Clinical results of uterine artery ligation in myomectomy

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AIM: *To compare intraoperative and postoperative clinical results of laparoscopic and laparotomic myomectomy operations in patients with and without bilateral uterine artery ligation.*
MATERIALS AND METHODS: *A retrospective analysis of 217 patients with intramural ≥ 5 cm myoma who underwent laparoscopic (n = 100) or laparatomic (n = 117) myomectomy was conducted. The patients were grouped according to the number of uterine myomas removed (≤2 or > 2). Clinical results of both laparoscopic and laparotomic myomectomy methods and the presence of uterine artery ligation were compared. The recurrence of myomas and pregnancy outcomes were also reported.*
RESULTS: *For patients with > 2 myomas removed without uterine artery ligation, the amount of bleeding, operation time, and hospital stay were significantly lower in patients who underwent laparotomic myomectomy but no significant difference in patients with <2 myomas removed. The rate of hemorrhage was lower in both the laparoscopy and laparotomy uterine artery ligation groups. The recurrence rate of myomas ≤ 3 cm was higher in the laparoscopic myomectomy group (p = .022) and in patients without uterine artery ligation group (p = .028) but recurrence rates for myomas > 3 cm were similar between in groups. Pregnancy occurred in 24 of the 96 patients who underwent uterine artery ligation, and 14 pregnancies resulted in live births.*
CONCLUSION: *Uterine artery ligation might be a suitable addition to myomectomy surgery to reduce intraoperative bleeding and the recurrence of myoma, especially in cases where more than two uterine myomas are removed laparoscopically.*

KEY WORDS: Laparoscopic myomectomy, Laparotomic myomectomy, Myomas, Haemorrhage, Uterine artery ligation

Introduction

Uterine fibroids (also known as leiomyomas or myomas) are the most common type of benign uterine tumors. Myomas are seen in 50-60% of women, and this rate increases to 70% for women in their 50s. Twenty-five percent of myomas cause symptoms requiring treatment [1].

The primary blood supply to the uterus comes from the uterine artery (2 to 6 mm in diameter), which is the branch of the anterior division of the internal iliac artery [2]. While the uterus has various blood supplies, myomas get their vascular supply exclusively from uterine arteries [3]. Since most of the blood enters the uterus through uterine arteries, it has been suggested that transient uterine ischemia occurs following occlusion of the arteries with the help of a catheter or a laparoscopic technique. Shortly after occlusion of the arteries, blood within the myometrium clots, the myometrium becomes hypoxic, and the metabolism shifts from oxidative pathways to anaerobic glycolysis. A few hours after the occlusion, the clot within the myometrium lyses, and the uterus is reperfused through the collateral arteries [4].
The four most common surgical approaches used for myomectomy are hysteroscopic, laparoscopic, robotic,

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and laparotomic myomectomy [5]. Haemorrhage continues to be a risk of any surgical myomectomy approach during the removal of these highly vascular tumors [6].
This study aims to compare intraoperative and postoperative clinical results from patients who underwent laparoscopic and laparotomic myomectomies and patients who received or did not receive additional bilateral uterine artery ligation. The groups will be assessed for differences in terms of recurrence of fibroids and pregnancy outcomes.

Materials and Methods

Ethical Approval

The retrospective study was carried out in the Mugla Sıtkı Koçman University Faculty of Medicine Hospital in Mugla/Turkey. The study was approved by the Clinical Investigations' Ethics Committee of Mugla University/Turkey (Approval no: 13/II. Date: 11/11/2020). The study was conducted in accordance with the provisions of the Declaration of Helsinki. Prior to undergoing surgery, written informed consent was obtained from all the participants.

