomyoma, the number of leiomyomas, the size of the leiomyoma, neonatal birth weight, placenta problems, preeclampsia, and operation time > 60 minutes.

Statistical analysis

All statistical analyses were conducted using SAS Version 9.4 (SAS Institute, Cary, NC, USA). The continuous data are presented as mean ± standard deviation and the categorical data as number and percentage. P-values are calculated using the Chi-squared test or Fisher's exact test for categorical variables and the t-test or Wilcoxon rank-sum test for continuous variables. A P-value below 0.05 was considered statistically significant. To assess the independent predictors of adverse outcomes of CM, we calculated the odds ratios (ORs) and 95% confidence intervals (CIs) using logistic regression models.

Results

From January 2010 to May 2020, 779 patients who underwent CS and were either diagnosed with leiomyoma (n = 548) or had a history of previous myomectomy (n = 231) were included. The average age of the patients in the CS only group was 34.8 ± 3.6 years and 34.8 ± 3.7 years in the CM group. There were 438 women in the CS-alone group and 341 women in the CM group (Table 1).

Table 1
Epidemiologic characteristics between CS group and CM group.

	CS group (n=438)	CM group (n=341)	*P* value
Maternal age (years)	34.8±3.6	34.8±3.7	0.918*
Height (cm)	161.1±5.2	161.6±5.2	0.224*
Weight (kg)	68.9±10	69.4±11.1	0.570*
BMI (kg/m^2)	26.3±3.4	26.4±3.8	0.758*
Nulliparous (%)	385 (87.9)	302 (88.6)	0.776
abortion, mean±SD	0.4±0.8	0.4±0.8	0.901
Gestational days at delivery (day)	261.5±20	259.2±21.7	0.021
singlet/twin			0.142
Single (%)	420 (95.9)	319 (93.6)	
Twin (%)	18 (4.1)	22 (6.5)	
Birth weight of baby (g)	2891.7±685.8	2818.4±734.4	0.101
Apgar score at 5 minute <7 (%)	82 (18.7)	81 (23.8)	0.087
Presentation of fetus			0.056
Cephalic (%)	374 (85.8)	281 (82.4)	
Abnormal presentation (%)	62(14.25)	60 (17.6%)	
IUGR of baby (%)	38 (8.7)	36 (10.6)	0.374
Operation time (minute)	44.5±18.2	52.5±23.8	<0.001
Emergency operation (%)	133 (30.4)	110 (32.3)	0.572

Values are numbers(percentages) or means(SD) for categorical variables.

P values are calculated using Chi-square test or Fisher's exact test for categorical variables and t-test* or wilcoxon rank sum test for continuous variables

CS cesarean section, *CM* cesarean myomectomy, *BMI* body mass index, *IUGR* intrauterine growth retardation

The indications for CS included previous myomectomy (n=209, 26.8%), fetopelvic disproportion (n=189, 24.3%), fetal distress (n= 77, 9.9%), abnormal fetal presentation (breech, transverse position, n = 77, 9.9%), pathological placenta presentation (placenta previa, low-lying placenta, placental abruption)(n =

58, 7.4%), known leiomyoma (n = 63, 8.1%), history of a previous cesarean section (n = 38, 4.9%), IUGR, twins, preeclampsia, and preterm labor.

Table 1 shows the demographic characteristics of the study population. There were differences in the number of gestational days at delivery (261.5 ± 20 days (CS only group) vs 259.2 ± 21.7 days (CM group; $P = 0.021$) and the operation time (44.5 ± 18.2 (CS only group) vs 52.5 ± 23.8 minutes (CM group); $P < 0.001$) between the two groups. Although no statistically significant differences were detected between the groups in fetal presentation, the rate of abnormal presentations was slightly higher in the CM group (17.6% vs 14.25%; $P = 0.056$). There were no significant differences in maternal age, maternal BMI, parity, number of fetuses, or emergency operations. Also, no significant differences were detected in terms of the Apgar scores of the neonates.

The characteristics related to uterine leiomyoma and operative outcomes are shown in Table 2. A lower percentage of patients in the CM group underwent a previous myomectomy (8.5% vs 46.1%; $P < 0.001$), whereas there was a higher percentage of patients with a previous CS or preterm labor in the CM group (7.3% vs 3.4%; $P = 0.014$, 32.3% vs 22.25%; $P = 0.002$). The mean leiomyoma size in the CM group was 5.8 ± 3.2 cm and it was significantly larger than that of the CS only group ($P = 0.005$). Also, the types of leiomyomas were different. Intramural leiomyoma was the most common in the CS only group (59.5%), whereas subserosal leiomyoma was the most common in the CM group (48.7%). More patients in the CM group (90.9%) had fewer than three leiomyomas compared to the CS only group (72.4%) who had a higher percentage of patients with multiple leiomyomas. The complications related to pregnancy, especially placenta problems, preeclampsia, and oligohydramnios, occurred significantly more often in the CS only group (24.4%) than in the CM group (10.6%). Pathologic examination revealed degeneration in 54.6% of the leiomyomas after CM. One patient was later diagnosed with smooth uterine muscle of uncertain malignant potential and total hysterectomy was performed. There were no statistically significant differences in terms of postoperative complications such as postpartum hemorrhage, total hysterectomy, or the insertion of intrauterine balloon tamponade.

