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Original Article

Single port access laparoscopic subtotal hysterectomy using contained manual morcellation: Experience from a tertiary referral center in Taiwan

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ABSTRACT

Objective: To describe the surgical outcomes of single port access laparoscopic subtotal hysterectomy (LSH) using in-bag manual morcellation and evaluate the feasibility of this procedure.

Materials and Methods: Thirty patients with symptomatic leiomyoma or adenomyosis were enrolled. A 2-cm transverse incision was made at the umbilicus and single port apparatus (LagiPort) was applied. After dissection of vesicouterine peritoneum from the uterus, the uterine ligaments and vessels were secured and transected by Gyrus PK cutting forceps. Cervical amputation at the level of internal os was made by SupraLoop (Karl Storz). The uterine corpus was put into an Endobag before morcellation. The opening of Endobag was exteriorized from the umbilical incision and the uterine corpus was removed in a contained manner by manual morcellation with a scalpel.

Results: This procedure was successfully performed on all patients. Neither laparotomic conversion nor additional port was needed. The mean age and mean BMI of the patients were 43.63 years and 24.02 kg/m². The mean operative time was 148 min and the estimated blood loss in most patients was less than 150 ml. The median weight of uterine corpus was 214 g. No intraoperative complications occurred in any patient. One patient was diagnosed with unexpected endometrioid adenocarcinoma FIGO grade 1 postoperatively. One patient reported cyclic bleeding and underwent a transvaginal trachelectomy 17 months later.

Conclusion: Single port access LSH using contained manual morcellation represents a safe and feasible alternative to conventional LSH using open power morcellation.

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Introduction

Hysterectomy remains the most commonly practiced surgical procedure in gynecological operations for patients with benign uterine diseases [1]. Due to rapidly new-found concepts, as well as ever-progressing surgical techniques used in minimal invasive therapy, the use of laparoscopic hysterectomy is becoming increasingly adapted in many countries [2,3]. Yet, the decision to remove or retain the cervix is still an ongoing debate that shows no signs of reaching a consensus in the near future. Laparoscopic subtotal hysterectomy (LSH) was developed during the early 1990s

[4,5], but it was not as well received as laparoscopic total hysterectomy (TLH). Many concerns about LSH may contribute to this condition. A major uncertainty in the past was the risk of cervical stump neoplasia, but removal of the cervix to prevent malignancy was proved unnecessary as long as excellent cervix screening programs are available [6]. Moreover, limited scientific evidence stating theoretical advantages for cervical preservation has made both surgeons and patients wary on opting for this procedure. Technical challenges for the retrieval of the uterine corpus in LSH have also deterred many gynecologists from performing this procedure.

Due to the development of advanced endoscopic equipment, including the introduction of the electromechanical morcellator and the single port apparatus, single port access laparoscopy has gained more acceptance from many surgeons in recent years. Although single port laparoscopic surgery poses some technical

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difficulties compared to conventional laparoscopy, and may require lengthened operative time, it can reduce postoperative pain and improve cosmetic outcomes [7,8]. Single port access LSH is also performed more frequently because the application of power morcellation facilitates specimen retrieval with smaller incisions. In April 2014, the US Food and Drug Administration released a safety communication that discouraged the use of power morcellation during hysterectomy or myomectomy for uterine fibroids, and advocated the use of a specimen bag during morcellation, in order to minimize the risk of spreading unexpected uterine malignancies [9]. The concern about potential hazards from power morcellation drives surgeons to develop new techniques for morcellation in a contained manner [10]. In contrast to open power morcellation, we believe morcellation in a contained manner will become a standard practice in minimally invasive surgery. Herein, we report the surgical outcomes of single port access LSH using in-bag manual morcellation, and an evaluation of the feasibility of this procedure.

Materials and methods

Patient selection

Patients with symptomatic leiomyoma or adenomyosis were preoperatively evaluated by routine blood tests, pelvic examinations, ultrasonography, and cervical cytology screening. Those who desired a hysterectomy and opted to preserve the cervix were enrolled to undergo this procedure. Informed consents emphasizing the advantages and disadvantages of subtotal hysterectomy were collected from all patients. Medical charts were reviewed and clinical data about demographic characteristics, preoperative evaluations, operative findings, pathology results, postoperative courses, and complications were collected and analyzed. This study was approved by our institutional review board.

