

Laparoscopic Myomectomy With Lateral Dissection of the Uterine Artery

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ABSTRACT

Background: We assessed the results and impact of lateral uterine artery dissection on clinical outcome following laparoscopic myomectomy.

Methods: We retrospectively analyzed the clinical data for 27 laparoscopic myomectomy cases (Group I) and 54 laparoscopic myomectomy cases combined with lateral uterine artery dissection (Group II) between January 2001 and August 2004 in one center. Only 81 patients who had dominant fibroids between 4 cm and 10 cm in diameter were included in the study. We assessed the clinical outcomes: perioperative blood loss, operating time, hospital stay, complications, hemoglobin decrease, inflammatory response, and tissue markers (C-reactive protein, white blood cells, creatinine kinase) changes.

Results: The mean operating time was 70.37 minutes in group I and 78.61 minutes in group II. The mean length of hospital stay was 2.7 days versus 2.2 days, respectively ($P>0.05$). The difference in intraoperative blood loss was 70.1 mL (147.7 mL vs 77.3 mL, Group I) and 33.9 mL (105 mL vs 71.1 mL, Group II); estimated postoperative blood loss was statistically significant ($P<0.001$, $P<0.05$, respectively). Group 2 demonstrated a less intense stress response in C-reactive protein ($P<0.001$) and white blood cell count ($P<0.05$).

Conclusion: The dissection of the uterine artery in laparoscopic myomectomy is a feasible operative procedure with a low rate of complications. The procedure reduced perioperative blood loss and resulted in significant improvement in fibroid-related symptoms.

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INTRODUCTION

Uterine fibroids are the most common tumor in women during the reproductive years, occurring in an estimated 20% to 50% of women over the age of 30.¹ The long-established and conventional treatment for symptomatic and rapidly enlarging fibroids is a hysterectomy. In cases where it is advisable to preserve the uterus, myomectomy is recommended. Laparoscopic myomectomy (LM) is currently the procedure of choice for the removal of intramural or subserosal fibroids. The procedure is associated with several advantages including a shorter hospital stay, less postoperative pain, and faster recovery, while offering the same results as the conventional myomectomy by laparotomy.² The most serious complication during myomectomy is severe intra- or postoperative bleeding. Several methods to control blood loss are available, including the preoperative use of GnRH agonists,³ injection of diluted vasopressin into the myometrium,⁴ oxytocin administration,⁵ tourniquet, and bilateral uterine ligation.^{6,7}

Recently, some authors reported their experience with laparoscopic uterine artery coagulation, occlusion and dissection for symptomatic fibroids.⁸⁻¹² In addition, intra- and postoperative reduced blood loss after uterine depletion procedures were reported by Liu et al¹³ and Holub et al.¹⁴

The aim of this study was to demonstrate the value of laparoscopic lateral uterine artery dissection (LUAD), coagulation, and transection on clinical outcomes in laparoscopic myomectomy.

METHODS

The retrospective study was carried out in the Department of Obstetrics and Gynecology and Endoscopic Training Centre at the Baby Friendly Hospital in Kladno, Czech Republic. From January 2001 to August 2004, consecutive selected patients requiring laparoscopic myomectomy for symptomatic uterine fibroids were enrolled in this clinical

study. The diagnosis was confirmed by ultrasound or magnetic resonance imaging. The patients with submucosal fibroids and incomplete records were excluded. Only 81 patients with a dominant fibroid between 4 cm and 10 cm were included in the study. The patients were divided into 2 groups after receiving an explanation of the advantages or disadvantage of the planned procedure. Group I (n=27) included the patients who underwent laparoscopic myomectomy alone, and Group II (n=54) included the patients who underwent laparoscopic myomectomy, lateral uterine artery dissection, coagulation and transection. **Table 1** presents the patient characteristics.

The duration of the surgical procedure was calculated from a skin incision to the last skin suture. All operative procedures were performed by one surgery team (ZH, JL). The intraoperative blood loss was measured as the blood volume accumulated in the aspirator during surgery. The postoperative blood loss was approximated from the postoperative fluid collection using a Redon catheter. Febrile morbidity was defined as body temperature of at least 2 consecutive measurements at least 6 hours apart, excluding the first 24 hours after surgery.

