A Transient Blocking Uterine Perfusion Procedure to Decrease Operative Blood Loss in Laparoscopic Myomectomy

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Background: To evaluate the feasibility and effectiveness of reversible ligating clips to block uterine arteries and reduce operative blood loss during laparoscopic myomectomy (LM).

Methods: Twenty consecutive women with symptomatic uterine fibroids desiring to preserve the uteri underwent laparoscopic surgery with ligation of the uterine arteries with ligating clips, followed by myomectomy and removal of the clips.

Result: Laparoscopic uterine artery ligation with reversible ligating clips was successfully performed in all patients. The median main fibroid diameter and fibroid weight were 7.3 cm (interquartile range [IQR] 7.0-9.0) and 210 g (IQR 150-295 g), respectively. The median operating time was 120 minutes (IQR 100-148 minutes) and blood loss was 100.0 mL (IQR 56.3-137.5 mL). The median number of fibroids removed was 1 (IQR 1-4.3). The median post-operative hospital stay was 3 days (IQR 2-3 days) and no patient developed complications. Menstrual bleeding problems and bulk-related symptoms were controlled in 90.0% and 100% of women, respectively after 6 months of follow-up. One woman conceived spontaneously 4 months after surgery and delivered a baby girl at 38 weeks gestation via cesarean section.

Conclusions: Blocking uterine perfusion before LM is valuable and feasible for the management of women with symptomatic fibroids. The procedure controlled operative blood loss without affecting the uterine blood supply after surgery.
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Key words: myomectomy, laparoscopy, ligating clip, uterine artery

Myomectomy, as an alternative treatment for symptomatic uterine fibroids, can avoid hysterectomy and preserve fertility. Although laparoscopic technique for subserous and even intramural fibroids have been described, and the efficacy of laparoscopic myomectomy (LM) has been confirmed,[1-5] it is a challenging surgical procedure for gynecologists and is relatively time-consuming, which can result in great blood loss. Methods employed to reduce blood loss during traditional myomectomy include a tourniquet,[6,7] injection of diluted vasopressin into the myometrium,[8] preoperative use of gonadotropin releasing hormone (GnRH) agonist,[9] and bilateral uterine artery ligation.[10]

Bilateral uterine artery ligation either by laparotomy or laparoscopy before myomectomy can decrease operative blood loss,[10-12] however, the complications include thermal damage to the ureter owing to use of bipolar diathermy and potentially impaired fertility. Suture ligation is the standard method of controlling the uterine artery in open surgery; nevertheless, laparoscopically- formed intracorporeal knots are somewhat time-consuming and difficult to master. Extracorporeal knotting is quicker and easier to perform but is not reliable enough.[13] In addition, both types of knots are difficult to release.

Although permanent uterine depletion has the potential to compromise fibroid growth, endometrial microcirculation and fertility capacity might be impaired after this procedure. Therefore, this is a concern when performing uterine artery ligation or embolisation in those who wish to preserve childbearing capacity. The Hem-o-lok clip (Weck Closure Systems, Research Triangle Park, NC, U.S.A.) is made of a nonabsorbable polymer and applied using a 5-mm laparoscopic applier. Misplaced clips can be removed with an endoscopic remover. Herein, we applied this instrument to perform temporary uterine depletion before LM with the aims of controlling intraoperative bleeding with preservation of childbearing capacity.

METHODS

This prospective study consisted of 20 women (age range 26-45 yrs, median 38.0 yrs) with symptomatic uterine fibroids scheduled to undergo LM performed by one of the authors (CJW) at Chang Gung Memorial Hospital. The indications for LM in these patients included menorrhagia, bulk-related symptoms (frequent, or rectosigmoid compression), and infertility. Before the surgery, the risks and benefits of laparoscopic myomectomy were explained, including the potential need to switch to laparotomy during the operation, the risks of intra-operative bleeding, transfusion and adhesions, and alteration of uterine tensile strength and the need for a cesarean section in future deliveries. The potential risks and benefits of temporary uterine artery ligation prior to myomectomy were extensively explained. Written informed consent was obtained from all subjects.

