



## Original Article

## Two-port myomectomy using bag-contained manual morcellation: A comparison with three-port myomectomy using power morcellation

Juseok Yang <sup>a, b</sup>, Yong Jung Song <sup>a, b</sup>, Yong Jin Na <sup>a, b</sup>, Hwi Gon Kim <sup>a, b, \*</sup><sup>a</sup> Department of Obstetrics and Gynecology, Pusan National University Yangsan Hospital, Yangsan, South Korea<sup>b</sup> Research Institute for Convergence of Biomedical Science and Technology, Pusan National University Yangsan Hospital, South Korea

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## ABSTRACT

**Objectives:** To evaluate the feasibility and safety of two-port myomectomy using bag-contained manual morcellation compared to three-port myomectomy using power morcellation.**Material and methods:** A retrospective chart review was conducted for 428 cases of either two-port or three-port laparoscopic myomectomy performed by single operator in the university hospital between January 2011 and December 2016.**Results:** The cohorts of three-port myomectomy with power morcellation was consisted of two hundred and forty-eight patients. One hundred and eighty patients underwent two-port myomectomy with manual morcellation in contained bag. Two-port group showed shorter hospital stay ( $5.16 \pm 1.39$  d vs.  $4.83 \pm 1.19$  d,  $p = 0.001$ ), less estimated blood loss ( $61.8 \pm 58.2$  mL vs.  $50.2 \pm 52.4$  mL,  $p = 0.001$ ), and higher hemoglobin level at postoperative day 1 ( $10.7 \pm 1.17$  g/dL vs.  $11.0 \pm 1.14$  g/dL,  $p = 0.028$ ) with statistical significance. Morcellation time ( $25.8 \pm 9.30$  min vs.  $18.9 \pm 10.11$  min,  $p = 0.001$ ) and total operative time ( $82.4 \pm 30.19$  min vs.  $76.4 \pm 25.47$  min,  $p = 0.047$ ) were also significantly shorter in two-port group. There were no identified spillages of fibroids, ruptures of specimen bag during manual morcellation in two-port myomectomy. In both groups, there were no cases of leiomyosarcoma diagnosed postoperatively.**Conclusion:** Two-port laparoscopic myomectomy with bag-contained manual morcellation is a feasible and safe alternative for three-port with power morcellation. Its surgical outcomes were shown to be superior to conventional laparoscopic myomectomy according to our study but further evaluation in near future is needed.© 2019 Taiwan Association of Obstetrics & Gynecology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Uterine fibroid is the most common type of benign tumor of the female pelvic organ [1,2]. Abnormal uterine bleeding is the most common symptom [3], and the management of symptomatic fibroids varies from watchful waiting to surgical treatment [1,2]. Myomectomy is an effective treatment option for symptomatic fibroids when the affected woman desires future fertility [1,3–5].

Minimally invasive surgery (MIS) has taken the place of a conventional laparotomy in the gynecologic field owing to its clear benefits over a laparotomy [6,7]. Specimen retrieval is one of the

key steps in laparoscopic surgery. Semm first devised the use of mechanical morcellators [8], and the U.S. Food and Drug Administration (FDA) approved the application of electromechanical morcellation in gynecologic surgery in 1995. Power morcellation enabled the optimization of a specimen removal during a laparoscopic myomectomy or hysterectomy and has been attributed to the significant growth of MIS in the gynecologic field.

Almost 20 years later, a tragic case of intraabdominal dissemination of an occult leiomyosarcoma has occurred. It eventually resulted in the FDA's warning statement against the use of power morcellation in 2014 [9,10]. A significant decrease in the performance of laparoscopic hysterectomies and myomectomies was followed [11,12].

Several reports have proposed creating a contained environment to prevent tissue dissemination. A contained tissue extraction system was reported to be reliable, feasible, and reproducible for use with a laparoscopic myomectomy and hysterectomy [13–22],

\* Corresponding author. Department of Obstetrics and Gynecology, Pusan National University Yangsan Hospital, 20 Geumo-ro, Mulgeum-eup, 50612, Yangsan, South Korea. Fax: +82 55 360 2160.

