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A review of hysteroscopic myomectomy cases: A 5-year experience in a tertiary hospital

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Abstract:

BACKGROUND: Hysteroscopic myomectomy is regarded as the gold standard in the management of intracavitary myomas. With its increased use, it is essential to explore its effectiveness for better therapeutic planning and patient selection.

OBJECTIVES: This study aimed to determine the effectiveness of hysteroscopic myomectomy performed in a tertiary hospital in the Philippines.

METHODS: A retrospective cross-sectional study of women who underwent hysteroscopic myomectomy in 5 years was performed.

RESULTS: A total of 167 women were included. Completeness of resection was achieved in 88.46% of the cases. In the final multivariate model, older age, pretreatment with gonadotropin-releasing hormone (GnRH) agonist, and lesser total fluid input were associated with increased odds of complete resection. Submucous myoma at least 3 cm in size had greater total fluid input, greater blood loss, the presence of complications, and a greater need for transfusion. Pretreatment with GnRH agonists had more International Federation of Gynecology and Obstetrics Grade 1 and 2 myoma, higher frequency of ≥3 myomas, lower frequency of complete resection, and increased operative time compared to those without pretreatment with GnRH agonists. Pretreatment with other hormonal therapy had a lesser need for transfusion compared to those without pretreatment with hormonal therapy.

CONCLUSIONS: Hysteroscopic myomectomy is a generally safe and effective procedure for the treatment of submucous myomas. The odds of complete resection are greater with older age and decreased with pretreatment with GnRH agonist and more distention fluid used. Larger submucous myoma was associated with greater total fluid input and blood loss, more complications, and greater need for transfusion. Pretreatment with GnRH agonist had no significant benefit and was associated with longer surgical time and lesser complete resection.

Keywords:

Fibroids, hysteroscopy, myomectomy, submucous myoma

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Introduction

Uterine leiomyomas are the most common solid benign tumors of the uterus, affecting 50%–60% of women. While the majority remain asymptomatic, about 30%–40% of patients manifest with various symptoms depending on the size and location of the myoma.[1] Clinical presentation includes abnormal uterine bleeding, pelvic mass or pain, and pressure symptoms and they may also be associated with infertility and poor obstetric outcomes.[1,2] Myomas have historically been surgically managed through hysterectomy or abdominal myomectomy.[3,4] With the advent of endoscopy, submucous myomas are accessible from the inner surface of the uterus and can now be removed transcervically with the use of a resectoscope.[5,6] Hysteroscopic myomectomy is regarded as the gold standard in the treatment of intracavitary

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myomas.[7,8] The increased use of myomectomy stems from the desire to retain reproductive potential, especially in young patients.[3] Hysteroscopic myomectomy should ideally be completed in only one surgical procedure.[6] Several factors, such as the number, size, and location of the myoma and preoperative hormonal treatment, influence the surgical outcomes, including the presence of complications.[6]

A study that explored the factors associated with complete myomectomy in a single surgical step and early complications, found that the chance for a complete resection is greater in small and completely intracavitary or International Federation of Gynecology and Obstetrics (FIGO) Grade 0 myoma.[9] The only independent factor found for the occurrence of early complications was an incomplete myomectomy.[9] Various studies have established that the size of the myoma plays a crucial role in the completion of a single-step hysteroscopic myomectomy. Myomas with a diameter >3 cm in Type 2 myomas were significantly associated with multi-step procedures.[10] In addition, preoperative hormonal treatment, particularly gonadotropin-releasing hormone (GnRH) analogs has been used over the years to decrease the size and vascularization and treat the symptoms of myomas.[11,12] It has been used as an adjunct in the treatment of myomas to facilitate its resection during hysteroscopy.[13] While some studies have shown a significant decrease in the volume of the myoma, reduction in operative time, bleeding, and total volume of fluid used, and decreased failure rate among patients pretreated with GnRH analogs,[13,14] other studies show that there was no improvement in outcomes including surgical time, complications, resolution of symptoms postoperatively, and the need for repeat surgery.[15,16] Literature search has shown very limited studies on hysteroscopic myomectomy cases done in the Philippines.