Blood samples for hemoglobin and assay of markers of inflammatory response and tissue trauma [C-reactive protein (CRP), creatinine kinase (CK) levels, and white blood cell (WBC) count] were taken preoperatively and postoperatively on the first and third day. Patients were interviewed 3 months after surgery regarding changes in bleeding, pain, and bulk-related symptoms on the scale described by Yen et al.¹⁵

Operative Procedure

Laparoscopy was performed with the patient in the lithotomy position by using videomonitoring equipment. The telescope was inserted subumbilically and one 11-mm port was placed suprapubically and medially. Two 5-mm ports were placed in each of the lower quadrants at the lateral edge of the rectus abdominis muscle.

Laparoscopic Myomectomy

An incision was made through the uterine wall and the pseudocapsule of the fibroid. Traction was applied to the fibroid associated with Harmonic scalpel dissection to cleave the fibroid. After complete fibroid removal using Steiner's electric morcellator (Storz, Tuttlingen, Germany), the edges of the uterine defect were approximated with ultrasonically activated shears (LCS-K5 or LCS-C) (UltraCision, Ethicon EndoSurgery, Johnson & Johnson Ltd, Cincinnati, USA) coagulating the superficial myometrium without suturing. If the defect was deeper or larger than 2 cm, the uterine incision including myometrium and serosa was closed with 1 or 2 layers of interrupted absorbable sutures of 1-0 or 2-0 caliber Vicryl (Polyglactine, Ethicon, Edinburg, Scotland). In cases of fibroids >8 cm, the operative technique of laparoscopic-assisted myomectomy (LAM) was used. This modification of LM was introduced and described in more detail by Nezhat et al.¹⁶ After a final check to control hemostasis, a Redon catheter was left in place for drainage. Prophylaxis consisted of a single dose of ampicillin (2.0 g) and anticoagulant therapy with low molecular-weight heparin.

Table 1.
Patient Characteristics and Main Complaints

| Parameter | Group I (n = 27) | Group II (n = 54) | P Value |
|--------------------------------------|------------------|-------------------|---------|
| Age (year) (range) | 35.0 (25–50) | 38.1 (25–54) | NS |
| Weight (kg) | 77.1 (48–90) | 77.6 (53–98) | NS |
| Previous pelvic surgery (%) | 8 (29.6) | 14 (25.9) | NS |
| Laparoscopic myomectomy (n) | 20 | 42 | NS |
| Laparoscopic-assisted myomectomy (n) | 7 | 12 | NS |
| Symptoms (n) | | | |
| Menorrhagia | 14 | 32 | NS |
| Dysmenorrhea | 6 | 11 | NS |
| Pelvic pain or pressure | 8 | 14 | NS |
| Urinary frequency | 5 | 7 | NS |

Lateral Uterine Artery Dissection

Lateral peritoneum dissection using UltraCision was started. The line of dissection was between the round ligament anteriorly, infundibulopelvic ligament medially and pelvic sidewall laterally. The peritoneum was opened and paravesical and obturator space developed by a blunt dissection. Subsequently, distancing uterine vessels from the ureter with a safe ultrasonic coagulation of uterine artery and cutting just medial to their origin from the hypogastric artery were performed. After the bilateral transection of the uterine artery was performed, the laparoscopic myomectomy using LCS or Harmonic scalpel followed (Figure 1).

Statistical Analysis

Statistical analysis was performed with the Mann-Whitney *U* test in the case of unpaired results. Differences within groups were analyzed with the paired Wilcoxon rank sum test for 2 related samples. Data are presented as mean ± standard deviation and range or as percentages. Statistical significance was defined as $P < 0.05$.

RESULTS

Twenty-seven women were selected for laparoscopic myomectomy alone and 54 for laparoscopic myomectomy and lateral uterine artery dissection. No difference existed between groups with respect to age, weight, previous surgery, or the indications for surgery (Table 1). Myomec-

tomy and lateral uterine artery dissection, coagulation, and transection were performed successfully in all women.

Values related to the number of fibroids, number of enucleated fibroids, largest fibroid diameter, fibroid position, and localization were similar and are shown in Table 2. The number of fibroids of each patient varied from 1 to 4 with a single fibroid of 18 patients (66.6%) in Group I and from 1 to 5 with a single fibroid of 30 patients (55.5%) in Group II.

