

Clinical Use of the Intrauterine Morcellator: A Single Academic Center's Experience

Stephanie Rothenberg, Shweta Nayak, Joseph S. Sanfilippo

University of Pittsburgh Medical Center, Magee—Women's Hospital, Pittsburgh, USA
Email: nayaksr2@upmc.edu

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Abstract

Objective: To reveal the breadth of experience for the intrauterine morcellator amongst gynecologists in a single US academic center. **Design:** Retrospective Descriptive. **Setting:** University Hospital. **Patients:** In total, 33 hysteroscopic procedures, with intrauterine morcellation, were performed for 28 patients for benign endometrial disease at Magee—Womens Hospital at the University of Pittsburgh Medical center between October 2006 and February 2012. **Intervention:** Operative Hysteroscopy with an intrauterine morcellator. **Measurement and Main Results:** The major indication for hysteroscopic surgery was endometrial polyp (54.5%), followed by intrauterine fibroids (18.2%), filling defect on sonohysterogram (15.2%), abnormal uterine bleeding (9.1%), and uterine synechiae (3%). The mean greatest diameter for all intrauterine pathology resected was 1.14 ± 0.46 cm (Range 0.6 - 1.9 cm), and, notably, the largest fibroid resected was 1.5 cm in greatest diameter. The average operative time was 39 ± 29 minutes (range 15 - 122 minutes), and average hysteroscopic fluid deficit was 286 ± 479.5 mL (range 30 - 2000 mL). There were only 2 patients for whom the deficit was greater than 1 L, one of whom underwent a myomectomy with total operative time of 26 minutes, while the other underwent a hysteroscopic adhesiolysis and had a total operative time of 122 minutes. The complication rate was 6.0%, and complications reported included uterine perforation (n = 1) and cervical injury (n = 1). **Conclusion:** The intrauterine morcellator is a useful tool for surgical treatment of intrauterine pathology that confers a low operative risk.

Keywords

Intrauterine Morcellator; Morcellation; Operative Hysteroscopy; Myomectomy; Polypectomy

1. Introduction

Since the mid 1970s, hysteroscopic resectoscopy has been the preferred technique for the removal of intrauterine

pathology, including endometrial polyps and fibroids. The resectoscope provides the ability to use both electro-surgical and mechanical instruments. Older resectoscope techniques required the utilization of a monopolar current, for which electrolyte-free distending media was necessary; with such methods, a meticulous recording of fluid deficit was necessary to avoid the life threatening complications associated with the absorption of excess free fluid, including hyponatremia, nausea, and cerebral edema [1]. The next wave of resectoscopy utilized bipolar electrocautery, introducing a safer alternative as isotonic distending media could be used. However, the resectoscope's functionality can be disrupted by the creation of tissue fragments during resection. In order to maintain adequate visualization of the operative field, intermittent removal of free specimen from the field is required, which may rely on either intermittent removal of the scope itself or the use of an aspirating device [2]. This may subsequently result in increased operative time, as well as an increased risk of uterine perforation with repeated replacement of the hysteroscope [2].

The newest wave of commercially available hysteroscopic tools, the intrauterine morcellator, utilizes isotonic distension media, a sophisticated fluid management system, and a vacuum device to collect the specimen. Because of this, the hysteroscopic morcellator has been suggested as a safe and effective alternative in experienced hands for the removal of intrauterine pathology [3]-[5]. To date, the clinical experience with this novel technique is limited [3]-[6]. Additionally, only one other center has described their use of this technique in the United States. The purpose of this study is to describe our experience with the Smith and Nephew Morcellator at a large academic teaching hospital in the mid-Atlantic.

2. Materials and Methods

The hysteroscopic morcellator was initially introduced to our Academic teaching center (Magee—Womens Hospital, Pittsburgh, Pennsylvania, United States of America) in 2006. Prior to this, all operative hysteroscopies were performed either conventionally, with the utilization of an operative port through which hysteroscopic instruments could be placed, or with the resectoscope.