This study reviewed and analyzed the cases of hysteroscopic myomectomy done in a tertiary hospital in the Philippines, evaluated its effectiveness, and compared the results with those in published literature. The results will not only help in the evaluation, therapeutic planning, and proper selection of patients with submucous myoma to undergo hysteroscopic myomectomy but also guide in the proper counseling of patients. This is done to achieve more favorable surgical outcomes and prevent complications in doing hysteroscopic myomectomy.

Objectives

General objective

To determine the effectiveness of hysteroscopic myomectomy performed in a tertiary hospital.

Specific objectives

1. To determine the proportion of complete resection after an initial hysteroscopic myomectomy procedure
2. To determine the factors (age, parity, pretreatment with hormonal therapy, characteristics of the myoma including size and location, FIGO classification, operative time, fluid input and deficit, and complication rate) associated with complete resection after an initial hysteroscopic myomectomy procedure
3. To compare the operative outcomes (completeness of resection, total operative time, total fluid input, fluid deficit, estimated blood loss, and complication rate) of submucous myoma <3 cm versus ≥3 cm
4. To compare the operative outcomes (completeness of resection, operative time, total fluid input, fluid deficit, estimated blood loss, and complication rate) of cases preoperatively treated with GnRH agonist, other hormonal therapy, and those with no preoperative hormonal treatment.

Methods

A retrospective cross-sectional study was done with a review of medical records of women who underwent hysteroscopic myomectomy during 5 years between January 2017 and December 2021 in a tertiary university hospital in the Philippines.

Inclusion criteria

1. All women who underwent hysteroscopic myomectomy will be included in the study
2. Only patients with a histopathologic confirmation of a myoma will be included.

Exclusion criteria

1. Patients with FIGO Type 3 submucous myoma
2. Women with no histopathologic confirmation of a myoma
3. Women with incomplete data in patient records.

A thorough search of all cases that underwent myomectomy was done through the review of medical charts, census, and operative records and confirmed with the histopathologic findings. Nine cases with a histopathologic finding not showing a myoma, such as a polyp or carcinoma, were excluded from the study. The procedures were performed by senior fellows-in-training on Reproductive Endocrinology and Infertility under the supervision of consultants or consultant-assisted procedures. All the demographic variables and data were analyzed.

The following clinical, sociodemographic information, including age, body mass index (BMI), obstetric score, menopausal status, and pretreatment with GnRH agonist or other hormonal therapy, were extracted from patient records using a data collection form. The following

characteristics of the hysteroscopy procedure were also recorded:

i. Preoperative: Indication for the procedure, ultrasound and SIS findings, preoperative antibiotics, and cervical priming agent used
ii. Intraoperative: Type of anesthesia, operative findings – size, location, number and type of submucous myoma, fluid distention media used and the total input, output, and volume deficit, total operative time, estimated blood loss, and size and model of resectoscope used
iii. Postoperative: Completeness of procedure (complete resection or not), complications encountered (cervical laceration, perforation, infection, and bleeding), need for transfusion, postoperative antibiotics, and histopathology findings.

Data from the surgeries that were performed from March 2020 to December 2021 were reviewed through the hospital's electronic medical records system. There were 15 charts not in file upon request from the medical records section and thus not included in the study as well.

Statistical analysis

Descriptive statistics was used to summarize the demographic and clinical characteristics of the patients. Frequency and proportion were used for categorical variables (menopausal status, parity, preoperative hormonal treatment, location of myoma, FIGO Grade, and number of myomas), median and interquartile range (IQR) for nonnormally distributed continuous variables (length of hospital stay, operative time, fluid input, fluid output, fluid deficit, estimated blood loss, and complication rate), and mean and standard deviation for normally distributed continuous variables (age, BMI, and size of myoma). Mann–Whitney *U* test and Fisher's Exact/Chi-square test were used to determine the difference of rank and frequency, respectively, between two independent groups (size of myoma, pretreatment with GnRH agonist, and pretreatment with other hormonal therapy). Odds ratio (OR) and corresponding 95% confidence intervals (CIs) from binary logistic regression were computed to determine the factors associated with complete resection among patients after an initial stage procedure. The backward stepwise elimination method was utilized to determine the final multivariate model. All statistical tests were two-tailed tests. Shapiro–Wilk test was used to test the normality of the continuous variables. Missing values were neither replaced nor estimated. Null hypotheses were rejected at 0.05 α-level of significance. STATA 13.1 (StataCorp LLC, College Station, TX, USA) was used for data analysis.