When comparison of single fibroid blood loss was made between the groups (128.2 mL vs 72.1 mL), a significant difference ($P < 0.001$) was noted. An insignificant difference was found between group I and II for single fibroid at the time of surgery (63.7 min vs 71 min). The size of dominant fibroids ranged from 4 cm to 10 cm. The mean size of the dominant fibroid was 6.0 cm (Group I) and 6.1 cm (Group II).

The most common indication for surgery was menorrhagia, but most patients had more than one indication. In Group I, 24 (88.8%) of 27 patients who underwent only the myomectomy procedure reported that their symptoms were resolved after the operation (Table 3). Menorrhagia improvement rate was 85.7% (12/14) 3 months after surgery. In Group II, 53 (98.1%) of 54 patients who underwent the LM combined procedure reported significant symptom improvement after surgery, and only 1 of 11 patients with dysmenorrhea did not experience complete improvement. The most important finding was that all 32

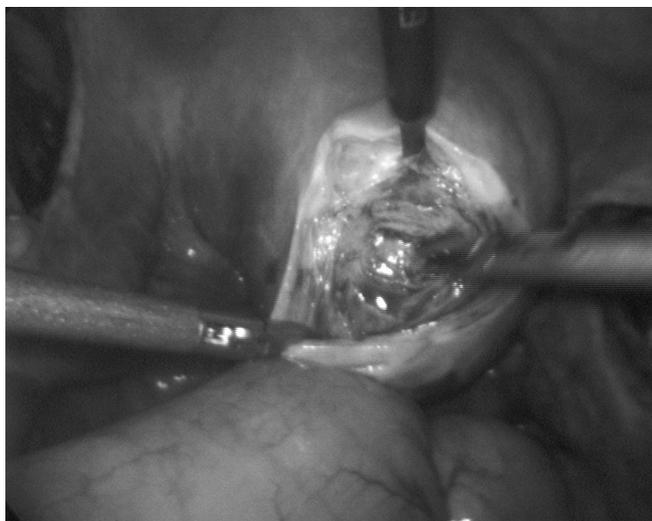


Figure 1. The fundal subserosal fibroid is excised by using a Harmonic scalpel after previous lateral uterine artery dissection. The ischemic margins of the fibroid bed are white.

| Parameter | Group I (n = 27) | Group II (n = 54) | <i>P</i> Value |
|-----------------------------------|---------------------|----------------------|-------------------|
| Number of fibroids | 62 | 141 | NS |
| Diameter of dominant fibroid (cm) | 6.0 | 6.1 | NS |
| Localization of dominant fibroid | | | |
| Intramural | 12 | 26 | NS |
| Subserous | 11 | 24 | NS |
| Pedunculated | 4 | 4 | NS |
| Fibroid position | | | |
| Fundal | 14 | 16 | NS |
| Corpus | 10 | 34 | NS |
| Isthmic | 3 | 4 | NS |

Table 3.
Clinical and Surgical Results

| Parameter | Group I (n = 27) | Group II (n = 54) | P Value† |
|---------------------------------|------------------------|----------------------|-----------------|
| Intraoperative blood loss* (mL) | 147.44±110.59 (10–350) | 77.31±81.23 (10–550) | <i>P</i> <0.001 |
| EPBL*‡ (mL) | 105.0±98.25 (5–350) | 71.1±88.9 (10–500) | <i>P</i> <0.05 |
| Operation duration* (min) | 70.37±27.41 | 78.61±23.05 | NS |
| Hospital stay* (day) | 2.7±0.3 | 2.2±0.2 | NS |
| Symptom resolution (%) | | | |
| Menorrhagia | 85.7 (12/14) | 100 (32/32) | <i>P</i> <0.05 |
| Dysmenorrhea | 83.3 (5/6) | 90.9 (10/11) | NS |
| Pelvic pain or pressure | 100 (8/8) | 100 (14/14) | - |
| Urinary frequency | 100 (5/5) | 100 (7/7) | - |
| Complications (n) | | | |
| Bladder injury | 1 | 0 | NS |
| Febrile morbidity | 1 | 2 | NS |
| Obturator n. irritation | 0 | 1 | NS |

*Values shown as mean ± standard deviation

†NS = *P* > 0.05.