Study Design

The study investigated 217 patients (laparoscopic n = 100 and laparotomic n = 117) who underwent myomectomy between January 2012 and November 2019, had an intramural myoma of at least 5 cm in preoperative imaging, and whose cytopathological results were reported as myoma. Major indications for myomectomy are symptomatic myomas causing pelvic pain, abnormal uterine bleeding together with symptomatic anaemia, and feelings of pressure in the urinary bladder, bowel, or pelvic vessels. Bilateral uterine artery ligation was performed in patients with myomas close to the vascular region and in patients with multiple myomas. Uterine artery ligation was not performed for patients who wanted to preserve their fertility.
Patients who were under 18 years of age, were pregnant, had a malignant or adenomyoma cytopathological result, and had a laparoscopy first before going for a laparotomy were excluded from the study.
Data were retrieved from electronic medical records and included demographic and clinical patient characteristics, such as age(year), gravida(noun), body mass index (BMI kg/m^2), preoperative hemoglobin (Hb)/hematocrit (Hct), postoperative 24th hour Hb/Hct values, Hb/Htc drop values, blood transfusion, hospitalization length, and operative times were recorded. The results for ultrasounds performed during patient follow-ups at least 12 months after myomectomy were recorded. Additionally, clinical follow-up, postoperative pregnancy information, and pregnancy outcomes were examined by reviewing hospital records and contacting patients by phone.
Patients were divided into four groups: patients undergoing laparoscopic myomectomy with persistent uterine artery ligation and without uterine artery ligation, and patients undergoing laparotomic myomectomy with persistent uterine artery ligation and without uterine artery ligation.
Additionally, we divided the patients into two groups based on whether they had ≤ 2 myomas removed or > 2 myomas removed when reporting our results.
According to the number of uterine myomas removed through myomectomy, the clinical results of laparoscopic and laparotomic myomectomy methods were compared, and the clinical results of patients with and without uterine artery ligation were compared.

Surgical Technique

Surgery was performed under general anaesthesia in the dorsolithotomy, 30° Trendelenburg position. We used four-port laparoscopic techniques, a central 10 mm umbilical trocar for the 0-degree camera, two lateral ports, and a fourth ipsilateral port. A Foley catheter was inserted into the bladder, and the RUMI® II (Cooper Surgical, Trumbull, CT, USA) system uterine retractor with balloon tip was inserted inside the uterine cavity for uterine manipulation and adequate exposure. First, lateral peritoneum dissection was performed in patients undergoing laparoscopic uterine artery ligation. An incision was made between the uterosacral ligament below and the infundibulopelvic ligament above along the ureteric trace on the pelvic sidewall. The internal iliac artery, ureter, and uterine artery were visualized (Fig. 1). The uterine artery was ligated within a 2 cm space after having been split from the internal iliac artery using the vessel sealing system LigaSure Impact ™ (Fig. 2).
In patients with a pouch of Douglas obliteration within the sacrouterine space, the paravesical space was dissected, the ureter and uterine arteries were visualized, and then the bilateral uterine arteries were ligated (Fig. 3).
In the laparotomy group, the uterine arteries were reached by dissecting the peritoneum laterally or by performing paravesical dissection, and they were then tied with no:0 Vicryl (polyglactin 910) absorbable sutures. Uterine arteries were not cut after ligation in either the laparotomy or laparoscopy group. Vasopressin was injected into all intramural myomas before myomectomy. Dissection of the myoma with monopolar diathermy and scissors was then performed. Enucleation was performed along the cleavage plane by separating the myoma from the surrounding myometrium. In laparoscopic patients, the myoma was removed vaginally through the cul-de-sac or umbilical space by breaking it up with scissors within the endobag. Power morcellators were not used in any cases. The myoma capsule was closed using the