Ethical approval

Ethical approval was obtained from the research ethics review board.

Results

A total of 167 patients who underwent hysteroscopic myomectomy were included in the study with a retrieval rate of 91.8%.

Clinical and sociodemographic data

The average age at the time of the procedure was 39.58 (±8.56) years. Most (around 42%) of the women were obese: 28.74% Obese 1, 11.38% Obese II, and 1.8% Obese III. The majority (nearly 70%) had at least one child. A total of 11 women or 6.59% were menopausal. One hundred thirty-six or 81.44% of the women received preoperative hormonal treatment where only 36 women (21.56%) were pretreated with GnRH agonist. For the preoperative ultrasound findings of these women, the mean size of the largest diameter of the myoma was 3.7 (±1.80) cm. The most common location was at the anterior wall (39.61%), followed by the posterior wall (25.97%), fundal (22.73%), and lastly at the lateral wall (2.6%). Majority of the myoma were classified as FIGO Grade 0 (70.13%). Table 1 summarizes the demographic and clinical profile of the patients with their preoperative ultrasound findings.

Characteristics of the hysteroscopy procedure

The different characteristics of the hysteroscopy procedure are shown in Table 2. The main indication for the hysteroscopy procedure was abnormal uterine bleeding in 157 patients (94.01%) The second main indication was infertility at 7.19%. All patients were given pre-operative (80.84%) was the most common antibiotic given. Evening primrose capsule was the cervical priming agent used in 92 women (55.09%) The cervical priming agent used was not indicated in 75 cases (44.91%). In total, 156 or 93.41% of the cases were initial-staged procedures and 10 (5.99%) were second-staged procedures. A third-stage or third-step myomectomy procedure was done in one of the cases. antibiotics and Cefuroxime.

The majority of the myomas (73.05%) had the largest diameter of at least 3 cm while 26.95% measured <3 cm. The most common location of the myomas was in the posterior wall (38.92), followed by lateral (35.33%), fundal (20.96%), and lastly at the anterior wall (20.36%). Most myomas were classified as Grade 0 (64.67%), 38.32 as Grade 1 and 3.59% as Grade 2. In 88.62% of the cases, there was a single myoma, in 5.39%, there were two myomas, and in 5.99%, there were at least three myomas to be treated. In total, 63 women presented with a prolapsed submucous myoma.

The median duration of the surgery was 65 min (IQR 45–94). The median volume of irrigation fluid required was 10,000 mL (IQR 6000–16500) while the median fluid

Table 1: Demographic and clinical profile of the patients (*n*=167)

	Frequency (%), mean±SD, median (IQR)
Age	39.58±8.56
Menopausal	11 (6.59)
Parity	
Nulliparous	51 (30.54)
Parous	116 (69.46)
Length of hospital stay (days)	4 (3–5)
BMI	24.78±4.06
Underweight	2 (1.2)
Normal	54 (32.34)
Overweight	41 (24.55)
Obese I	48 (28.74)
Obese II	19 (11.38)
Obese III	3 (1.8)
Chief complaint	
Nonbleeding	14 (8.38)
Bleeding	153 (91.62)
Preoperative hormonal treatment	
Yes	136 (81.44)
GnRH agonist	36 (21.56)
Other hormonal treatment	131 (78.44)
No	31 (18.56)
Preoperative ultrasound findings (*n*=154)	**Frequency (%), mean±SD, median (IQR)**
Size (cm)	3.70±1.80
Locations	
Anterior	61 (39.61)
Posterior	40 (25.97)
Fundal	35 (22.73)
Lateral	4 (2.6)
FIGO Grade	
Grade 0	108 (70.13)
Grade 1	36 (23.38)
Grade 2	9 (5.84)
Grade 3	2 (1.3)
Grade 4	3 (1.95)
Grade 5	1 (0.65)
Number of submucous myoma	
0	3 (1.95)
1	141 (91.56)
2	8 (5.19)
3	2 (1.3)

