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# Transvaginal Morcellation

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## ABSTRACT

**Background and Objectives:** Transvaginal uterine morcellation has been described in the literature for more than a century. Despite an extensive body of literature documenting its safety and feasibility, concerns about morcellating occult malignant entities have raised questions regarding this technique. In this study, we looked at a single teaching institution's experience with transvaginal morcellation for leiomyomatous uteri. In addition, we reviewed the published literature for outcomes associated with transvaginal morcellation techniques.

**Methods:** This study was a retrospective case series. Charts of women who underwent total laparoscopic hysterectomy, robot-assisted laparoscopic hysterectomy, and laparoscopic-assisted vaginal hysterectomy for leiomyoma from July 1, 2011, through December 31, 2013, were reviewed. Cases were included if transvaginal morcellation was performed. Morcellation was performed by bringing the uterus into the vagina and by performing a wedge resection technique to reduce the volume of the specimen. Baseline demographics and intra- and postoperative outcomes were abstracted from the charts. A PubMed search from January 1, 1970 to October 31, 2014 was performed to review the literature regarding transvaginal morcellation.

**Results:** Sixty-four women who underwent laparoscopy for leiomyomatous uteri with transvaginal morcellation were identified from July 1, 2011 through December 31, 2013. Mean operative time was 210 minutes (SD 75.5; range, 93–420). The mean blood loss was 153 mL (SD 165; range, 25–1000). The mean uterine size was 608 g (SD 367; range, 106-1834). There were no surgical complications directly attributed to morcellation. The literature search yielded 22 articles describing outcomes after transvaginal morcellation, with a total of 1953 morcellated specimens.

**Conclusions:** Transvaginal uterine morcellation appears to be a safe alternative to laparotomy for the removal of large uterine specimens in select patients.

**Key Words:** Fibroid, Laparoscopic abdominal vaginal hysterectomy, Leiomyoma, Transvaginal morcellation

## INTRODUCTION

Hysterectomy remains one of the most commonly performed procedures in the United States.[1] In 2003, approximately 66.1% of hysterectomies were performed abdominally, 21.8% vaginally, and 11.8% laparoscopically.[1] During the past decade, rates of laparoscopic and robot-assisted laparoscopic hysterectomies have continued to rise, while the rates of vaginal and abdominal hysterectomies have declined.[2] The driving forces for choosing a minimally invasive approach over an abdominal approach include a shorter hospital stay, a more rapid recovery, decreased pain, an improved postoperative quality of life, and a better cosmetic outcome.[3] One of the challenges of minimally invasive hysterectomy is how to remove large uterine specimens. Published techniques for specimen removal include transvaginal uterine morcellation, laparoscopic power morcellation, and removal through a mini-laparotomy incision.[4,5] Transvaginal morcellation has been documented in the medical literature since the 1890s as a means of reducing the morbidity and mortality associated with hysterectomy, when compared to abdominal hysterectomy.[4] In the 1990s, the power morcellator was introduced as a method to remove large specimens through small incisions and quickly gained popularity in gynecologic surgery.[5] Along with studies documenting the instrument's overall safety and efficiency, there have been sporadic case reports of the morcellation of occult malignant entities and the parasitic spread of benign disease.[6,7]

In this study, we describe a single teaching institution's experience and outcomes related to vaginal morcellation

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**Table 1.**
Baseline Characteristics of the Patients

| | Mean (SD) | Range |
|---|---|---|
| Age, years | 48.5 (7.87) | 34–73 |
| BMI, kg/m$^2$ (n = 63) | 31.0 (8.28) | 18.3–70.3 |
| Charlson comorbidity index (n = 64) | 1.75 (1.43) | 0–6 |
| Parity (n = 56) | 1.25 (1.16) | 0–4 |
| Estimated uterine size, wk (n = 58) | 17 (4.7) | 8–30 |
| Race, n (%) | | |
| White | 24 (37.5) | |
| Black | 21 (32.8) | |
| Hispanic | 6 (9.4) | |
| Other/unknown | 13 (20.3) | |

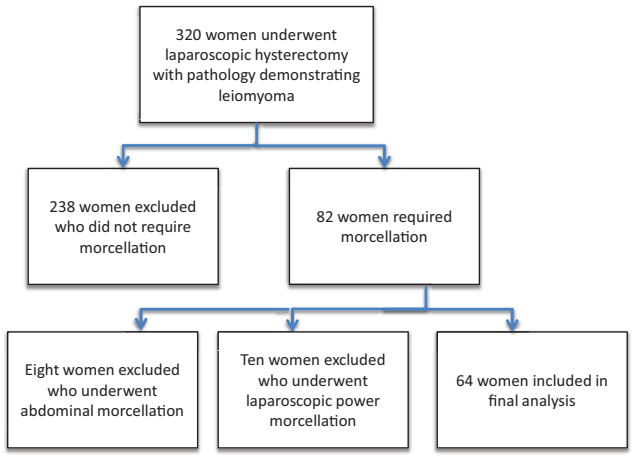


**Figure 1**. Depiction of case selection.

for the removal of large leiomyomatous uteri. In addition, we review the published literature for outcomes regarding transvaginal morcellation of large uteri.