Table 2
Characteristics related uterine leiomyoma between CS group and CM group related obstetrical factors

	CS group (n=438)	CM group (n=341)	*P* value
History of previous CS (%)	15 (3.4)	25 (7.3)	0.014
History of previous myomectomy (%)	202 (46.1)	29 (8.5)	<0.001
History of preterm labor (%)	97 (22.2)	110 (32.3)	0.002
Size of leiomyoma(cm), mean±SD	5.2±3.1	5.8±3.2	0.005
Type of leiomyoma (%)			<0.001†
Intramural leiomyoma	122 (59.5)	139 (41.5)	
Subserosal leiomyoma	70 (34.2)	163 (48.7)	
Submucosal leiomyoma	4 (2)	5 (1.5)	
Mix type leiomyoma	7 (3.4)	28 (8.4)	
Cervical leiomyoma	2 (1)	-	
Number of leiomyoma (%)			<0.001
Number <3	165 (72.4)	301 (90.9)	
Multiple	63 (27.6)	30 (9.1)	
IVF (%)	391 (89.3)	294 (86.2)	0.195
Transfusion during CS (%)	22 (5)	16 (4.7)	0.832
Complication of CS (PPH+Backri, adhesion, inverted C/sec, T/H) n(%)	4 (3.2)	7 (2.1)	0.328
Complication of pregnancy (Placenta problem(low lying, pl.previa, pl.abruptio, pla.accreta),preeclampsia, oligohydramnios (%)	107 (24.4)	36 (10.6)	<0.001

Values are numbers(percentages) and means (standard deviation) for categorical variables.

P values are calculated using Chi-square test or Fisher's exact test† for categorical variables.

CS: cesarean section; CM: cesarean myomectomy; IVF: in vivo fertilization; PPH: postpartum hemorrhage; C/sec: cesarean section; T/H: total hysterectomy

No significant difference between the groups in pre and postoperative hemoglobin levels was observed (Table 3). The initial preoperative Hgb was 12.1 ± 1.3 mg/dL in the CS only group and 12 ± 1.3 mg/dL in the CM group. The postoperative day 1 Hgb in the CS only group was 11 ± 1.4 mg/dL and 10.9 ± 1.5 mg/dL in the CM group.

Table 3
Hematologic change between CS group and CM group

	CS group	**CM group**	***P* value**
Initial preop Hb (mg/dL)	12.1±1.3	12±1.3	0.313*
pod#1Hb (mg/dL)	11±1.4	10.9±1.5	0.761*
pod#3Hb (mg/dL)	10±1.3	9.9±1.4	0.311*
Values are means (standard deviation) for categorical variables.			
P values are calculated using Chi-square test or t-test* or wilcoxon rank sum test for continuous variables.			
CS cesarean section, *CM* cesarean myomectomy			

Multiple logistic regression analysis was performed to identify the risk factors for adverse outcomes after CM such as blood transfusion, a decrease in hemoglobin levels, or other postoperative complications. The size of the leiomyoma (OR = 1.162; 95% CI: 1.07 – 1.25; $P < 0.001$) and operation time > 60 minutes (OR = 2.461; 95% CI: 1.45 – 4.15; $P = 0.001$) were significant independent predictors of adverse outcomes after CM (Table 4).

Table 4
Independent risk factors of adverse outcomes of CM

	OR	95% CI	*P* value
Birth weight of baby	1.000	1.000-1.000	0.432
Size of leiomyoma	1.162	1.077-1.253	<0.001
Number of leiomyoma > 3	2.078	0.950-4.548	0.067
Location of myoma (anterior)	1.228	0.745-2.023	0.42
Location of myoma (posterior)	0.666	0.314-1.414	0.29
placenta problem (low lying, pl.previa, pl.abruptio, pl.accreta)	0.241	0.030-1.929	0.18
preeclampsia	0.891	0.273-2.910	0.848
Operation time>60min	2.461	1.458-4.154	0.001
Outcome: Transfusion or complication of CS or change of hematologic result(decrease of Hgb>3mg/dL)			
Odds ratios were calculated by using logistic regression.			
OR odd ratio, *CI* confidence interval			

Discussion

This study to evaluate the factors that determine complications during pregnancy associated with uterine leiomyoma provided important information for managing women's health. The incidence of uterine leiomyoma is continuously increasing, uterine surgery using robot including laparoscopic myomectomy has also increased. In particular, when uterine leiomyomas are present in young women of childbearing age or myomectomy has been performed, pregnancy-related problems and various complications may occur. Preterm labor, placental problems, and uterine rupture are particularly serious obstetrical problems, so research on pregnancy, uterine leiomyoma, and myomectomy is very important.