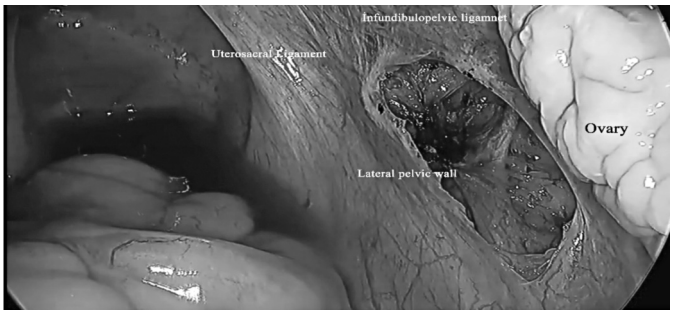

Fig. 1: Lateral pelvic wall anatomy and ligated uterine artery

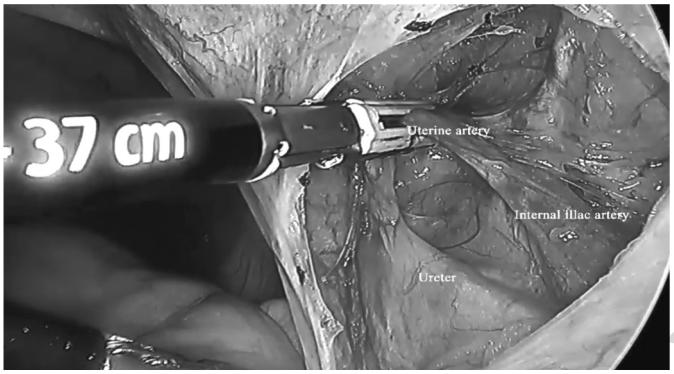

Fig 2: Uterine artery dissection in the lateral pelvic wall

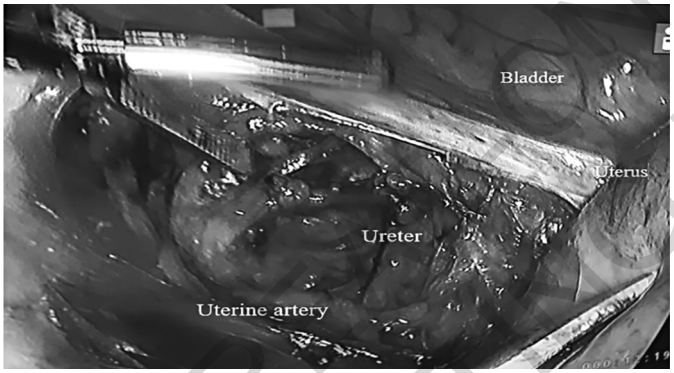

Fig. 3: Uterine artery dissection in the paravesical space

intermittent intracorporeal method with one- or two-fold no:0 Vicryl (polyglactin 910) absorbable sutures, depending on the depth of the myoma in the uterine wall.

Statistical Analysis

The data obtained from the study were analysed using the Statistical Package for Social Science (SPSS) 20.0 for Windows (SPSS Inc., Chicago, Illinois, USA) program. Summary statistics included mean ± standard deviation, median, and (minimum, maximum) and percentage. The distribution of the continuous variables was investigated using the Kolmogorov-Simirnov test, and a homogeneity test was performed. The Student's t-test was used for continuous variables. The Mann-Whitney U-test was used for intergroup comparisons of parameters without normal distribution. The chi-square test was used to compare categorical data. The statistical significance level of the data obtained from the study was interpreted with a p-value, and < 0.05 was considered to be statistically significant.

Results

A total of 217 cases were included in the retrospective study. Laparoscopic myomectomy was performed for 100 patients, and laparotomic myomectomy was performed for 117 patients. Uterine artery ligation was performed in 52 (52%) patients in the laparoscopic myomectomy group and in 44 (37.7%) patients in the laparotomic myomectomy group. The average age, BMI, and gravida of patients who underwent laparoscopic myomectomy was 35.33[27-46], 27.56[19-34], and 2[1-6], respectively. The average age, BMI, and gravida of patients who underwent laparotomic myomectomy was 34.90[30-49], 26.46 [19-36], and 2[1-5], respectively. No statistically significant differences were found in the demographic characteristics of patients who underwent myomectomy.

Postoperative Hb and Hct values were significantly lower in the group of patients who underwent laparoscopic myomectomy than in the laparotomic myomectomy group (7.37±1.11 vs 9.23±1.19, respectively and p=0.026 for Hb values; 23.44±2.24 vs 27.36±2.18, respectively, p=0.035 for Hct values). The Hb and Htc drop values were higher in the group of patients who underwent laparoscopic myomectomy compared to the laparotomic myomectomy group (p=0.015 and p=0.031, respectively). The amount of blood transfusion required and the length of operative time and hospitalization were also significantly higher in the laparascopyc myomectomy group (p = 0.011, p = 0.047, and p = 0.036, respectively) (Table I).