## MATERIALS AND METHODS

All cases of hysterectomy for leiomyoma from July 1, 2011, through December 31, 2013, at a tertiary care referral center were identified by reviewing pathology reports. The patients' characteristics before the operation are shown in **Table 1**. Uterine cancer cases during the study period were also reviewed, to identify atypical fibroids, uterine smooth muscle tumors of uncertain malignant potential (STUMP), and leiomyosarcomas that may have been morcellated during the study period. Cases were included in the study if the patients had undergone total laparoscopic hysterectomy, robotic-assisted laparoscopic hysterectomy, or laparoscopic-assisted vaginal hysterectomy (LAVH) with transvaginal morcellation of the specimen. Cases were excluded from the study if no morcellation was performed, if specimens were morcellated laparoscopically, or if morcellation was performed via a minilaparotomy (**Figure 1**). Institutional review board approval was obtained before the study began.

Data extracted from the charts included age, race, body mass index (BMI), parity, obstetrical history, surgical history, pelvic examination findings, and surgical indications. The operative reports were reviewed to identify the surgical approach (laparoscopic versus robotic), operative details (including approach to morcellation), estimated blood loss (EBL), operative time, and time under anesthesia. Charts were also reviewed for final pathology, uterine weight, and postoperative outcomes. Surgical risk was assessed with the Charlson Comorbidity Index,[8] and postoperative outcomes were classified in accordance with the Clavien-Dindo Surgical Complications Scale.[9] In addition, charts were reviewed for complications directly attributed to transvaginal morcellation, including visceral injury or vaginal lacerations that occurred during morcellation.

### Surgical Technique

All patients receive a preoperative dose of intravenous antibiotics per the institutional protocol. After induction of general anesthesia, the patient is positioned in the dorsal lithotomy position, pneumoperitoneum is established with a Veress needle, and conventional laparoscopic or robotic ports are placed at the surgeon's discretion.

After complete devascularization and separation of the uterus, large specimens are removed through the vagina by hand morcellation. If a robotic system is used for the procedure, the robot is undocked to provide a greater range of motion for the operator and assistant. Manual morcellation is performed by the resident or fellow, with the attending as the assistant. The cervix is grasped with a tenaculum under camera visualization and is brought into the vagina. Breisky-Navratil vaginal retractors are used to provide exposure and protect the vaginal walls, rectum, and bladder. The morcellation procedure is performed within the vagina with a no. 10 scalpel and a wedge resection technique. Myomectomy is performed as indicated. Once the specimen is removed vaginally, the vaginal apex is reapproximated using a vaginal or laparoscopic approach. In cases of robotic procedures, the robot is redocked, if necessary, for completion of the operation.

### Statistical Analysis

Descriptive statistics were used to analyze the data. Continuous variables are reported as the mean with the SD and range. Categorical data are reported as percentages of the total. Statistical analysis was performed with GraphPad Prism version 6 (GraphPad Software, San Diego, California).

### Literature Review

A PubMed search of the literature from January 1, 1970, through October 31, 2014, was conducted for papers discussing hysterectomy with specimen removal via transvaginal morcellation. Search terms included "hysterectomy and morcellation," "vaginal hysterectomy," "morcellation," "vaginal morcellation," "morcellation and malignancy," "fibroids and morcellation," "leiomyoma and morcellation," "morcellation and dissemination," "hysterectomy," and "leiomyosarcoma." Reference lists provided by the articles were explored for citations related to transvaginal morcellation of hysterectomy specimens. Only articles published in English were included. Articles were excluded if outcomes for transvaginal morcellation were not analyzed separately from other means of morcellation and if specimens were morcellated in specimen bags. We identified 22 series reporting outcomes after transvaginal manual morcellation, with a total of 1953 vaginally morcellated specimens.