Three patients had menometrorrhagia and underwent diagnostic hysteroscopy to exclude pathologic lesions in the uterine cavity. GnRH agnoist was not administered preoperatively. All women had bowel preparation the morning of surgery. Intravenous cephalosporin prophylaxis was given just before surgery.

Operative procedures

The laparoscopic myomectomy was performed in accordance with the technique described by Wang et al.[5] Briefly, with a laparoscope and video camera in place, the triangle enclosed by the round ligament, external iliac vessels, and infundibulopelvic ligament was opened 2 to 3 cm with unipolar scissors, and the lateral umbilical ligament was identified. Tracing cephalad, the uterine artery could be seen originating from the internal iliac artery crossing over the ureter. After dissecting surrounding areolar tissue, the uterine artery was isolated and ligated with a single Hem-o-lok clip (Fig. 1).

A transverse incision was made on the serosa overlying the largest myoma with a unipolar electrode. A second puncture was then inserted into the myoma so that traction could be applied while a probe was used for blunt dissection in the cleavage plane to leverage the tumor against the uterine wall and pry it out of its bed. Vessels were electrocoagulated by Kleppinger forceps before being dissected. After the removal of the myomas, the uterine surgical defect was closed in layers. Any excessive
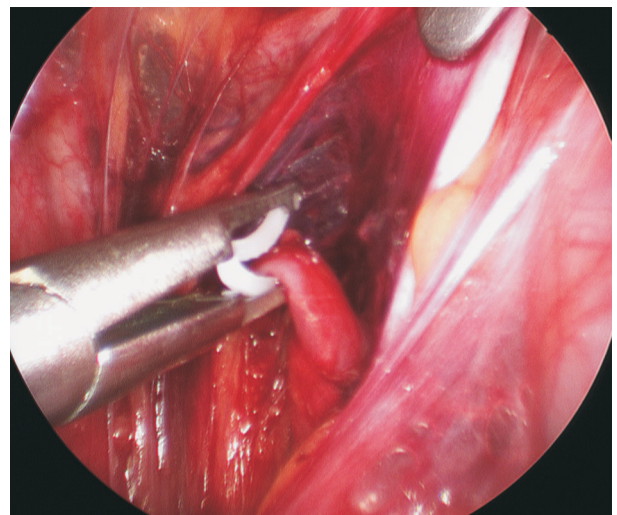

Fig. 1 Uterine vessel identified and ligation by a reversible ligating clip.

myometrium and serosa were trimmed off. A 0 monofilament poliglecaprone 25 suture (Monocryl; Ethicon Inc, Somerville, NJ, U.S.A.) on a large curved needle was used to make a deep, wide (1 cm from the cut edge of the incision) bite. A continuous non-running-lock suture at 1-cm increments was then carried out, with each suture penetrating the full thickness of the myometrium.

Specimens were removed by posterior colpotomy. Medium and large myomas were morcellated with a scalpel or scissors first. After removal of all myomas, the culpotomy incision was closed with 2-0 polyglycolic acid sutures. Pneumoperitoneum was reestablished at this time, and the peritoneal cavity was irrigated and lavaged until fluid ran clear. The Hem-o-lok clips were then removed. All port sites were sutured with 3-0 polyglycolic acid sutures at the level of the fascia to prevent herniation. The skin was approximated by sterile adhesive tape. Total blood loss was estimated from collection in the suction bottles plus the difference in weight between unused and used sponges minus the amount of irrigating solution used.