We compared patients who had ≤ 2 myomas removed without laparoscopic uterine artery ligation with those who had ≤ 2 myomas removed without laparotomic uterine artery ligation. No statistically significant differences were found in the amount of haemorrhage, the operative time, or the length of hospitalization between the groups. When we compared patients who had > 2 myomas removed without laparoscopic uterine artery ligation and patients who had > 2 myomas removed without laparotomic uterine artery ligation, the amount of Hb/Hct drop and blood transfused and the length of the operative time and hospitalization was significantly less for patients who underwent laparotomic myomectomy (p = 0.014, p = 0.019, p = .012, p = 0.021, and p = 0.027, respectively) (Table II).

The amount of Hb/Htc drop and blood transfused was less, and the operative time was shorter for patients who

TABLE I - *Clinical and surgical results of cases in laparoscopic and laparotomic myomectomy groups.*

Variables	Laparascopic myomectomy n=100 [a]Mean ± SD, [b]Median[Min-Max]	Laparatomic myomectomy n=117 [a]Mean ± SD, [b]Median[Min-Max]	P
Preop Hb (g/dL)	10.89±1.27	10.64±0.99	[a]0.473
PostopHb(g/dL)	7.37±1.11	9.23±1.19	[a]0.026*
Hb drop, (g/dL)	2.14±1.16	0.97±0.85	[a]0.015*
Preop Htc, %	31.22±3.04	30.27±2.81	[a]0.381
Postop Htc,%	23.44±2.24	27.36±2.18	[a]0.035*
Htc drop, %	6.45±3.23	3.67±1.95	[a]0.031*
Transfusion (Unit)	1[0-5]	0[0-2]	[b]0.011*
Operative time (min)	88[55-115]	79[52-91]	[b]0.047*
LOH (day)	1[1-7]	1[1-5]	[b]0.036*

SD: Standart deviaiton, Preop: Preoperative, Postop: Postoperative, Hg: hemoglobin, Htc: hemotocrit, *Significant at 0.05 level; [a]Independent samples t test; [b]Mann whitney u test.

TABLE II - *Clinical and surgical results for patients without uterine artery ligation where fewer than two and more than two myomas were removed.*

	Uterine Artery Ligation Absent					
	Number of Myoma ≤ 2 [a]Mean ± SD [b]Median[Min-Max]			Number of Myoma > 2 [a]Mean ± SD [b]Median[Min-Max]		
Variables	**L/S n=30 (30%)**	**L/T n=41 (56.1%)**	**p**	**L/S n=18 (18%)**	**L/T n=32 (43.8%)**	**P**
Preop Hb (g/dL)	10.89 ±0.63	11.02 ±0.90	[a]0.245	10.84 ±1.67	10.22 ±1.37	a0.213
Postop Hb (g/dL)	8.88 ±1.20	9.45 ±1.35	[a]0.305	7.02 ±1.34	9.08 ±1.10	a0.022*
Hb drop (g/dL)	0.77±0.96	0.87±1.01	[a]0.076	2.64±0.81	1.23±1.21	a0.014*
Preop Hct (%)	32.53 ±3.49	33.48 ±2.41	[a]0.115	30.92 ±3.31	30.09 ±3.15	a0.391
Postop Hct (%)	27.26 ±3.44	29.50 ±3.06	[a]0.097	21.14 ±3.44	27.77 ±3.59	a0.034
Htc drop (%)	4.72±2.85	4.73±2.1	[a]0.113	7.99±1.25	3.2±2.16	a0.019*
Blood Transfusion (Unit)	0[0-3]	0[0-2]	[b]0.192	1[0-5]	0[0-2]	b0.012*
Operative time (minute)	79[55-87]	61[52-79]	[b]0.215	85[59-115]	66[59-91]	b0.021*
Length of hospitalization (day)	1[1-5]	1[1-5]	[b]0.425	2[2-7]	1[1-5]	b0.027*

SD: Standart deviaiton, Preop: Preoperative, Postop: Postoperative, Hg: hemoglobin, Htc: hemotocrit, *Significant at 0.05 level; [a]Independent samples t test . [b]Mann whitney u test.

underwent myomectomy with laparoscopic uterine artery ligation than for patients who underwent myomectomy without laparoscopic uterine artery ligation (p= .026, p= .023, p=.027, and p=.013, respectively). The amount of Hb/Htc drop and blood transfusion were lower in patients who underwent myomectomy with laparotomic uterine artery ligation than in patients who underwent myomectomy without laparotomic uterine artery ligation (p = .023, p = .021, and p =.037, respectively). The operative times and length of hospitalization were similar (Table III).