The mean gestational age at delivery was significantly lower in the CM group and this might have been due to the increased contractility of the myometrium with the presence and mass effect of the leiomyoma [9]. For similar reasons, the incidence of preterm labor was increased significantly in the CM group in our study. In addition, although not statistically significant, there was a higher rate of abnormal fetal presentations in the CM group, suggesting that the presence of leiomyomas affected fetal malpresentation [10, 11].

Our data suggested a significant difference (8 min) in the duration of surgery between the groups. In a previous report, the operation time was 4.94 minutes longer in the CM group than the CS-only group,

which was not a significant difference [12]. In another study, the operation time in the CM group was 15 minutes longer than that of the CS-only group and this was a significant result [9].

The history of a previous myomectomy was significantly higher in the CS-only group than in the CM group. This may have been because the patients who underwent a previous myomectomy were likely to have fewer or no leiomyomas, so only a CS was performed. The history of a previous CS was significantly higher in the CM group. The probable reason for this was to prevent additional surgery due to remnant leiomyomas in the future.

Generally, CM has been controversial and is not recommended routinely. This is because CM tends to increase the rate of intraoperative or postoperative hemorrhage, and in the worst case, leads to hysterectomy, which surgeons fear, and pelvic adhesions due to bleeding. A meta-analysis was conducted in 2017 examining 19 studies and comparing a total of 2,301 patients who underwent CM with patients who underwent only CS [13]. This study reported that the group that underwent CM had a greater decrease in Hgb levels and needed more blood transfusions (mean difference in Hgb 0.25 mg/dL, 95% CI: 0.06 – 0.45; risk of transfusion OR: 1.41, 95% CI: 0.96 – 2.07). In contrast, in a retrospective cohort study conducted in 2019, no differences were detected in terms of average Hgb decreases or blood transfusion rates between the patients who underwent CM and the patients who underwent only CS [14]. Similarly, in our study, we did not find any significant differences between the groups in hemoglobin level decreases or blood transfusion rates. In addition, postoperative complications such as the incidence of postpartum hemorrhage, postoperative insertion of intrauterine balloon tamponade, or hysterectomy also showed no significant differences. Therefore, CM is a reliable and safe approach, preventing the need for future operations.

Many factors should be carefully considered before performing CM such as the patient's condition, location of the leiomyoma, emergency status of the surgery, and the surgeon's skill. In particular, the surgeon's skill and preference for CM are likely to play an important role because CM can be associated with operative complications.

Pregnancy-related uterine rupture after myomectomy should be dangerous complication in mother and fetus. Gambacorti et al. reported that labor after myomectomy was associated with a 0.47% risk of uterine rupture [15]. According to a study by Koo et al., uterine rupture during pregnancy occurred in only three (0.6%) cases out of 523 patients who underwent laparoscopic myomectomy [16]. This study concluded that laparoscopic myomectomy is a safe surgical option for women who desire pregnancy. However, studies on the correlation between CM and uterine rupture are very scarce. Additional research and investigation are required for a better understanding of the relationship.

Standardized indications for CM have not yet been defined. As can be derived from our results, the characteristics of leiomyomas in the CM group were mostly subserosal type, singular or fewer than three in number, or large in size. This seems to be a result of surgeons considering the risk-benefits of CM to avoid risk during surgery. According to a study by Zhao et al. [14], the presence of a leiomyoma larger than 5 cm and birth weight of more than 4,000 g were the important risk factors for postpartum

hemorrhage of ≥ 1,000 ml in pregnant women with leiomyomas during CS, whereas the location and type of leiomyoma had little effect. Kwon et al. reported that large size exceeding 8 cm and lower segmental position of the leiomyoma were significant risk factors for intraoperative hemorrhage during CM [17].

Conclusions

CM is a considerable safe approach in pregnant women with leiomyoma. In the present study, the independent risk factors affecting adverse outcomes after CM were the size of the leiomyoma and the duration of surgery. The larger the leiomyoma and the longer the surgery, the higher the risk of adverse outcomes. A prospective study on the effectiveness of CM is needed. It seems that objective data on the surgeon's skill and safety of CM should be accumulated. Therefore, novel guidelines for CM may be developed from future studies.