E-mail address: [bislsan@naver.com](mailto:bislsan@naver.com) (H.G. Kim).

and some studies have adopted the use of power morcellation with an insufflated tissue retrieval bag [13,14,18–21].

We also changed our clinical practice of laparoscopic myomectomy by abandoning the use of power morcellation. Instead, we implemented our own in-bag manual morcellation system. The technique of manual morcellation of ours is very similar with which Chang et al. reported in 2018 [23]. The present study was conducted to evaluate the feasibility and safety of manual morcellation with bag-contained system in two-port laparoscopic myomectomy compared to three-port myomectomy with power morcellation.

## Materials and methods

We conducted a retrospective chart review for laparoscopic myomectomy cases performed by a single gynecologic surgeon (Dr. Kim) at Pusan National University Yangsan Hospital between January 2011 and December 2016. Four hundred and twenty-eight patients were recruited. A thorough review of the electric clinical charting was conducted including indications for myomectomy, a history of previous abdominal surgery, postoperative clinical outcomes of the hospitalization days and surgical complications, re-admission for any complications, a final histologic report, and the basic demographics.

### *Surgical procedures common in both groups*

Carbon dioxide was insufflated to achieve 12 mmHg of intra-abdominal pressure. A zero-degree 10-mm rigid laparoscope (Karl Storz, Germany) was used, whereas a 30-degree 5-mm rigid laparoscope was applied during power morcellation in a three-port myomectomy. Vasopressin diluted with normal saline at a ratio of 1:20 was injected at the connective capsule of the fibroids. A barbed V-Loc™ 180 suture with a 1/2 37 mm curved needle (Covidien, USA) was applied in the majority of cases. A Jackson-Pratt drainage system connected with 200 cc EZ-Vac (EZ-Vac™) was placed in the pelvic cavity.

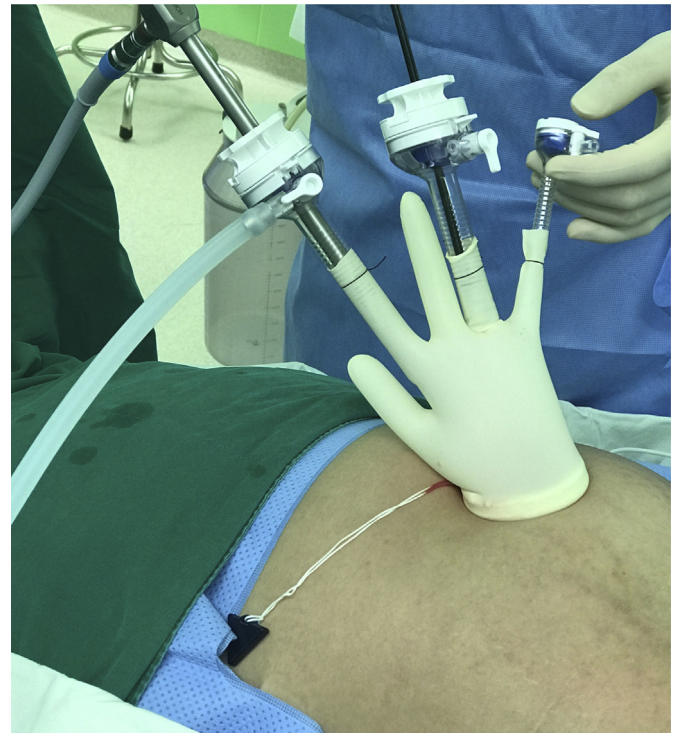
### *Three-port myomectomy with power morcellation*

A direct trocar insertion was applied in this group. A vertical incision was made at the umbilicus about 1 cm long, and a 12-mm trocar was placed under direct visualization. Two ancillary trocars were engaged to the right- and left-lower quadrants of the abdomen using 12- and 5-mm trocars, respectively.

Power morcellation was achieved using a GYNECARE X-Tract Tissue Morcellator (Ethicon Inc.). The morcellation power was set at between 800 and 1200 Hz. We did not employ contained-bag system during power morcellation.