BMI: Body mass index, IQR: Interquartile range, SD: Standard deviation, FIGO: International Federation of Gynecology and Obstetrics, GnRH: Gonadotropin-releasing hormone

deficit at the end of the surgery was 300 mL (IQR 0–500). The median estimated blood loss was 70 mL (IQR 50–150). In 43 cases, "minimal blood loss" was reported for the estimated blood loss with no specific quantity indicated. Additional procedures were performed in addition to the hysteroscopy procedure in 64 cases. The additional procedures included 32 hysteroscopic polypectomies, 36 endometrial curettages, 1 insertion of Mirena, 4 operative laparoscopies with oophorocystectomy, 1 operative laparoscopy with bilateral tubal ligation and fulguration of implants, 1 operative laparoscopy with myomectomy, 1 operative laparoscopy with enterolysis and excision of paratubal cyst, 1 operative laparoscopy with adhesiolysis and laparoscopic guided hysteroscopic myomectomy, 2 diagnostic laparoscopy, and 1 case with overlapping sphincteroplasty, with layered repair, perineoplasty. Out of the 156 patients who had an initial-stage procedure, complete resection was achieved in 88.46%.

Complications were encountered in 15 (8.98%) cases. These complications included seven cases of bleeding, three with asymptomatic hyponatremia, one case of hypokalemia, one case of fluid overload, 1 case of tachycardia intraoperatively, and another case of chest heaviness with the occurrence of premature ventricular contractions. The complication rate included the patients who had blood transfusions intraoperatively and postoperatively. Blood transfusion was done in a total of 59 cases, 56 (33.53%) preoperatively, 2 (1.2%) intraoperatively, and 10 (5.99%) postoperatively. The median length of hospital stay of the patients was 4 days. In nine cases, a histopathology result of adenomyoma was found.

In the univariate analysis of variables associated with complete resection after an initial stage procedure, as shown in Table 3, it was found that the factors associated with complete resection include age, parity, pretreatment with GnRH agonist, location of myoma, FIGO classification of myoma, number of myoma, total operative time, total fluid input, fluid deficit, presence of complications, and the need for blood transfusion. Women with older age (OR 1.1793, 95% CI 1.08–1.28; $P < 0.001$), who at least had one vaginal delivery ($P = 0.014$), and with a FIGO Grade 0 myoma ($P = 0.014$) had increased odds of having complete resection in an initial-staged procedure. Women with pretreatment with GnRH agonist (OR: 0.12, 95% CI: 0.04–0.34, $P < 0.001$), with myomas located at the lateral (OR: 0.2979, 95% CI: 0.11–0.82; $P = 0.019$) or fundal wall (OR: 0.3143; 95% CI: 0.11–0.90; $P = 0.030$), with FIGO Grade 1 (OR: 0.1293; 95% CI: 0.04–0.42; $P = 0.001$) or Grade 2 myoma (OR: 0.0735; 95% CI: 0.01–0.48; $P = 0.006$), with 2 (OR: 0.0415; 95% CI: 0.01–0.20; $P < 0.001$) or at least 3 myoma (OR: 0.0865; 95% CI: 0.02–0.38; $P = 0.001$), with longer operative time (OR: 0.9818; 95% CI: 0.97–0.99; $P < 0.001$), with greater total irrigation fluid used (OR: 0.9216; 95% CI: 0.87–0.97; $P = 0.005$) and greater fluid deficit (OR: 0.1702; 95% CI: 0.06–0.49; $P = 0.001$), with presence of complications (OR: 0.2154; 95% CI: 0.06–0.81; $P = 0.023$) and the need for blood transfusion (OR: 0.3079; 95% CI: 0.11–0.85; $P = 0.023$) have decreased odds of having complete resection. After multivariate analysis was performed with backward stepwise elimination of variables at $P = 0.05$, only older age, pretreatment with GnRH agonist, and total fluid input remained to be