Abbreviations

BMI
body mass index
CI
confidence interval
CM
cesarean myomectomy
CS
cesarean section
Hgb
Hemoglobin
IUGR
intrauterine growth retardation
OR
odds ratio

Declarations

Ethics approval and consent to participate

This study obtained ethical approval from the Institutional Review Board of the Catholic University of Korea for the use of anonymized patient data for medical research. . The study was conducted in accord with the guidelines of the Declaration of Helsinki, and the rights of all participants were protected. The need for an informed consent was waived by the IRB listed above because this was a retrospective cohort study.

Consent for publication

Not applicable since there are no details, images, or videos relating to an individual person.

Availability of data and materials

All authors had full access to the data and materials. Data is available from the authors upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

MJ designed the study. MJ, JH and IY extracted and analyzed data. KE and JH conducted the literature search. MJ and JH wrote the first draft of the manuscript. IY contributed to the discussion and drafting of the manuscript. All authors reviewed and approved the final version of the manuscript prior to submission.

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Figures

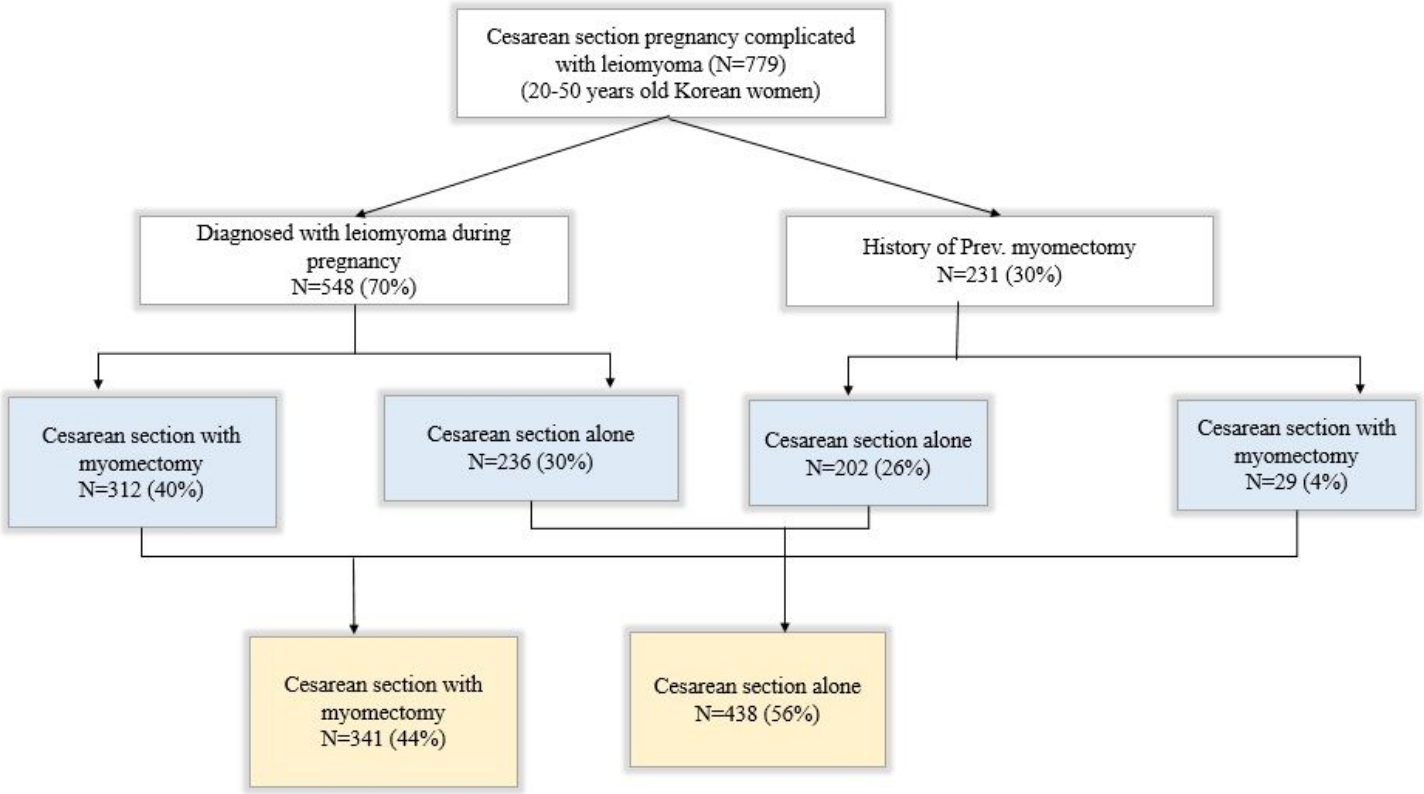

Figure 1

Flow chart for selection of studies.