This study was approved by the Institutional Review Board of the University of Pittsburgh. Notably, since 2010, all retrospective chart reviews at our institution have been completed by the Center for Assistance in Research using eRecords (CARE), an inter institutional mechanism which allows researchers to not only access components of the electronic record (eRecord) but to also utilize the appropriate technical and regulatory expertise necessary to facilitate eRecord searches. We initially searched all records that were linked to disease specific ICD-9 Codes (621.0: Endometrial polyp, 218.9: Uterine fibroid), procedure specific ICD-9 codes (68.12: Hysteroscopy), CPT codes (58555, 58558, 58561), Revenue Code (0272), and product specific codes (7210908, hysteroscopic reciprocating morcellator, 7209509, hysteroscopic rotary morcellator). Additionally, we requested the following de-identified information: patient age, chief complaint, history and physical exam from 1 month prior to the procedure, operative reports, operating room records (for operative time), pathology reports, abdominal and pelvic imaging (6 months prior to and following the procedure), additional hospitalization (6 months prior to and following the procedure and all pertinent documentation from these hospitalizations, including progress notes, operative and pathology reports), and discharge summaries from all hospitalizations. From this search we received data from 28 patients for a total of 33 cases.

Morcellation was performed with the hysteroscopic morcellator (HM) (TRUCLEAR, Smith & Nephew, Andover, USA). Briefly, the morcellating system consists of a 9 mm, 27 Fr sheath, as well as a 8 mm, 24 Fr 0° hysteroscope (Smith & Nephew, Andover, USA). The working channel also acts as an inflow channel and allows for continuous pressurized flow via peristaltic pump. All cases utilized the hysteroscopic fluid management system, which allows for a maximum flow rate of 700 mL/min (Smith & Nephew, Andover, USA). Notably, all cases utilized normal saline for distending media. The morcellating device is inserted into the operative port of the hysteroscope, and consists of a 4-mm blade, and a rigid inner tube that rotates within an outer tube. The blade has a window opening, which allows tissue to be aspirated by vacuum, but is locked when the inner tube is activated in order to prevent fluid from escaping the uterus. The outflow channel however is passive; the outflow tubing is set to gravity to facilitate collection into the fluid management system. Fluid deficit was calculated by subtracting both this passive collection as well as fluid from the vacuum tubing connected to the inner blade in order to calculate the deficit. All tissue resected was collected in a single pouch and sent to pathology for gross and microscopic examination.

Statistics were performed using STATA software (StataCorp. 2011. *Stata Statistical Software: Release 12.*

College Station, TX: StataCorp LP). When applicable, student's t test was used to evaluate the means of 2 groups, and the result was deemed statistically significant at an $\alpha = 0.0$.

3. Results

The average age of the cohort was 34 ± 3.38 , and the majority of patients (87%) were nulliparous (**Table 1**). The major indication for hysteroscopic surgery was endometrial polyp (54.5%), followed by type 0 intrauterine fibroids (18.2%), filling defect on sonohysterogram (15.2%), abnormal uterine bleeding (9.1%), and uterine synechiae (3%) (**Table 2**). Patients who presented with a "filling defect on sonohysterogram" were those who underwent a routine cavity evaluation prior to in vitro fertilization in our Department's Division of Reproductive Endocrinology and Infertility. These patients were all asymptomatic, but were found to ultimately have endometrial polyps, which were confirmed by surgical pathology. Eleven patients had prior procedures: seven patients with 1 - 3 prior, and four with 4 or more prior. The prior procedures included hysteroscopy along with dilation and sharp curettage (33%), hysteroscopic polypectomy with an operative hysteroscopy (27%), hysteroscopic myomectomy with the resectoscope (12%), hysteroscopic adhesiolysis (3%), and 25% of patients had prior abdominal surgery unrelated to intrauterine pathology.

Five of the patients contributed 2 procedures each to the 33 cases reviewed. Of these, only 2 patients had a second hysteroscopic procedure that utilized the intrauterine morcellator within 6 months of their primary procedure. Notably, one of these patients underwent a repeat procedure within 3 months, as their initial procedure was prematurely terminated for uterine perforation; the second patient underwent a repeat procedure 6 months following their primary procedure for new pathology, as "uterine fibroid" was the indication for the initial procedure and "endometrial polyp" was the indication for the second procedure. The remaining 3 patients underwent their second procedure 8 - 16 months after their first procedure for newly diagnosed pathology.

All patients underwent pre-operative imaging prior to their procedure, with the majority (63.6%) undergoing sonohysterogram. The mean greatest diameter for all intrauterine pathology resected was 1.14 ± 0.46 cm (range 0.6 - 1.9 cm), and notably, the largest fibroid resected was 1.9 cm in greatest diameter (**Table 1**).