Table 2: Characteristics of the hysteroscopy procedure

	Frequency (%), median (IQR)
Indication for procedure	
Abnormal uterine bleeding	157 (94.01)
Infertility	7 (4.19)
Incidental finding on ultrasound	4 (2.4)
Introital mass	3 (1.8)
Postmenopausal bleeding	2 (1.2)
Procedure	
Initial stage	156 (93.41)
2nd stage	10 (5.99)
3rd stage	1 (0.60)
Operative findings	**Frequency (%), median (IQR)**
Size of myoma (cm)	3.86±1.80
<3	45 (26.95)
>3	122 (73.05)
Location of myoma	
Posterior wall	65 (38.92)
Lateral wall	59 (35.33)
Fundal wall	35 (20.96)
Anterior wall	34 (20.36)
FIGO classification	
Type 0	108 (64.67)
Type 1	64 (38.32)
Type 2	6 (3.59)
Number of myomas	
1	148 (88.62)
2	9 (5.39)
>3	10 (5.99)
Total operative time (min)	65 (45–94)
Fluid input (cc)	10,000 (6000–16,500)
Fluid output (cc)	10,000 (5600–16,200)
Fluid deficit (cc)	300 (0–500)
Estimated blood loss (cc)	70 (50–150)
Additional procedures performed	64 (38.32)
Complete resection	145 (86.83)
Complete resection (initial stage)	138 (88.46)
Histopathology result	
Leiomyoma	159 (95.21)
Adenomyoma	9 (5.39)

IQR: Interquartile range, FIGO: International Federation of Gynecology and Obstetrics

associated with complete resection after an initial-staged procedure in the model.

Table 4 shows the comparison of operative outcomes with the size of the submucous myoma. The size of the myoma is associated with total fluid input, estimated blood loss, the presence of complications, and the need for transfusion. Those myoma with at least 3 cm in size diameter had greater total fluid input ($P < 0.001$), greater blood loss ($P = 0.014$), presence of complications ($P = 0.012$), and a greater need for transfusion ($P < 0.001$), particularly the need for preoperative transfusion ($P < 0.001$). There was no association and significant differences found among the other outcomes such as completeness of the resection, total operative time, fluid deficit, and the need for intraoperative and postoperative transfusion.

Table 5 shows the comparison of parameters among those pretreated with GnRH agonists versus those not pretreated with GnRH agonists. Those pretreated with GnRH agonist had more Grade 1 ($P = 0.020$) and Grade 2 ($P = 0.020$) myoma with less Grade 0 ($P = 0.018$) myoma, had a higher frequency of at least 3 myomas ($P = 0.015$), lower frequency of complete resection ($P < 0.001$), and increased operative time ($P = 0.017$). There were no significant differences in terms of fluid input and deficit, estimated blood loss, presence of complications, and need for blood transfusion between those with pretreatment with GnRH agonist and those without. On the other hand, Table 6 shows the comparison of parameters among those pretreated with other hormonal therapy versus those not pretreated with other hormonal therapy. Patients pretreated with other hormonal therapy had a lesser need for transfusion ($P = 0.038$), particularly the need for preoperative transfusion ($P = 0.027$), compared to those without pretreatment with other hormonal therapy.

Discussion

Hysteroscopic myomectomy is widely used as the standard approach in the removal of submucosal myomas, which comprise 5%–10% of all myomas.[9] The hysteroscopic approach is generally preferred, when possible, because of its effectiveness and minimally invasive nature.[17] It has significant advantages in terms of shorter recovery time and length of hospitalization, decreased pain, less complications with a faster return to daily activities.[16]

Abnormal uterine bleeding is the most common presentation, which prompts patients to seek medical attention and eventually leading to surgical treatment of the myoma.[4] Preutthipan reported a series of 50 patients who underwent hysteroscopic myomectomy where heavy menstrual bleeding was the most common presentation (60%).[3] In another retrospective review of 120 hysteroscopy myomectomy cases by Muñoz *et al*., abnormal uterine bleeding (84.1%) was the most frequent indication for the surgery.[4] In our patients, abnormal uterine bleeding was also the most common indication for the surgical procedure (94.01%). Reproductive problems such as infertility are also common indications for hysteroscopic myomectomy and are considered the second leading indication.[4] In this study, infertility (4.19%) was the second most frequent indication for the procedure. This is similar to the findings in the study by Munoz, where infertility was the second leading reason for consult.