RESULTS

In the 20 women, 9 main fibroids were located in the anterior wall, 7 in the posterior wall, and 4 in both the anterior and posterior walls. All main tumors were the intramural type. The median diameter of the main fibroid was 7.25 cm [interquartile range (IQR) 7.0-9.0 cm]. The median weight of the fibroids removed was 210 g (IQR 150-295 g). Six women had more than one fibroid and the median number of fibroids removed was 1 (IQR 1-4.3). All fibroids were removed in one procedure. The median operating time and amount of blood loss were 120 minutes (IQR 100-148 min) and 100 mL (IQR 56.3-137.5 mL), respectively. The median post-operative hospital stay was 3 days (IQR 2-3; Table 1). No major complications, such as ureter injuries, bladder injury or bowel injury, occurred, and no patient required laparotomy or blood transfusion during or after surgery.

Histologic examination of the resected tissue showed leiomyomatous tissue in all patients. One specimen had hyaline degeneration. Two patients had adenomyosis concomitantly. No sarcomatous changes were observed. One woman had a perforated

Table 1. Patient Characteristics

Variable	Value
Age (y)	38.0 (32.3-40.0)*
BMI (kg/m^2)	21.0 (20.0-23.3)
Parity, no. (%)	
Nulliparous	9 (45)
Multiparous	11 (55)
Symptoms, no. (%)	
Menorrhagia	10 (50)
Compression	17 (85)
Infertility	2 (10)
Wall where main fibroids originated, no. (%)	
Anterior	9 (45)
Posterior	7 (35)
Both	4 (20)
Diameter of main fibroid (cm)	7.3 (7.0-9.0)
Fibroid weight (g)	210 (150-295)
Fibroids removed, no.	1.0 (1.0-4.3)
Operating time (min)	120 (100-148)
Blood loss (mL)	100 (56.3-137.5)
Postoperative stay (days)	3 (2-3)

Abbreviations: BMI: body mass index; *: Values are median (interquartile range).

uterine cavity during surgery and a control hysteroscopy performed 4 weeks postoperatively showed no intrauterine adhesions. Menstrual bleeding problems and bulk-related symptoms were controlled in 9 (90.0%) and 17 (100%) women after 6 months of follow-up, respectively. One woman conceived spontaneously 4 months after surgery. The pregnancy was uneventful, and a low transverse cesarean section was performed at 38 weeks. During the cesarean section, it was noted that the omentum adhered loosely to the site of the myomectomy.

DISCUSSION

Excision of fibroids from the uterine corpus, repair of the uterine incision, control of operative blood loss, and removal of large fibroids are major concerns during LM. Control of operative blood loss might be the most critical consideration. Most intraoperative conversions to laparotomy reported in the literature have been because of intraoperative bleed-

ing.[14] Our prior study also confirmed the most serious complication during LM for large fibroids is severe intra-operative hemorrhage and subsequent blood transfusion.[5]

More women with symptomatic uterine fibroids request laparoscopic management with preservation of the uterus. As the size of fibroids increases, it is necessary to develop a management strategy to circumvent surgical problems related to large fibroids. Pretreatment with GnRH agonist can shrink the fibroids and theoretically simplify myomectomy. However, GnRH agonist therapy may alter the myoma-myometrium interface and induce the disappearance of small fibroids; therefore, it may increase the difficulty of fibroid enucleation and the incidence of recurrent fibroids.[15-17] In addition, GnRH agonist therapy provides only a slight benefit in reducing blood loss.[9] Therefore, it is suggested that pretreatment with GnRH agonist be used in selected LM cases.

Vasopressin is a posterior pituitary hormone with a strong vasoconstrictive effect on smooth muscle. Local administration of vasopressin to the uterus is helpful in controlling bleeding during myomectomy.[8,18] Possible drawbacks include bleeding from the needle puncture sites, which often persists throughout the procedure, requiring later electrosurgical coagulation, and delayed bleeding in the myometrium.[19] If unexpected bleeding occurs, the goal of controlling operative bleeding will not be achieved.