Surgical procedures

After general endotracheal anesthesia was administered, the patient was prepared and draped in the dorsal lithotomy position. A uterine manipulator was placed vaginally to facilitate uterine movement during the operation. A 2-cm transverse incision was made at the umbilicus and extended into the peritoneum. The single port apparatus (LagiPort, LAGIS, Taiwan) was inserted into the umbilical opening. After pneumoperitoneum was set at 15 mmHg, we used a rigid 0-degree, 10-mm laparoscope (Endoeye, Olympus, US) for all procedures. The vesicouterine peritoneum was first dissected off the anterior portion of the uterus using a monopolar scissors. The uterine ligaments and vessels were secured and transected by Gyrus PK cutting forceps (Gyrus Medical, Maple Grove, MN). Cervical amputation at the level of internal os was made by SupraLoop (Karl Storz, Tuttlingen, Germany). Bleeding at the cervical stump was controlled by a bipolar coagulator. We simultaneously desiccated approximately 1 cm of the endocervical canal in all patients. Reperitonealization was not performed in this case series. The uterine corpus was then put into an appropriately-sized Endobag (Covidien, Mansfield, MA). After removal of the port apparatus, the opening of the Endobag was exteriorized from the umbilical incision and the uterine corpus was removed in a contained condition by manual coring with a scalpel (Fig. 1). Avoidance of bag perforation should be closely attended to during the entire morcellation process. At the end of the procedure, the umbilical incision was closed using the standard method.



Fig. 1. The uterine corpus became a long strip after manual morcellation (coring).

Statistical analysis

Unless otherwise stated, continuous variables were expressed as mean \pm standard deviation or median (interquartile range) if not normally distributed by Kolmogorov–Smirnov test. In search for bivariate correlations, this investigation used Spearman's rank correlation for continuous variables. All reported *p* values were based on two-sided tests, and were considered statistically significant if they were less than 0.05. Data were analyzed using IBM SPSS release 21.0 (IBM, Armonk, New York).

Results

From May 2014 through April 2016, thirty patients underwent this procedure, and neither laparotomic conversion nor additional port was needed. The mean age and mean body mass index (BMI) of the participants were 43.63 ± 3.57 years and 24.02 ± 4.46 kg/m², respectively. Nine patients (30%) had had at least one cesarean section, and three patients (10%) had previously undergone laparoscopic surgery for pelvic endometriosis. During the operation, pelvic adhesive disease was found in 8 patients (26.7%), who needed additional adhesiolysis. The mean operative time was 148 ± 34.53 min, and the estimated blood loss in most patients was less than 150 ml (only one patient required blood transfusion after surgery). The median weight of resected uterine corpus was 214 g. No intraoperative complications, including visceral and vascular injuries, occurred in any patient. Postoperative recovery was smooth, and all patients were discharged on the second day after surgery. Final pathologic examinations revealed leiomyoma and adenomyosis consistent with preoperative diagnosis for all

patients, but one patient was diagnosed with unexpected endometrioid adenocarcinoma FIGO grade 1. Concurrent chemoradiotherapy after thorough cancer work-up was applied to this patient, and the patient had remained no evidence of disease for 30 months since completion of the treatment. Another patient reported cyclic bleeding after the procedure and underwent a transvaginal trachelectomy 17 months later. Patient characteristics and surgical outcomes are summarized in Table 1.

Neither the patient's age nor the patient's BMI correlated with the operative time and the blood loss. A significant direct correlation was noticed between the uterine weight and the operative time ($r = 0.501$, $p = 0.005$). The uterine weight also correlated significantly with the blood loss ($r = 0.434$, $p = 0.017$). In addition, the estimated blood loss was significantly increasing with the operative time ($r = 0.630$, $p < 0.001$).