## RESULTS

Three hundred twenty cases were identified as having a histologic diagnosis of leiomyoma during the study period. Of those, 82 patients had undergone laparoscopic hysterectomy followed by morcellation. Eight patients were excluded because tissue extraction was performed through a minilaparotomy incision, and 10 patients were excluded because a laparoscopic power morcellator was used to remove the specimen. Sixty-four women underwent transvaginal manual morcellation and were included in our analysis. There were no patients with incidental leiomyosarcoma or other malignant uterine disease who underwent morcellation during the study period.

The mean age of the women who underwent transvaginal morcellation was 48.5 years (SD 7.87; range, 34–73) and the mean BMI was 31.0 (SD 8.28; range, 18.3–70.3). As a cohort, they had few comorbidities, with a mean Charlson Comorbidity Index of 1.75 (SD 1.43; range, 0–6). Approximately 89% of the operations were performed with robotic assistance, and the remaining 11% were performed with conventional laparoscopy. The mean EBL was 153 mL (SD 165; range, 25–1000). The mean operative time was longer than typically reported for laparoscopic and robotic hysterectomies, at 210 minutes (SD 75.5; range, 93–420). The mean uterine size was 608 g (SD 367; range, 106-1834). The 106-g uterus required morcellation because of the presence of a large pedunculated fibroid in a nulliparous patient. In this case, a myomectomy was performed vaginally, followed by delivery of the uterus. Patients who underwent transvaginal morcellation did well after surgery. Only 4 had major postoperative complications: 2 with thermal or devascularization injury to the ureter, 1 with a cuff abscess requiring drainage by interventional radiology, and 1 with a prolonged postoperative course involving a 41-d hospitalization related to a cuff abscess and dehiscence requiring reoperation (**Table 2**).

A review of the literature identified 22 case series in which outcomes after transvaginal morcellation of large uteri were described. Studies involving morcellation of uteri, after vaginal hysterectomy (VH), LAVH, and total laparoscopic hysterectomy (TLH), and 1953 morcellated hysterectomy specimens were included in the review. **Table 3** summarizes the literature describing transvaginal morcellation and reported outcomes, including operative time, uterine size, final pathology, and complications.[4,6,10–29] These studies report successful transvaginal morcellation of hysterectomy specimens, with a maximum weight of

**Table 2.**
Intraoperative and Postoperative Outcomes

| | Result | Range |
|---|---|---|
| Surgical parameter, mean (SD) | | |
| EBL, mL (n = 62) | 153 (165) | 25–1000 |
| Time under anesthesia, min (n = 54) | 210.9 (75.5) | 93–420 |
| Size of uterus, g (n = 63, 10) | 608 (367) | 106–1834 |
| Length of stay, d | 1 (median) | 1–41 |
| Laparoscopic approach, n (%) | | |
| Conventional | 7 (10.9) | |
| Robotic | 57 (89.1) | |
| Postoperative complications, n (%) | | |
| None/Clavien-Dindo 1 | 46 (71.9) | |
| Clavien-Dindo 2 (minor) | 14 (21.9) | |
| Clavien-Dindo 3 (major) | 4 (6.2) | |

Uterine size is reported as a mean (with SD or the range), the range, or maximum uterine weight. Abbreviations: EBL, estimated blood loss.

**Table 3.**
Studies Reporting Surgical Outcomes and Parameters for Transvaginal Uterine Morcellation

| | Article | Patients (n) | BMI[a] ($kg/m^2$) | Surgical Approach | Uterine Weight[a] (g) |
|---|---|---|---|---|---|
| 1 | Draca (1986)[10] | 162 | NR | VH | 250–700 |
| 2 | Kovac (1986)[11] | 554 | NR | VH | 163 (100–750) |
| 3 | Hoffman et al (1994)[12] | 50 | NR | VH | 200–1120 |
| 4 | Mazdisnian et al (1995)[13] | 37 | NR | VH | 459 (SD 142) |
| 5 | Magos et al (1996)[14] | 14 | NR | VH | 638.7 (380–1100) |
| 6 | Kammerer-Doak and Mao (1996)[15] | 59 | NR | VH | 225 (65–536) |
| 7 | Pelosi and Pelosi (1997)[4] | 14 | NR | VH (4)/LAVH (10) | 455 (360–710) |
| 8 | Pelosi and Pelosi (1997)[16] | 1 | NR | VH | 247 |
| 9 | Pelosi and Pelosi (1998)[17] | 1 | 23 | VH | 2003 |
| 10 | Figueiredo et al (1999)[18] | 170 | 27.2 (17.2–46.7) | VH | 1160 |
| 11 | Unger (1999)[19] | 40 | NR | VH | 690 |
| 12 | Doucette et al (2001)[20] | 122[b] | NR | VH | 760 |
| 13 | Benassi et al (2002)[21] | 60 | NR | VH | 380 (220–1224) |
| 14 | Deval et al (2003)[22] | 114 | 25.0 (20.4–30.8) | VH | 1350 |
| 15 | Taylor et al (2003)[23] | 139 | 29.7 (20.2–33.2) | VH | 211 (42–982) |
| 16 | Nazah et al (2003)[24] | 30 | NR | VH/LAVH | 170–1100 |
| 17 | Li et al (2004)[25] | 21 | NR | VH | 750 |
| 18 | Wittich (2006)[26] | 119 | NR | VH/LAVH | 105–780 |
| 19 | Einstein (2008)[6] | 1 | NR | VH | NR |
| 20 | Chen et al (2008)[27] | 107 | NR | LAVH | 590–1047 |
| 21 | Wong et al (2010)[28] | 86 | NR | LAVH | 726 (500–1690) |
| 22 | Quinlan and Quinlan (2010)[29] | 52 | 4 patients >35 | VH | NR |