All patients underwent their procedures under monitored anesthetic care and following the placement of a paracervical block with 1% polocaine without epinephrine. Operative start time was defined as the time of paracervical block placement, and operative completion time was defined as the time when all instruments were removed from the vagina. The calculated operative time, therefore, additionally included time for cervical dilatation as well as time to hemostasis, and may over-estimate the actual operating time during which the morcellating device was actually used. The average operative time was 39 ± 29 minutes (range 15 - 122 minutes) (**Table 3**). Average operative time was not statistically significantly different for uterine fibroids vs. polyps (**Table 4**).

As mentioned in the methods, all cases utilized the fluid (normal saline) management system. The average hysteroscopic fluid deficit was 286 ± 479.5 mL (range 30 - 2000 mL) (**Table 3**). There were only 2 patients for whom the deficit was greater than 1 L, one of whom underwent a myomectomy with a total operative time of 26 minutes, while the other underwent a hysteroscopic adhesiolysis and had a total operative time of 122 minutes. Average fluid deficit was statistically significantly higher for uterine fibroids when compared to uterine polyps (**Table 4**).

The overall complication rate was 6%, and complications reported included uterine perforation ($n = 1$) and cervical injury ($n = 1$). The single perforation was noted at the time of dilation, and the intrauterine morcellator was not activated inside the uterus. No case reported a fluid deficit of >2000 mL, air embolus, pulmonary edema, or postoperative hospitalization. Additionally, there were 3 cases (9%) that reported a premature termination of the morcellator device. One premature termination was secondary to inadequate distension, while the remaining 2 were noted secondary to an inability of the operating room staff to properly prime and initiate the fluid management system. No procedure was prematurely terminated secondary to inadequate visualization.

4. Discussion

The hysteroscopic morcellator has many attractive features, which make it a desirable device for the treatment of intrauterine pathology. First, the sophisticated fluid management system, the vacuum within the handheld device, and the continuous outflow of the hysteroscope allow for a consistently clear visual field. Second, the absence of monopolar electrocautery allows surgeons to employ normal saline as the distending media, thus avoiding the risk of electrolyte abnormalities associated with larger fluid deficits. Finally, this technique allows for directed

Table 1. Baseline characteristics of cases that utilized the intrauterine morcellator.

Characteristic	Mean ± SD (Range)
Age of patient	34 ± 3.38 (29 - 40)
% Nulliparous	87%
Pathology Size	1.14 ± 0.46 cm (0.6 - 1.9 cm)
History of Prior Procedures	39%
Characteristic	Mean ± SD (Range)

Table 2. Surgical indication for cases that utilized the intrauterine morcellator.

Indication	Percentage
Endometrial polyp	54.5%
Type 0 intrauterine fibroid	18.2%
Filling defect on preoperative imaging	15.2%
Abnormal uterine bleeding	9.1%
Synechiae	3%

Table 3. Intraoperative characteristics of all cases that utilized the intrauterine morcellator.

Characteristic	Mean ± SD (Range)
Operative Time	39 ± 29 minutes (15 - 122 minutes)
Fluid Deficit	286 ± 479.5 mL (30 - 2000 mL)

Table 4. Comparison of mean operative time and fluid deficit for endometrial polyps versus submucosal fibroids.

Characteristic	Endometrial Polyp (Mean ± SD)	Uterine Fibroid (Mean ± SD)	P value
Operative Time	32 ± 22	47 ± 20.9	0.11
Hysteroscopic Fluid Deficit	197 ± 184.4	785 ± 956.7	<0.05

pathologic tissue removal, avoiding damage to the remaining endometrium, which can often be encountered with conventional hysteroscopy with dilation and curettage or from resectoscopy secondary to thermal spread.

Despite its introduction early in the millennia, very few studies have evaluated the use of this, and the only reports within the United States have come from a single center [3]-[6]. However, all of which have concluded that it is a safe and effective means to treat a variety of intrauterine pathology (Table 4) [5] [7]-[11]. The original report of the use of the intrauterine morcellator was published in 2005 [3]. In this study, Emanuel, *et al.* reported that operative time for both endometrial polyps as well as submucous fibroids were significantly lower with the use of the intrauterine morcellator when compared to the use of monopolar high-frequency resectoscopy; this reduction in operative time has since been corroborated at different institutions [3]-[5]. Thereafter, the authors performed a randomized controlled study to compare conventional resectoscopy and hysteroscopy amongst residents in training to assess the ease of learning this new technique [4]. Again, despite novice use, the mean operative time was reduced with the intrauterine morcellating device, and subjective surgeon and trainer scores for convenience of the technique favored the intrauterine morcellator [4]. Importantly, there was no learning curve in first time users [4]. Finally, review of the literature also allowed us to appreciate that morcellation has not been found to change the interpretation of the resected tissue evacuated, and may result in an overall lower recurrence rate of endometrial polyps when compared to conventional resectoscopy [6, MM Alhilli, Mayo Clinic, unpublished data, 2010] (Table 5).