To determine the effect of uterine artery ligation on clinical outcomes in laparoscopic myomectomy cases, we compared patients who had ≤ 2 myomas removed through laparoscopic uterine artery ligation and patients who had ≤ 2 myomas removed through laparoscopic without uterine artery ligation. No statistically significant difference was determined in the amount of haemorrhage, the operative time, or the length of hospitalization between groups with and without uterine artery ligation in patients with laparoscopic removal of ≤ 2 myomas. We determined that the amount of Hb/Hct drop and blood transfused and the operative time was less in patients with uterine artery ligation as compared to patients without uterine artery ligation in cases of laparoscopic removal of > 2 myomas. Hospitalization length was similar between the two groups (p = 0.031, p = 0.027, p = 0.032, and p = 0.022, respectively) (Table IV).

In 183 of 217 patients who underwent myomectomy, ultrasound and examination findings from at least 12 months after surgery were obtained. When a myoma > 3 cm was found on a transvaginal ultrasound performed in at least the 12th postoperative month, it was determined to be a recurrence. There was no statistically significant difference in terms of whether a laparoscopic or laparatomic myomectomy had been performed on the rate of reocurrence of myomas > 3 cm. Similarly, there was no statistical difference in the reoccurrence rate of > 3 cm myomas between the groups who did and did not have uterine artery ligation. In asymptomatic ≤ 3 cm myomas determined to be a recurrence, we found

TABLE III - *Clinical and surgical results for myomectomy patients with uterine artery ligation and those without uterine artery ligation.*

	Laparoscopic n=100 Uterine Artery Ligation [a]Mean ± SD, [b]Median[Min-Max]			Laparotomic n=117 Uterine Artery Ligation [a]Mean ± SD, [b]Median[Min-Max]		
Variables	**Absentn=48**	**Present n=52**	**p**	**Absent n=73**	**Present n=44**	**p**
Preop Hb (g/dL)	10.34 ±0.93	10.29 ±1.00	[a]0.117	10.41 ±1.19	10.92 ±1.14	[a]0.172
Postop Hb (g/dL)	7.02 ±0.83	9.05 ±1.15	[a]0.032*	8.02 ±0.84	9.48 ±1.10	[a]0.041*
Hb drop (g/dL)	3.16±0.86	1.09±1.11	[a]0.026*	2.67±1.05	0.71±0.47	[a]0.023*
Preop Hct (%)	30.63 ±3.27	30.73 ±2.73	[a]0.267	33.92 ±3.31	31.09 ±3.15	[a]0.297
Postop Hct (%)	23.29 ±1.96	27.50 ±2.06	[a]0.031*	25.21 ±4.44	28.77 ±2.59	[a]0.035*
Htc drop (%)	6.72±2.25	2.73±1.91	[a]0.023*	7.61±2.25	3.1±2.66	[a]0.021*
Blood Transfusion (Unit)	2[0-6]	0[0-2]	[b]0.027*	1[0-5]	0[0-3]	[b]0.037*
Operative time (minute)	97.71 ±9.60	61.50 ±5.53	[b]0.013*	63.02 ±6.35	60.14 ±3.01	[b]0.314
Length of hospitalization (day)	1[1-7]	1[1-5]	[b]0.437	1[1-5]	1[1-5]	[b]0.551

Preop: Preoperative, Postop: Postoperative, Hg: hemoglobin, Htc: hemotocrit, *Significant at 0.05 level; [a]Independent samples t test . [b]Mann whitney u test.