### *Two-port myomectomy with bag-contained manual morcellation*

A variation of home-made style single-port system was applied for the two-port myomectomy (Fig. 1). The operator made a single vertical incision of 1.5–2.0 cm at the umbilicus. Four Langenbeck retractors were used for the upward traction of the abdominal wall. An Alexis wound retractor® (Applied Medical, CA, USA) was placed for settlement of the homemade multi-accessible port. Two 12-mm trocars were accessible through the index and ring fingers and were used as the route for the laparoscope and working channels, as well as carbon-dioxide insufflation. An ancillary 5-mm trocar was placed in the lower-left quadrant of the abdomen. The fibroid(s) was enclosed using a properly sized laparoscopic specimen retrieval bag (Sejong Medical, Korea) before manual morcellation.



**Fig. 1.** A home-made style multi-accessible single port system at umbilicus. There is one ancillary trocar in lower-left quadrants.

### *Statistical analysis*

R, an open-source statistic language supported by the R Foundation for Statistical Computing, release version of 3.4.2, was downloaded from the website ([www.r-project.org](http://www.r-project.org)) and applied for a statistical analysis of this study. A Student's t-test and Wilcoxon signed-rank test showed statistical significance of the non-parametric data according to the distribution. For the categorical parameters, a chi-squared test was applied. The statistical significance was considered at  $p < 0.05$ .

## Results

The cohorts of three-port myomectomy with power morcellation were consisted of two hundred and forty-eight patients. One hundred and eighty patients underwent two-port myomectomy with manual morcellation in contained bag.

The demographics of this study are shown in Table 1. Average patient age of three-port group was  $41.3 \pm 6.42$  years and  $40.50 \pm 6.26$  years in two-port group. There was no significant difference between the two groups in terms of the age, height, and weight of the patients. Concerning the parity, two-port group ( $1.18 \pm 0.92$ ) experienced less parturition than three-port group ( $1.45 \pm 0.96$ ) with a statistical significance. However, number of patients who experienced previous cesarean section was not significantly different between the groups; sixty-five patients (26.2%) in three-port group and forty-five patients (25.0%) in two port group. Previous history of gynecologic surgeries including adnexal operation and myomectomy either by laparotomy or laparoscopy was not significant between two groups.

The leading indication for a myomectomy was menorrhagia related with the fibroids in both groups; one hundred thirty-six patients (54.8%) in three-port group and ninety-three patients (51.7%) in two-port group. Myomectomy indicated by infertility

**Table 1**  
Demographic characteristics.

	Three-Port Myomectomy (control group, n = 248)	Two-Port Myomectomy (test group, n = 180)	p
Age (years)	41.3 ± 6.42	40.50 ± 6.26	0.296
Height (cm)	159.5 ± 5.41	159.5 ± 4.92	0.952
Weight (kg)	59.1 ± 8.82	59.0 ± 9.29	0.887
Parity	1.45 ± 0.96	1.18 ± 0.92	0.007
Indication for surgery			
Menorrhagia	136 (54.8)	93 (51.7)	0.581
Pelvic Pain	58 (23.4)	45 (25.0)	0.786
Pressure Symptom	21 (8.5)	9 (5.0)	0.231
Infertility	4 (1.6)	9 (5.0)	0.083
Previous Pelvic Surgery			
Adnexal operation	10 (4.0)	4 (2.2)	0.444
Myomectomy	6 (2.4)	5 (2.8)	1.000
Cesarean Section <sup>a</sup>	65 (26.2)	45 (25.0)	0.864

Values are mean ± standard deviation or n (%).

<sup>a</sup> At least one cesarean section.

was only 4 cases (1.6%) in three-port group and nine cases (5.0%) in two-port group.