We aimed to review the use of the HM at a single US academic center. The limitations of the current study include the limited number of cases reported as well as a lack of a comparable control group utilizing other hys-

Table 5. Literature review of hysteroscopic morcellation.

Author, Year	Study Design	Objective	N	Summary	Conclusions	Limitations
Pakrashi, 2013	Case Report	To describe a case of complete enucleation of a Type II leiomyoma using the hysteroscopic morcellator (HM)	1	Removal of two submucosal leiomyomas (Type I 2.9 cm and Type II 1.9 cm) in a 41 y/o P0 female with infertility and symptomatic uterine fibroids	THM can act as a hook allowing for complete removal of submucous fibroids	No post-operative follow up imaging
Simons, 2011	Case Report	To describe whether the hysteroscopic morcellator (HM) can be used as an alternative device for uterine septum removal	1	Successful removal of a uterine septum in a 34 yo woman with recurrent miscarriages and history of bicornuate uterus.	HM is safe (no complications, EBL <100 cc), efficient (23 minute procedure time), and effective (follow up MRI at 10 weeks post-op revealed no signs of septum) alternative for uterine septum	None
Hamerlynck, 2011	Case Series	To evaluate the feasibility, effectiveness and safety for removal of intrauterine lesions using a small diameter hysteroscopic morcellator (HM)	23	Operative details of HM in women (age 28 - 76 yo) who underwent HM for various uterine pathology, including endometrial polyp (n = 15), submucous fibroid (n = 5), retained placenta (n = 2), and thickened endometrial lining (1).	HM is a safe (median fluid loss 210) and efficient (mean operating time 6 minutes) alternative to conventional resectoscopy (no conversion to conventional method)	No direct comparison to conventional resectoscopy
AlHilli, 2011	Retrospective cohort review	To compare recurrence rates and factors associated with recurrence of endometrial polyps (EP) following operative hysteroscopy (OH) and hysteroscopic morcellation (HM).	311 ^a	Operative details of HM in women with endometrial polyps were compared between OH and HM. A total of 59 patients had a recurrence, the majority of which occurred 5 years post-operatively (29%).	Recurrence of EP is independent of the method of removal (OH vs. IM, p = 0.40). Risk factors for recurrence included younger age and being premenopausal.	None
Lanzani, 2011	Prospective descriptive	To evaluate the feasibility of office hysteroscopy in the treatment of endometrial polyps larger than 15 mm with a "two-step" removal using the intrauterine morcellating device.	59	The "two-step" office polyp removal included an initial histologic sampling at the base of polyp and deep incision of the pedicle without removal of the lesion followed by removal after 2 months. This approach was performed in a postmenopausal cohort with a median age of 58.37.	A "two step" office confers lower cost, and is a safe (no severe complications reported) and efficient (median time of procedure 8.25 minutes) alternative to conventional resectoscopy in postmenopausal women.	No definition for severe complications or direct comparison to conventional resectoscopy.
Hamerlynck, 2011	Retrospective descriptive	To report the experience with a novel technique, the hysteroscopic morcellator (HM), for removal of intrauterine fibroids and endometrial polyps.	315	Operative details of HM in women with endometrial polyps (n = 278) and fibroids (n = 37) were assessed. The mean diameter for intrauterine fibroids was 2.0 cm (Type 0, n = 23; Type 1, n = 11; Type 2, n = 3)	The HM is a safe (mean fluid deficit for fibroids 440cc, for polyps, 40cc) and efficient (mean operating time 18.2 minutes for fibroids, and 6, 6 minutes for polyps) alternative to conventional resectoscopy. However, 3 conversions to conventional resectoscopy were needed in the fibroid cohort, and they recommended against its use in Type 2 fibroids.	

a. (OH = 172, IM = 139).

teroscopic techniques. Given our very strict inclusion criteria, as well as the use of an electronic search system, it is not surprising that the number of cases yielded is low. The limitations of an electronic database include the inclusion of cases that may have not utilized the HM despite their note of its use intra-operatively, for instance the single case during which uterine perforation was encountered, and as such the HM was not activated. Additionally, there may have been missed cases secondary to poor charting or coding. As this is a descriptive study, our next step in examining the utilization of this device will include comparison to a conventional resectoscopic control group.