TABLE IV. *Clinical results of laparoscopic myomectomy cases with and without uterine artery ligation with ≤ 2 and > 2 myomas removed.*

	Laparoscopic Myomectomy					
	Number of Myoma ≤ 2n=49 (49%) L/S Uterine Artery Ligation [a]Mean ± SD [b]Median[Min-Max]			Number of Myoma > 2n=51 (51%) L/S Uterine Artery Ligation [a]Mean ± SD [b]Median[Min-Max]		
Variables	**Present n=19 (38.8%)**	**Absent n=30(61.2%)**	**p**	**Present n=33 (64.7%)**	**Absent n=18 (25.3%)**	**p**
Preop Hb (g/dL)	11.09 ±0.73	10.89 ±0.63	[a]0.405	10.70 ±0.87	10.84 ±1.67	[a]0.526
Postop Hb (g/dL)	9.78 ±1.29	8.88 ±1.20	[a]0.084	9.312±1.39	7.12 ±1.34	[a]0.018
Hg drop (g/dL)	0.96±1.17	0.79±0.98	[a]0.084	2.79±1.13	1.21±1.14	[a]0.031*
Preop Hct (%)	33.53 ±2.69	32.53 ±2.91	[a]0.377	31.83 ±3.57	30.92 ±3.31	[a]0.105
Postop Hct (%)	29.02 ±4.54	27.26 ±3.44	[a]0.025	28.31 ±4.04	21.21 ±3.44	[a]0.035*
Htc drop (%)	3.75±1.85	3.83±2.1	[a]0.211	7.94±3.31	4.81±3.57	[a]0.027*
Blood Transfusion (Unit)	0[0-2]	0[0-3]	[b]0.248	0[0-2]	1[0-5]	[b]0.032*
Operative time (minute)	67[59-94]	81 [73-129]	[b]0.057	79[64-105]	95[83-141]	[b]0.022*
Length of hospitalization (day)	1[1-5]	1[1-5]	[b]0.421	1[1-3]	1[1-5]	[b]0.031*

SD: Standart deviaiton, Preop: Preoperative, Postop: Postoperative, Hg: hemoglobin, Htc: hemotocrit, * Significant at 0.05 level; [a]Independent samples t test . [b]Mann whitney u test.

that the rate of recurrence was higher in patients who underwent laparoscopic myomectomy than in those who underwent laparatomic myomectomy (15 [15.7%], 4 [4.5%], p=.022). We determined that the rate of ≤ 3 cm myoma recurrence was higher in patients who underwent myomectomy without uterine artery ligation than in those who underwent myomectomy with uterine artery ligation (16 [15.3%], 3 [3.7%], p = .028).
Pregnancy occurred in 24 of 96 patients who underwent uterine artery ligation because of ineffective birth control methods or because the patients changed their minds and wanted pregnancy. While 5 patients decided to voluntarily terminate the pregnancy, 19 patients decided to continue the pregnancy. Five out of the 19 pregnancies that were continued resulted in miscarriage. Two pregnancies resulted in preterm deliveries at 29 and 31 gestational weeks, respectively. Two patients had caesarean section deliveries between 34 and 37 gestational weeks due to intrauterine growth retardation, and ten patients had caesarean section deliveries between 37 and 39 gestational weeks without any complications.

Discussion

Laparoscopic myomectomy was first reported by Nezhat et al., who used this new technique in 57 operations [7]. Initially, it was postulated that abdominal myomectomy was less traumatic, harboured less risk for intra-postoperative haemorrhage, and caused less morbidity as compared to laparoscopic myomectomy [8-10]. Many studies conducted in the past decade have reported that laparoscopic and robotic myomectomy have more advantages in terms of haemorrhage, complication, length of hospitalization, and cosmetic appearance, but have disadvantages in terms of operative time and cost when com-

pared to abdominal myomectomy [5, 11]. In our study, the amount of haemorrhage, the need for blood transfusion, and the operative time were higher in patients who underwent laparoscopic myomectomy. We found no statistically significant difference between the two methods regarding the length of hospitalization.