Placing a tourniquet around the lower uterus to stop the blood flow to the uterus can facilitate a myomectimy. It is, however, difficult to perform during a laparoscopy because there are no appropriate instruments. Modified procedures have been introduced for this purpose in laparoscopic surgery.[11,12] They can effectively reduce blood loss during LM and have the potential to prevent fibroid recurrence. Nevertheless, suture and hemoclip ligations are permanent methods and might not be suitable for women who want to retain their childbearing capacity. Hem-o-lok clips can stop uterine blood flow at the uterine artery level and reperfusion occurs after removal. With the aid of this instrument, blood loss can be controlled and childbearing preserved when performing a uterine depletion procedure followed by a myomectomy.

Criticisms of the transient blocking uterine perfusion procedure are that the average 2 hour occlusion time might induce irreversible damage in the uterine myometrium and cause embolic events and pulmonary emboli after release of the clips. Traditional uterine tourniquets usually require only an hour.[20] A review of the literature on ischemic, necrotic twisted adnexa showed no reports of embolic phenomena after detorsion.[21,22] In addition, the uterus has a dual extrinsic blood supply. The primary supply is from the uterine arteries, and the secondary supply is from branches of the ovarian arteries. If the uterine arteries are occluded, the myometrium is supplied by the ovarian arteries through the communicating arteries. If the ovarian arteries remain intact during the operation, damage to the myometrium theoretically would not occur, regardless of the length of time the uterine arteries are occluded.

Blood loss in myomectomy mainly occurs during removal of fibroids and uterine repair. Therefore, it is necessary to quickly suture the wound to avoid a massive hemorrhage. It is not easy to perform a perfect uterine repair with minimal blood loss within a short time in laparoscopic surgery unless surgeons are proficient in laparoscopy. A uterine depletion procedure can provide a relatively bloodless situation and let the surgeon perform laparoscopic suturing with ease.

In conclusion, LM offers several benefits to the patient. It is still a challenging technical procedure and might be associated with high surgical morbidity and incidence of blood transfusion. Surgical strategies are needed to overcome these problems in LM. A transient blocking uterine perfusion procedure can control operative blood loss in LM and preserve the childbearing capacity of the patient, However, larger studies to investigate the feasibility and effectiveness of this procedure are crucial before definite conclusions can be drawn.

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以暫時性子宮血流阻斷術來減少
腹腔鏡子宮肌瘤切除術的手術失血量

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背 景： 本篇文章之目的乃在評估可逆式子宮動脈阻斷法運用於腹腔鏡子宮肌瘤切除術，以減少手術失血量的臨床可行性及有效性。

方 法： 20 名具有臨床症狀之子宮肌瘤患者，在接受腹腔鏡子宮肌瘤切除手術時，以血管夾先將子宮動脈夾住再進行手術，手術後再將血管夾移除恢復子宮動脈血流。

結 果： 子宮動脈阻斷術成功施行於所有病患。切除子宮肌瘤的大小及重量中位數為 7.3 公分 (四分位數區間 7.0-9.0) 和 210 公克 (四分位數區間 150-295)，手術時間中位數為 120 分鐘 (四分位數區間 100-148)，手術失血量中位數為 100.0 毫升 (四分位數區間 56.3-137.5)，切除子宮肌瘤總數中位數為 1 顆 (四分位數區間 1-4.3)，手術後住院天數中位數為 3 天 (四分位數區間 2-3)，無手術合併症發生。手術後 90.0% 患者月經量得以改善，100% 患者骨盆腔壓迫症狀得到解除。1 名婦女手術後第四個月自然受孕並於懷孕 38 週以剖腹產生出 1 名女嬰。

結 論： 子宮動脈阻斷術有運用於腹腔鏡子宮肌瘤切除手術的價值及實用性，可逆式子宮動脈阻斷術可控制手術失血量且不損傷子宮血液循環。
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關鍵詞： 子宮肌瘤切除手術，腹腔鏡手術，血管夾，子宮動脈