In accordance with these previous reports, we found that the total operating time while utilizing the intrauterine morcellator was acceptably short, allowing for the overall fluid deficit to also be small. Importantly, as all data was obtained from an academic training center, we should note that the primary surgeon in all cases was either a resident or fellow physician, which may account for the slightly higher operating time encountered when compared to other descriptive studies for HM. Additionally, the operating time included the time from the placement of the speculum to the removal of the speculum, and so also included time for cervical dilation, which can also help to explain the slightly higher operating time encountered when compared to previous reports, especially as the majority of the patients in our study population were primiparous.

We also report a unique indication for the HM. Although all previous reports described the use of the morcellator for uterine polyps or fibroids, we report a novel use of the device for Asherman's syndrome.

Consistent with previous reports, we also found an acceptably low complication rate, with a single significant complication (uterine perforation). An advantage of the use of HM, in the setting of an unrecognized uterine perforation at the time of activation, is the absence of electrocautery. Accordingly, significant thermal injury in this scenario would be avoided. A single minor complication occurred secondary to cervical avulsion upon initial attempt at placing the hysteroscope, which resulted in no long-term morbidity, and was secondary to a difficult cervical dilation. The cited complication rate for operative hysteroscopy is 2% - 3%, and this risk may be elevated up to 5% in hysteroscopic myomectomies, and additionally, more than half of complications encountered during diagnostic and operative hysteroscopies is entry related [12]-[14]. We hypothesize that as the majority of our cohort were nulliparous, dilation of the non-parous cervix to accommodate a 9 mm hysteroscope may have been particularly challenging; our complication may also appear elevated given our small sample size, and we suspect that with prospective collection of a larger cohort of women, the complication rate will be very similar to that encountered with conventional hysteroscopy. Additionally, our reported cases were also performed prior to the introduction of a smaller 5 mm operative hysteroscope for the intrauterine morcellator, which would require less aggressive cervical dilation and uterine entry (Smith & Nephew, Andover, USA). As such, we believe that use of this newer device in a nulliparous population may help to avoid any cervical injury that may be encountered from forceful dilation of a non-accommodating cervix.

With the exception of a prematurely terminated case secondary to uterine perforation, we also found that the intrauterine morcellator completely removed all targeted pathology, including type 0 fibroids up to 1.5 cm, without recurrence or need for a second procedure for the same pathology within 6 months. Additionally, we did not find any reports of inadequate or reduced visualization, and we believe this is secondary not only to the fluid management system but also because of the immediate aspiration of all pathology once resected. Finally, we did not encounter any cases of excessive bleeding. This is especially important, as we initially believed that the absence of available energy for electrocautery to help seal vessels, which may be critical during hysteroscopic myomectomies, might be a disadvantage to the use of the morcellator. On the contrary, we found that the use of the morcellator was not precluded from excessive bleeding.

The intrauterine morcellator is a contemporary adjunct to operative hysteroscopy and has been overall understudied, specifically in the United States. From our small case series, we have found that this device is effective for the treatment of endometrial polyps, fibroids, and intrauterine synechiae, without a recurrence of pathology that the operative time is acceptably short, and the overall fluid deficit is small. Furthermore, the absence of energy for electrocautery shouldn't disqualify its use, even with hysteroscopic myomectomies. Finally, although the complication rate was noted to be 6%, this translated to 1 major complication (uterine perforation), and one minor complication which had no long-term effect and which may have been secondary to that patient's nulliparous state.

We note that, as this study is retrospective, the main limitation is that there is no control group; *i.e.*, we cannot definitely state from our cohort that operative times, fluid deficit, and complication rates were significantly different than that experienced with conventional operative hysteroscopy at our institution. However, with these in-

itial findings, we have fueled our desire to undergo a larger prospective cohort study; with this, we expect to find that these factors would be similar, especially with the advent of the smaller operative hysteroscope utilized for this device.

5. Conclusion

The intrauterine morcellator is a useful tool for the surgical treatment of intrauterine pathology that confers a low operative risk.

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