‡EPBL = Estimated Postoperative Blood Loss.

women with menorrhagia (100%) experienced symptom improvement within 3 months after surgical treatment.

The parameter during surgery for laparoscopic myomectomy alone and LM combined with lateral uterine artery dissection for mean operating time (70.37 min vs 78.61 min) was not significantly different (**Table 3**). The average interval between opening bilateral peritoneum and dissecting the uterine artery was 15 minutes (range, 10 to 25).

The mean intraoperative blood loss was 147.4 mL (Group I) versus 77.3 mL (Group II). The difference was statistically significant (*P*<0.001). A significant difference was established within the group in the comparison of hemoglobin basal and hemoglobin after surgery on the first day and on the third day (*P*<0.01). When a comparison was made between the groups, although basal hemoglobin levels were similar, a significant difference occurred after myomectomy on the third day (*P*<0.05) (**Table 4**). A statistically significant difference was found between groups in the mean quantity of drained blood fluid collection (*P*<0.05). The postoperative stay was insignificantly longer in LM alone than in LM combined with another procedure (2.7 days vs 2.2 days). The complication rate was low in both compared groups.

In Group I, 6 (22.2%) of 27 patients wished to achieve

pregnancy within one year after surgery. The number of patients who became pregnant and had live births was 2 (33.3%) in the myomectomy-only group. In Group II, 4 (50%) of 8 patients attempting conception became pregnant and had live births.

DISCUSSION

Myomectomy is the surgical option of choice for women with symptomatic fibroids. The most serious problem during abdominal and laparoscopic myomectomy is severe intraoperative bleeding. It is well known that deep intramural or larger fibroids might represent a contraindication to laparoscopic myomectomy, due to intra- and postoperative bleeding and inadequate closure of the myometrium.^{4,17} Unless the bleeding is controlled, a hysterectomy is required.¹⁸ However, with a view to decreasing intraoperative bleeding during myomectomy, the surgeons recommend closing the uterine blood circulation using a tourniquet or ligation of the ascending uterine branches.^{6,7} Uterine vessels can be compressed laparoscopically or abdominally.^{7,19} Mechanical vascular occlusion of the uterine vessels was done close to the uterus in an identical fashion as in a hysterectomy. Depending on the technique used, coagulation, clipping, or ligation of the ascending branches of the uterine vessels may be technically de-

Table 4.
Results of Hemoglobin and Tissue Markers

| Parameter | Posoperative Day | Group I | Group II | P Value |
|--|------------------|------------|------------|-----------------|
| Hemoglobin basal (g/dL) | 0 | 13.37±1.06 | 13.11±2.15 | NS |
| | 1 | 11.96±1.45 | 12.27±2.1 | NS |
| | 3 | 11.49±1.64 | 12.04±2.09 | <i>P</i> <0.05 |
| C-reactive protein (mg/L) | 0 | 5.63 | 7.75 | NS |
| | 1 | 43.70 | 23.30 | <i>P</i> <0.01 |
| | 3 | 97.00 | 26.70 | <i>P</i> <0.001 |
| Creatinine kinase (μkat/L) | 0 | 1.42 | 1.19 | NS |
| | 1 | 3.18 | 3.60 | NS |
| | 3 | 1.40 | 1.80 | NS |
| White blood cells (10 ⁹ /L) | 0 | 6.22 | 6.55 | NS |
| | 1 | 9.92 | 8.46 | <i>P</i> <0.05 |
| | 3 | 7.40 | 6.19 | NS |

manding, especially in an enlarged uterine fibroid. Recently, laparoscopic bipolar coagulation (LBCUV) and dissection of the uterine artery (LUAD) were considered the treatment of choice for symptomatic women with fibroids.^{9,11} The intraoperative mean blood loss during LUAD was less than 30 mL and ischemic changes of superficial myometrium and fibroids were observed.²⁰

Therefore, we used LUAD during myomectomy when we isolated, coagulated, and dissected the uterine artery close to the origin of the hypogastric artery. Lateral transection of the uterine vessels was successfully used in laparoscopic hysterectomy.²¹

In the present study, a significant statistical difference was detected in measured intraoperative and postoperative blood loss between the 2 compared groups (147.4 mL vs 77.3 mL, *P*<0.001), (105 mL vs 71.1 mL, *P*<0.05), respectively. Also, the difference was significant in hemoglobin decline on the third postoperative day (*P*<0.05).