Discussion

Although LSH was developed soon after the introduction of TLH in 1989 [11], it has not gained wide acceptance to date. According to a recent study based on National (Nationwide) Inpatient Sample data in the United States, LSH accounted for 14.4% of laparoscopic hysterectomies (TLH and LAVH: 85.6%) [2]. In Taiwan, subtotal hysterectomy had increased by 117% (from 672 in 1997 to 1458 in 2010), but most procedures were approached by laparotomy. LSH was extremely rare and only 123 procedures were performed nationwide in 2010 (0.6% of 21,688 hysterectomies) [3]. Due to the rarity of LSH in Taiwan, it is difficult to conduct a clinical study with sufficient participants. Apart from the medical debate about removal or retention of the cervix, other aspects such as patient preference, hospital features, and the surgeon's attitude will affect the type of hysterectomy chosen. A questionnaire survey regarding surgeon selection of subtotal versus total hysterectomy demonstrated that only 19% of gynecologists have regularly offered their patients the option for subtotal hysterectomy, and 61% have seldom or never offered this alternative choice [12]. In Taiwan, subtotal hysterectomy was more frequently performed on younger women before the menopausal age [3]. Owing to higher educational and socioeconomic characteristics, younger patients show preference for less invasive therapy and organ preservation, and are more concerned about postoperative sexual dysfunction. At the same time, cervical cytology screening is widely accepted by the younger population. All patients in this study were premenopausal, and the majority suffered from intractable dysmenorrhea and menorrhagia caused by leiomyoma or adenomyosis. In our experience, after

thorough discussion about the advantages and disadvantages of cervical preservation, more patients, especially younger patients, would choose to undergo subtotal hysterectomies rather than total hysterectomies, if the surgeons equally proposed these two options.

LSH can be approached by multiple-port, single-port, or robotically assisted laparoscopy, with no evidence for superiority of any of these approaches [13]. Single port LSH was first introduced in 1992 [5], but this technique was seldom performed by gynecologists at that time because of technical challenges. Cervical amputation and specimen retrieval are two crucial parts for LSH procedure, truly for single port access type. Using traditional straight instruments in single port LSH causes loss of angularity, and makes cervical transection almost impossible. With the expanding innovations of endoscopic equipment, such as angled laparoscopes and instruments, new vessel-sealing system, and Lap Loop system, LSH by single port access is becoming more and more feasible. The Lap Loop system was reported to reduce the time taken to separate the corpus and cervix by 80% [14]. We used a similar monopolar cutting loop (SupraLoop, Karl Storz) for cervical amputation, instead of flexible or angled instruments that were not available in our institution.

For single port access LSH, resected uterine corpus can be removed through umbilical port incision, posterior colpotomy, or transcervical power morcellation [15,16]. In addition to severe visceral and vascular injuries, the potential risks of uncontained power morcellation include iatrogenic endometriosis, peritoneal leiomyoma seedlings, and most important, spreading of unexpected uterine malignancy. Therefore, we suggest that the use of open power morcellation should be cautiously approached, and limited to exceptional cases. In our opinion, the 2-cm umbilical incision acts as a satisfactory route for specimen retrieval. We put the uterine corpus into a tissue bag and then performed manual coring by a scalpel through the umbilical opening protected by a wound retractor. In this manner, no tissue debris would be left in the abdomen, pelvis, or trocar site, provided that the tissue bag remains intact during whole morcellation. Recently, Venturella et al. conducted a randomized controlled trial to compare morcellation operative time between in-bag manual morcellation and uncontained power morcellation in laparoscopic myomectomy [17]. They found that morcellation operative time and surgical outcomes were similar in both study groups, and concluded that in-bag manual morcellation represented a time-efficient and feasible alternative to open power morcellation. Our technique of in-bag manual morcellation is very similar to the method described by Venturella et al. for uterine myoma. We propose that in-bag manual morcellation used in single port access LSH may be equivalent to results of open power morcellation, with minimized risk in tissue debris spread.

Our technique was successfully performed on all patients, and no intraoperative complications were observed. Most patients had minimal blood loss and smooth recovery. We found that a larger uterus resulted in more blood loss and longer operative time. In a case series and literature review about LSH for the larger uterus published by McGurk et al. [18], the authors concluded that a larger uterus (>500 g) resulted in an increase in both operative time and blood loss, but this did not translate to increase in hospital stay or intraoperative complications. Our results were compatible with their findings, although the average uterine weight in our study was much smaller (214 g). Besides uterine size, the operative time and blood loss are determined by other clinical factors, such as patient characteristics, concomitant pelvic adhesive diseases, and additional surgical procedures. We believe that single port access LSH with in-bag manual morcellation appears to be a safe and feasible procedure for uteri weighed under 500 g.

Table 1
Patient characteristics and surgical outcomes.

Patient characteristics (n = 30)	
Age (year)	43.63 ± 3.57
Body mass index (kg/m ²)	24.02 ± 4.46
Previous cesarean section	9 (30%)
Previous laparoscopy	3 (10%)
Pelvic adhesive disease	8 (26.7%)
Surgical outcomes	
Operative time (minute)	148 ± 34.53
Estimated blood loss (ml)	100 (112)
Uterine weight (g)	214 (112)
Perioperative complication	0
Blood transfusion	1
Unexpected malignancy	1
Cyclic bleeding	1

Values are expressed as mean ± standard deviation, median (interquartile range), numbers, and percentage.