The clinical parameters are summarized in Table 2. The duration of the hospital stay was  $5.16 \pm 1.39$  d in three-port group and  $4.73 \pm 1.19$  d in two-port group and it was statistically significant ( $p < 0.001$ ). The estimated blood loss was also significantly less in the two-port group (50.2 mL) than in the three-port group (61.8 mL,  $p < 0.001$ ). The morcellation of the two-port group ( $18.9 \pm 10.11$  min) was shorter than that of the three-port group ( $25.8 \pm 9.30$  min) with a statistical significance ( $p < 0.001$ ). The total duration of the operation also decreased from 82.4 to 76.4 min ( $p = 0.047$ ).

The weights of the fibroids removed were comparable in both groups;  $124.6 \pm 113.76$  g in three-port group and  $120.2 \pm 125.56$  g in two-port group ( $p = 0.297$ ). It revealed that the level of hemoglobin at postoperative day 1 was significantly higher in two-port group ( $11.0 \pm 1.14$  mg/dL) than in the control group ( $10.7 \pm 1.17$  mg/dL,  $p = 0.028$ ), although the change in hemoglobin level at postoperative day 1 was comparable in both groups.

One case of incisional hernia occurred in the test group and the patient had complications with diabetes and morbid obesity with a body mass index of  $31 \text{ kg/m}^2$ . Conversion to laparotomy did not occur in either group, and there were no major complications recorded during surgery.

## Discussion

FDA warning statements have significantly discouraged the application of minimally invasive gynecologic surgeries. The risk of aggravation of undiagnosed malignancies through the use of power morcellation should be discussed thoroughly with the patient, but it must also be balanced by the gains of minimally invasive surgery, such as lower postoperative pain, an earlier return to work, and a

shorter hospital stay [24,25]. In a decision analysis conducted in 2015, Siedhoff et al. revealed that the number of deaths overall during a laparoscopic hysterectomy was fewer than those occurring during an open hysterectomy, encompassing even deaths by disseminated leiomyosarcoma that was presumed preoperatively to be benign [26]. As Adelman stated, the debate is not whether the morcellation worsens the prognosis but rather whether the abandonment of the morcellation will increase mortality from another cause, namely, the dilemma is between the application of power morcellation and MIS [24]. Therefore, it is very reasonable to state that the benefit of MIS for treating fibroids must be carefully balanced against the risks of applying morcellation.

This study is the result of a balance between following the statements to reduce potential exacerbation of undiagnosed malignancies by using the power morcellation and achieving the benefits of a minimal approach. Many studies have proposed creating a safe environment for applying power morcellation [13,14,18–21]. An isolation bag theoretically prevents the spillage of tissue from the morcellation unless it breaks, and an insufflation of carbon dioxide is applied to provide sufficient spaces for a safe morcellation. Some researchers have adopted a specially designed specimen bag that is resistant to tearing, such as an *Espiner EcoSac 230* implemented in a study by Steller [21]. However, the complexity of adopting an isolation system with CO<sub>2</sub> insufflation and applying a specially designed bag has at least two possible implications: difficulty in standardizing the surgical procedures, and an increase in medical costs.

Our approach is based on the total abandonment of power morcellation during laparoscopic myomectomy, which adheres more to the FDA's literal statement. In addition, the absence of a new instrument specialized for MIS avoids an increase in medical costs. The absence of insufflation of the contained environment allows easy standardization.

**Table 2**  
Surgical outcomes.

	Three-Port Myomectomy (control group, n = 248)	Two-Port Myomectomy (test group, n = 180)	p
Hospital Stay (days)	5.16 ± 1.39	4.73 ± 1.19	0.001
EBL (mL)	61.8 ± 58.2	50.2 ± 52.4	0.001
Morcellation time (min)	25.8 ± 9.30	18.9 ± 10.11	0.001
Total operative time (min)	82.4 ± 30.19	76.4 ± 25.47	0.047
Fibroids weight (g)	124.6 ± 113.76	120.2 ± 125.56	0.297
Preoperative Hemoglobin (g/dL)	12.3 ± 1.40	12.5 ± 1.44	0.209
Hemoglobin Postoperative day 1 (g/dL)	10.7 ± 1.17	11.0 ± 1.14	0.028
Hemoglobin Postoperative day 3 (g/dL)	10.5 ± 1.25	10.7 ± 1.16	0.127
Change in hemoglobin level at postoperative day 1 (g/dL)	1.55 ± 1.08	1.44 ± 1.08	0.450

Values are mean ± standard deviation.