In the meta-analysis performed by Chen et al., the authors concluded that despite the increased operative time and cost of the laparoscopic myomectomy method, it was advantageous in terms of the amount of bleeding, length of hospitalization, and postoperative ileus, and it was also more suitable for patients with multiple myomas [12]. In our study, we found no difference between laparoscopic and laparotomic myomectomy methods used for patients having myomas ≤ 2 removed in terms of haemorrhage amounts, length of hospitalization, and operative time. But haemorrhage amount, blood transfusion, operative time, and length of hospitalization were higher in patients having myomas > 2 removed who underwent laparoscopy.

The use of surgical occlusion of the uterine arteries to reduce intraoperative blood loss and myoma recurrence rates in the surgical treatment of symptomatic myomas was described for the first time by Liu et al. in 2001 [13]. Even though the operative time was shorter with this method, clinical results, such as hemorrhage amounts and myomas-related symptoms, were worse in patients with uterine artery ligation or uterine artery embolization who did not undergo myomectomy compared to patients with uterine artery ligation combined with myomectomy [14]. MacKoul et al. reported that when laparoscopic myomectomy was combined with uterine artery ligation, it enabled the removal of numerous myomas by controlling blood loss, which was one of the major difficulties of laparoscopic myomectomy, and by eliminating the need for power morcellation [15]. Cheng et al. stated that there was no difference between the clinical results for patients who underwent uterine artery ligation performed using bipolar coagulation/desiccation, the surgical clips method, and uterine artery embolization [16]. In our study, while the intraoperative and postoperative clinical results for patients who underwent laparoscopic myomectomy for the removal of ≤ 2 myomas with and without uterine artery ligation were similar, the clinical results for patients who underwent laparoscopic myomectomy with the removal of ≥ 2 myomas with uterine artery ligation were better compared to patients without uterine artery ligation.

It is important to note that laparoscopic surgery is more difficult, and the risk for haemorrhage is higher for patients with adenomyosis. Uterine artery ligation is preferable for the removal of masses with difficult dissection criteria and adenomyosis [17].

The conversion rate of laparoscopic myomectomy to laparotomy is based on the skill and experience of the surgeon. The percentage of procedures converted from laparoscopy to laparotomy reported in the literature ranges between 1% and 40% [18]. In our study, conversion from the laparoscopic method not included in the study to the laparotomic method occurred in 3 (2.9%) patients. Uterine artery ligation was performed in none of these patients.

Liu et al. reported that recurrence was higher in patients who underwent laparoscopic myomectomy compared to laparotomic myomectomy. This was attributed to non-removal of myomas due to an inability to palpate non-visible, small-size myomas in deeper parts of the myometrium [19]. According to another perspective, uterine artery ligation limits the growth of myomas and prevents the development of new myomas by resulting in ischemic changes and insufficient blood flow to myoma [20]. In the meta-analysis performed by Sanders et al. reported that a markedly lower myoma recurrence rate in patients who underwent uterine artery occlusion than not performed uterine artery occlusion [21].

In Yang et al.'s [22] meta-analysis of patients who underwent laparoscopic myomectomy with and without uterine artery ligation, the authors evaluated patients with ≥ 3 cm myomas determined to be recurrences and found the recurrence rate to be lower in patients who underwent uterine artery occlusion ($p < 0.02$). In our study, when a myoma ≥ 3 cm was determined to be a recurrence in patients whose ultrasound information at least six months after myomectomy was recorded, we found similar recurrence rates between patients who underwent laparoscopic and those who underwent laparotomic myomectomy. The recurrence rates were also similar between groups that had and did not have uterine artery ligation. The rate of mostly asymptomatic < 3 cm myomas deemed to be a recurrence was lower in patients who underwent laparotomic myomectomy as compared with those who underwent laparoscopic myomectomy and was lower in patients who underwent uterine artery ligation as compared to patients who did not.

Contrary to uterine artery embolization, most studies have suggested that uterine artery occlusion is a selective procedure and does not lead to decreased ovarian reserve [23]. Additionally, many cases of pregnancy that reach term after internal iliac artery ligation and uterine artery ligation have been reported [24]. However, the effects of uterine artery embolization and ligation on fertility and pregnancy have not yet been clarified. The Society of Obstetricians and Gynaecologists of Canada does not recommend uterine artery ligation in patients desiring pregnancy [25]. Nonetheless, many recent studies have reported that performing uterine artery ligation did not negatively affect long-term fertility and pregnancy outcomes [26].