| | Operative Time[a] (min) | Diagnosis of Malignancy | Complications, type (n) |
|---|---|---|---|
| 1 | NR | None | Transfusion (37) |
| | | | Infection (26) |
| | | | Thrombophlebitis (2) |
| 2 | 40 (15–110) | None | Infection (47) |
| | | | Urinary tract infection (8) |
| | | | Hemorrhage (16) |
| | | | Bladder injury (9) |
| | | | Ileus (1) |
| 3 | 122 | None | Transfusion (3) |
| | | | wound infection (5) |
| 4 | 121 (114–141) | None | Conversion to laparotomy (6) |
| | | | Cystotomy (1) |
| | | | Transfusion (2) |
| | | | Postoperative infection (3) |
| | | | Postoperative hemorrhage (1) |

**Table 3.**
Continued

| | Operative Time[a] (min) | Diagnosis of Malignancy | Complications, type (n) |
|---|---|---|---|
| 5 | 84.3 (30–150) | NR | Transient hematuria (6) |
| | | | Blood transfusion (1) |
| 6 | 69.6 | None | Transfusion (3) |
| | | | Febrile morbidity (8) |
| 7 | 92 (49–170) | NR | None |
| 8 | N/A | Well differentiated endometrial adenocarcinoma | Endometrial cancer on final pathology (1) |
| 9 | 180 | None | None |
| 10 | 51 (20–130) | None | Cystotomy (2) |
| | | | Enterotomy (1) |
| | | | Conversion to laparotomy (2) |
| | | | Conversion to laparoscopy (1) |
| | | | Transfusion (1) |
| | | | Urinary tract infection (11) |
| 11 | 66.6 (28–135) | None | Cuff cellulitis (1) |
| 12 | 48.7 (25–110) | NR | Cystotomy (1) |
| | | | Cuff cellulitis (4) |
| | | | Cystitis (2) |
| | | | Cuff hematoma (1) |
| 13 | 86 (40–150) | None | Cuff hematoma (2) |
| | | | Postoperative fever (2) |
| 14 | 89.5 (53.8–125.2) | None | Bladder injury (11) |
| | | | Conversion to laparotomy (1)<br>reoperation (7) (hemorrhage, 3; cuff hematoma,3; abscess, 1) |
| 15 | 172 (SD 70) | None | Blood transfusion (4) |
| | | | Conversion to laparotomy (2) |
| | | | Cystotomy (3) |
| | | | Ureteral obstruction (1) |
| | | | Bowel laceration (1) |
| | | | Pelvic hematoma (2) |
| | | | Febrile morbidity (4) |
| 16 | 55–220 | None | Transfusion (5) |
| | | | Febrile morbidity (4) |
| | | | Hematoma (2) |
| | | | Urinary tract infection (3) |
| 17 | NR | None | Conversion to laparotomy (2) |
| 18 | NR | None | Conversion to laparotomy (2) |
| | | | blood transfusion (4) |
| | | | Bladder injury (2) |

**Table 3.**
Continued

| | Operative Time[a] (min) | Diagnosis of Malignancy | Complications, type (n) |
|---|---|---|---|
| 19 | NR | Endometrioid adenocarcinoma | Undiagnosed malignancy (1) |
| 20 | 148–243 | None | Conversion to laparotomy (1) |
| 21 | 96.0 (44–250) | None | Blood transfusion (7)<br>Febrile illness (2)<br>1 cuff hematoma (1) |
| 22 | 60 (35–110) | None | NR |

Abbreviations: LAVH, laparoscopic-assisted vaginal hysterectomy; NR, not recorded; VH, vaginal hysterectomy.
[a]Results are expressed as the mean (SD or the range), the range, or maximum uterine weight.
[b]Error in calculation of morcellated sample.