No significant differences occurred in the duration of surgery and hospital stay between the 2 groups. The mean difference between the 2 studied operative procedures was 8 minutes. The additional procedure (LUAD) took 15 minutes on average to identify and dissect uterine artery. On the other hand, the fibroids and superficial myometrium were found to be more ischemic after the uterine artery dissection. Our study results show that laparoscopic lateral dissection of the uterine artery and myomectomy performed ultrasonically with activated shears and Harmonic scalpel are associated with a low complication rate.

In connection with the difficult dissection of the uterine artery in adhesive retroperitoneal space, signs of irritation and edema of the obturator nerve have appeared postoperatively in one laparoscopically treated woman, which subsided after successful antiinflammatory and electrostimulative convalescent therapy.

Occlusion of the uterine artery effectively treats not only ischemic fibroids and uterus during myomectomy but also treats small symptomatic fibroids growing on the uterus.¹³ For all woman included in our study, all large visible fibroids were removed by surgery while the small concealed fibroids were treated by the uterine depletion procedure, resulting in 100% symptom resolution in menorrhagia compared with 85.7% in the myomectomy-only group.

The effects of different stress responses for different perioperative parameters were compared. CRP and WBC have been shown to correlate with the severity of tissue trauma, and CRP also correlates with blood loss (Table 4). Serum level of creatinine kinase was significantly increased in both groups on the first postoperative day. CK has 3 subtypes of isoenzymes composed to 2 subunits, M (muscle) and B (brain). Isoenzyme MM is typically found in skeletal muscle. In gynecologic surgery, the overall activity of CK may derive from the abdominal muscle wall and from the uterus, which, however, contains almost exclusively isoenzyme BB.²² The statistical difference between groups was insignificant. This may indicate that the local

uterine tissue injury in laparoscopic myomectomy measured by CK is not influenced by LUAD.

Recently, Sapmaz and Celik⁶ compared the effect of the ligation of ascending branches of bilateral uterine artery with the tourniquet method on the perioperative hemorrhage in abdominal myomectomy patients. The authors reported lower intraoperative blood loss (220mL, $P < 0.05$) in women with bilateral ligation of the uterine artery during myomectomy. Postoperative bleeding occurred in 3 cases in the tourniquet group. In abdominal myomectomy cases where a tourniquet was used, the tourniquet was taken out at the end of the operation and blood recirculation in uterine arteries started. However, by the method of uterine artery dissection that we have used, the closure is permanent and thus postoperative bleeding risk is reduced.

The procedure combining uterine depletion using uterine artery ligation and myomectomy has been recently introduced by Liu et al¹³ as a therapeutic alternative to the treatment of fibroids. This study demonstrates the value of uterine depletion before myomectomy for the laparoscopic and abdominal management of patients with fibroids. Authors reported that the procedure reduced blood loss during surgery, resulted in complete resolution of fibroid-related menorrhagia and has the potential to prevent fibroid recurrence.

Our study results are comparable to those of Liu et al¹³ and Dubuisson et al.²³ In contrast to the mentioned studies, smaller sizes of fibroids and less intraoperative blood loss were observed in our patients. On the other hand, we did not perform abdominal myomectomy but only laparoscopic or laparoscopic-assisted myomectomy procedures. This difference in the surgical approach to myomectomy and the technique of lateral uterine artery occlusion may influence the clinical and surgical results.

CONCLUSION

The lateral dissection of the uterine artery in LM by using a Harmonic scalpel and UltraCision is a feasible surgical procedure. Our study demonstrates that laparoscopic myomectomy combined with LUAD is associated with a lesser inflammatory response compared with that in myomectomy alone. Laparoscopic dissection of the uterine had a significant impact on intra- and postoperative bleeding and hemoglobin decline. Combining the uterine artery dissection procedure and myomectomy may be useful for treatment of small fibroids, which have not been primarily removed. Further, long-term randomized prospective

studies are required to establish the role of LUAD in the surgical management of fibroids.

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