In the meta-analysis conducted by Sander et al., live birth rates were reported to be 27% and 34% in patients who underwent myomectomy with and without uterine artery occlusion, respectively. There was no significant statistical difference between the groups in terms of live birth rates. In our study, uterine artery ligation was not performed for patients desiring pregnancy. Fourteen of the 96

patients who underwent uterine artery ligation had an unplanned pregnancy. Nine patients decided to continue their pregnancy. Seven of the pregnancies resulted in live births. Two of the seven had a preterm delivery. Intrauterine growth restriction was diagnosed in another two patients, and the final three patients delivered at term without complications.
Becoming pregnant and carrying to term is possible after uterine occlusion. However, evidence about whether or not the risks for miscarriage and early delivery increase as a result is insufficient. Therefore, proper counselling about the benefits and risks of pregnancy is necessary before the application of these procedures.

The limitations and strengths of the study

The most obvious weakness of this study is that it used a retrospective design. Another weakness is that we tried to interpret the amount of intraoperative and postoperative bleeding by analysing Hb and Hct values. The main strength of our study is that it made use of a significant number of uterine artery ligation cases, including data on patients' subsequent pregnancy outcomes—an area in which limited data are available in the literature.

Conclusion

While laparotomic myomectomy is a more invasive method than laparoscopic myomectomy, it is easier to learn. Ligation of the uterine artery may be an effective method for reducing the risk of bleeding in operations where large multiple myomas are removed. At the same time, it also seems to be effective in decreasing the chance of myoma recurrence. The effects of uterine artery ligation on pregnancy outcomes have not yet been completely clarified. However, it may be preferable to perform uterine artery ligation rather than risking morbidity due to hysterectomy complications or haemorrhage. Further prospective studies are required to perform myomectomy, which is one of the most frequently performed gynaecological surgeries, with the optimal method.

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Riassunto

Obiettivo: Confrontare i risultati clinici intraoperatori e postoperatori di interventi di miomectomia laparoscopica e laparotomica in pazienti con e senza legatura bilaterale dell'arteria uterina.
Materiali e Metodi: È stata condotta un'analisi retrospettiva di 217 pazienti con mioma intramurale ≥ 5 cm sottoposti a miomectomia laparoscopica (n = 100) o laparatomica (n = 117). I pazienti sono stati raggruppati in base al numero di miomi uterini rimossi (≤2 o> 2). Sono stati confrontati i risultati clinici dei metodi di miomectomia laparoscopica e laparotomica e la presenza di legatura dell'arteria uterina. Sono state anche segnalate la ricorrenza dei miomi e gli esiti della gravidanza.
Risultati: Per i pazienti con> 2 miomi rimossi senza legatura dell'arteria uterina, la quantità di sanguinamento, il tempo operatorio e la degenza ospedaliera erano significativamente inferiori nei pazienti sottoposti a miomectomia laparotomica, ma nessuna differenza significativa nei pazienti con <2 miomi rimossi. Il tasso di emorragia era inferiore sia nei gruppi di legatura dell'arteria uterina laparoscopica che di laparotomia. Il tasso di recidiva di miomi ≤ 3 cm era più alto nel gruppo miomectomia laparoscopica (p = .022) e nei pazienti senza gruppo legatura dell'arteria uterina (p = .028) ma i tassi di recidiva per miomi > 3 cm erano simili tra i gruppi. La gravidanza si è verificata in 24 dei 96 pazienti sottoposti a legatura dell'arteria uterina e 14 gravidanze hanno portato a nati vivi.
Conclusione: La legatura dell'arteria uterina potrebbe essere un'adeguata aggiunta alla chirurgia della miomectomia per ridurre il sanguinamento intraoperatorio e la recidiva del mioma, specialmente nei casi in cui più di due miomi uterini vengono rimossi per via laparoscopica.

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