In our study, clinical outcomes of two-port myomectomy with bag-contained manual morcellation has shown to be better than those of three-port myomectomy using power morcellation with statistical significance. The time benefit of manual morcellation is consistent with the findings of Sanderson et al., in 2018 [27]. In their study of robotic myomectomy, they concluded that contained manual morcellation was associated with a significant decrease in surgical time when compared to power morcellation (21-min decrease in mean operative time,  $p = 0.02$ ).

Although the time benefit is due considerably to the different types of morcellation applied, other clinical benefits such as a shorter hospital stay, and less estimated blood loss are thought to be the result of the operator's experience. Because two-port myomectomy with manual morcellation has been conducted relatively more recently than three-port myomectomy, the operator's learning curve has an influence on the clinical parameters. The estimated blood loss, for example, is thought to be unaffected by the morcellation itself.

Likewise, the shorter hospital stay is reasonably due to the operator's experience in patient management, rather than the type of morcellation applied. According to the critical pathway program at our institution for laparoscopic myomectomy, patient was admitted 1 day before surgery and the planned for discharge at postoperative day 3. However, when a patient wanted to extend her stay at the hospital for personal issues and not because of complications or other medical causes, it was frequently permitted. This extension for a personal issue might have had an effect on the difference in hospital stay for the two groups. Sanderson et al. also reported there was similar length of stay [27].

Chang et al. well described the technique of manual morcellation in their study of laparoendoscopic single-site supracervical hysterectomy [23]. It is very similar with the manual morcellation that we performed in the present. A one-sided cut, or semi-lunar type morcellation, was used to shape the globular fibroids into cylindrical pieces similar to those generated by a power morcellator. To prevent injury to the internal organs, the scalpel should always bounce nearly perpendicular to the fibroids, and not to the umbilicus (video 1). There were no cases of such injuries in our study.

Supplementary video related to this article can be found at <https://doi.org/10.1016/j.jog.2019.01.029>.

By enveloping the removed fibroids with a retrieval bag, we provided protection of fibroids from being disseminated inadvertently during manual morcellation. Although a specimen retrieval bag can theoretically create a barrier to prevent tissue dissemination, it is highly susceptible to tears or breaks. In our study, there were no accidental losses of fibroid tissues, although tissue spillage is dependent on the skill and experience of the operator in keeping the bag intact throughout the manual morcellation.

The recruitment of a large cohort of patients, the involvement of sole laparoscopic myomectomy, a direct comparison between manual and power morcellation, and data centering on a single surgeon are the major strengths of our study. Among the 428 cases considered, no postoperatively diagnosed leiomyosarcoma was found. As a limitation of this study, we failed to prove that no actual leakage of the fibroids occurs during manual morcellation. Although we did not show any recurrence of leiomyomatosis in the outpatient follow-ups, there is little evidence that convinces us that the contained system was ever intact for all cases. In the future, a properly designed study needs to be conducted to evaluate the spillage or leakage of fibroids during laparoscopic myomectomy using bag-contained manual morcellation.

In conclusion, a two-port myomectomy with transumbilical semi-lunar type manual morcellation applied in a bag-contained system is a feasible alternative to a conventional laparoscopic myomectomy using power morcellation. In our study, the two-port myomectomy

with contained bag manual morcellation is associated with significant decrease in length of hospital stay, the time consumed for morcellation and the total operation, and the estimated blood loss as compared with the three-port myomectomy using power morcellation. Contained-bag system minimizes the concerns regarding a possible insemination of undiagnosed malignant tissues. Large and multi-centered studies are required in the near future.

## Conflicts of interest

All authors have no affiliations with or involvement in any organization or entity with any financial interest, or nonfinancial interest in the subject matter or materials discussed in this manuscript.

All authors have no conflicts of interest.

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