2003 g. Most cases were performed by VH, although some studies included results for LAVH with transvaginal morcellation. In most cases, operative time was 3 h or less. Rates of complications varied widely among the studies; 2 articles reported an endometrial adenocarcinoma that was incidentally morcellated.

## DISCUSSION

In the late 1800s transvaginal morcellation was first described in the literature as a means of removing large uteri without subjecting women to the morbidity of abdominal hysterectomy.[4] Over the past century, surgeons continue to explore safe ways to remove large hysterectomy specimens through small incisions. Our literature search identified 22 articles describing the morcellation of 1953 specimens. In 1994, Hoffman et al[12] demonstrated that VH with morcellation is a safe alternative to abdominal hysterectomy, without increasing operating time or morbidity. In 1996, Kammerer-Doak and Mao[15] showed that VH with morcellation for large uteri (≤536 g) does not increase morbidity over VH without morcellation. In 1998, Pelosi and Pelosi[20] reported a successful VH with transvaginal morcellation for a 2003-g uterus. Following the introduction of the laparoscopic-assisted hysterectomy by Reich in 1989, multiple studies have demonstrated the safety and feasibility of transvaginal morcellation for removal of large uteri during LAVH.[4,24,26–28]

Each of these studies emphasizes that size alone is not a contraindication to transvaginal morcellation. However, they also suggest that known or suspected malignant disease would be a contraindication to use of the technique. Magos et al[14] suggested performing an endometrial biopsy before morcellation, to minimize the chance of occult malignancy. Our literature review included one case report of occult malignant disease after transvaginal morcellation. Pelosi and Pelosi[16] identified a well-differentiated endometrial adenocarcinoma in a morcellated specimen. Data regarding long-term outcomes for this patient were not included. In a case series reported by Einstein et al,[6] a single patient with endometrioid uterine cancer underwent transvaginal morcellation. At the time that the article was submitted, she was alive with recurrence at 90 months.[6] This data does not answer the question of whether prognosis is affected by specimen transvaginal hand morcellation.

The present study is a large retrospective review of 2.5 years of experience with transvaginal uterine morcellation at a single teaching institution. Uteri up to 1834 g were successfully morcellated vaginally. During the study period, there were no complications directly attributable to transvaginal morcellation, including injury to viscera or significant vaginal lacerations, and no malignant entities were morcellated. We found a major complication rate of 6.2% and a minor complication rate of 22%, comparable to rates in prior studies. Two postoperative cuff abscesses, one of which resulted in a cuff dehiscence, were identified and treated in this cohort. It is possible that this complication was related to transvaginal morcellation. According to a 2009 Cochrane Review of hysterectomy for benign disease, rates of vaginal cuff infection range from 0% to 20%,[30] and therefore, the 2.7% rate of cuff abscess in our study was attributed to the hysterectomy. It must be noted, that the mean operative time in this cohort was relatively long (mean, 210 min). There are many factors that could have contributed to the longer operative time. First, nearly all hysterectomies were for uteri greater than 250 g. Second, all cases were used for teaching, with

residents or fellows performing large portions of the procedures. The mean BMI for our study population was 31 kg/m$^2$, with a maximum of 70.3 kg/m$^2$. This study suggests that manual transvaginal morcellation is feasible in women with obesity and morbid obesity. In addition, this study reviews prior cases of transvaginal morcellation and attests to the long history of its safe performance in patients.

This study is limited by its retrospective design. In addition, it is not powered to address rare outcomes, such as morcellation of malignant disease or true rates of intraoperative complications. However, the results are similar to prior data supporting the feasibility of transvaginal tissue extraction via manual morcellation for the removal of large fibroid uteri.

## CONCLUSION

Based on these data, as well as prior published data, the results in this study suggest that transvaginal uterine morcellation is an effective way to remove large uterine specimens in appropriately selected patients. Furthermore, transvaginal morcellation of large uteri prevents women from being exposed to the morbidity of laparotomy and abdominal hysterectomy. This technique can be performed in most patients, including nulliparous and obese women. Further studies should be performed to gain better understanding of how to select patients, so that the potential risks of morcellation can be minimized.

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