A 37-year-old nulliparous patient, the most obese patient in this case series (BMI: 39.6), was diagnosed with unexpected endometrial adenocarcinoma FIGO grade 1 coexisting with adenomyosis after LSH procedure. Pathologic examination found focal myometrial invasion, but the thickness of myometrial invasion and the surgical margin could not be evaluated because of the fragmented specimen. Endocervical curettage of cervical stump revealed no residual endometrial cancer in the cervical canal. Whole abdomen computed tomography showed no extrauterine gross tumor, except for a small left obturator lymph node. CA125 value was 11.24 U/ml measured postoperatively. Although the uterine corpus was morcellated in a tissue bag and no bag perforation was recorded, the gynecological oncologist decided to give this patient concurrent chemoradiotherapy due to uncertain risk for this rare condition. The patient had remained no evidence of disease for 30 months since completion of the treatment. The estimated incidence of occult uterine malignancy varies among published studies, and the risk of morcellated specimen remains difficult to ascertain. For example, the risk of unexpected endometrial cancer was 9 (0.4%) in 2179 hysterectomies for benign indications in a tertiary referral center of France [19]. In contrast, the incidence of endometrial cancer was only 0.07% in 10,371 morcellated uteri during LSH in a German hospital [20]. Similarly, the estimated risk of undiagnosed uterine sarcoma may be as high as 0.49% in the United States [21], but only 0.06% according to the above study from Germany [20]. Our technique using in-bag manual morcellation minimizes the risk of tissue dissemination compared to open power morcellation, but malignant cells may spread to peritoneal cavities during cervical amputation (uncontained at this point). However, all types of subtotal hysterectomy have the same issue. Unlike uterine sarcoma, endometrial carcinoma may be detected more easily before operation. Endometrial assessment is now a routine preoperative evaluation process for subsequent patients undergoing LSH in our practice.

The possibility of cyclic bleeding after LSH is also difficult to predict, with a widely-ranged report incidence of 0%–37% [13]. Despite the high occurrence rate, the volume of cyclic bleeding is usually minimal [22], and it rarely affects the overall satisfaction of patients undergoing LSH. However, the possibility of cyclic bleeding and subsequent surgery should be included in preoperative informed consent. In our case series, we routinely destructed the endocervical canal via bipolar electrocoagulation. Only one patient reported cyclic bleeding after surgery and underwent a transvaginal trachelectomy 17 months later. The rate of cyclic bleeding seemed to be relatively low (3.3%) in our study, and this may be the result of the electrosurgical destruction procedure. Unfortunately, no available method has proved effective for prevention of postoperative cyclic bleeding after LSH to date [13]. We suggest that women who consider this risk unacceptable should not choose LSH as an option for hysterectomy.

This study has encountered some limitations. First, we did not compare our technique with other types of subtotal hysterectomy, so the differences in surgical outcomes between our procedure and others were absent in this study. All procedures were performed by one single surgeon, and the result may not be reproducible by other groups of gynecologists. In addition, the average uterine size was relatively small and the duration of follow-up was short (range: 12–36 months). With a larger uterus, single port access LSH could become more difficult because the bulky uterus may obstruct adequate visualization of pelvic organs and the mobility of surgical instruments. Due to the rarity of LSH in our country, a well-designed prospective study for single port access LSH will become practicable only if multiple institution involvement on a nationwide basis can be exercised.

Besides the advantages of minimally invasive surgery, single port access LSH has additional benefits, such as less operative pain

and better cosmetic satisfaction. In-bag manual morcellation can minimize the risk of tissue debris spread and appears to be time-efficient. Nevertheless, this technique may not be applicable to a larger uterus because of technical difficulties. All patients undergoing LSH should receive thorough consultations focusing on the possibility of ongoing cyclic bleeding, and the need for continuous cervical screening. Despite the low incidence of occult uterine malignancy, morcellation-related consequences should be discussed preoperatively. In conclusion, LSH by single port access with in-bag manual morcellation for selected patients represents a safe and feasible alternative to conventional LSH using open power morcellation.

Conflicts of interest

The authors declare that they have no conflicts of interest relevant to this article.

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