Table 3: Factors associated with complete resection among patients who underwent an initial stage procedure

Parameters	Univariate		Multivariate	
	Crude OR (95% CI)	*P*	Adjusted OR (95% CI)	*P*
Age	1.1793 (1.08–1.28)	<0.001	1.2050 (1.08–1.34)	0.001
Parity				
Nulliparous	Reference	-	-	-
Parous	3.5417 (1.30–9.67)	0.014	-	-
Pretreatment with GnRH agonist	0.12 (0.04–0.34)	<0.001	0.1509 (0.04–0.51)	0.002
Operative findings	**Univariate**		**Multivariate**	
	Crude OR (95% CI)	*P*	Adjusted OR (95% CI)	*P*
Location of myoma				
Lateral wall	0.2979 (0.11–0.82)	0.019	-	-
Fundal wall	0.3143 (0.11–0.90)	0.030	-	-
FIGO classification				
Type 0	3.5918 (1.30–9.91)	0.014	-	-
Type 1	0.1293 (0.04–0.42)	0.001	-	-
Type 2	0.0735 (0.01–0.48)	0.006	-	-
Number of myomas				
1	Reference	-	-	-
2	0.0415 (0.01–0.20)	<0.001	-	-
>3	0.0865 (0.02–0.38)	0.001	-	-
Total operative time (min)	0.9818 (0.97–0.99)	<0.001	-	-
Fluid input	0.9216 (0.87–0.97)	0.005	0.8884 (0.82–0.97)	0.006
Fluid deficit	0.1702 (0.06–0.49)	0.001	-	-
Complication rate	0.2154 (0.06–0.81)	0.023	-	-
Need for transfusion	0.3079 (0.11–0.85)	0.023	-	-
Preoperative	0.2784 (0.10–0.77)	0.014	-	-

OR: Odds ratio, CI: Confidence interval, FIGO: International Federation of Gynecology and Obstetrics, GnRH: Gonadotropin-releasing hormone

Table 4: Comparison of operative outcomes between submucous myoma <3 cm and ≥3 cm

	Size of myoma, frequency (%); median (IQR)		*P*
	<3 (*n*=45; 27%)	>3 (*n*=122; 73%)	
Complete resection	42 (93.33)	103 (84.43)	0.196
Fluid input	6000 (4000–9500)	12,650 (8000–19,000)	<0.001
Fluid deficit	300 (0–500)	300 (0–500)	0.657
Total operative time (min)	60 (42–80)	70 (45–100)	0.198
Estimated blood loss (cc)	50 (50–60)	100 (50–200)	0.014
Complication rate	0	15 (8.98)	0.012
Need for transfusion	1 (2.22)	58 (47.54)	<0.001
Preoperative	1 (2.22)	55 (45.08)	<0.001
Intraoperative	0	2 (1.64)	1.000
Postoperative	0	10 (8.2)	0.064

IQR: Interquartile range

The success of hysteroscopic myomectomy is largely dependent on the characteristics of the myoma such as diameter, location, type/grade, and number, and also on the surgeon's experience and available equipment.[7] In this present study, we found that those with submucous myoma, at least 3 cm in size had greater total fluid input, greater blood loss, had presence of complications, and greater need for transfusion. These may be expected findings owing to the larger diameter and volume of the myoma. The diameter of the myoma appeared to be the most significant factor associated with the need for multiple-step procedures due to the correlation between diameter and volume increments of the myoma as the diameter increases.[7] The volume of a myoma increases faster with an increase in the diameter.[7,18] A retrospective review by Keskin *et al*. revealed that Type 0, 1, or 2 myomas that are <3 cm can be resected by a single-step hysteroscopy while larger myomas with diameter ≥3 cm may necessitate multiple sessions.[7] This was similar to the findings of another retrospective study by Mazzon *et al*.[6] In the patients who completed a single-step procedure, the mean size of the fibroids resected was 22.83 ± 9.36 mm, while those in the multiple-step procedure had a mean size of 29.67 ± 10.76 mm.[6] All Grade 0 myomas were removed in a single-step procedure, while the chance of successfully completing the hysteroscopic myomectomy in a single-step was 88.59% for Grade 1

Table 5: Comparison of operative findings and outcomes between those pretreated with gonadotropin-releasing hormone and those without gonadotropin-releasing hormone agonist

Operative findings	Pretreatment with GnRH agonist, frequency (%); median (IQR)		*P*
	With (*n*=36; 22%)	Without (*n*=131; 78%)	
Size of myoma (cm)			
<3	11 (30.56)	34 (25.95)	0.672
>3	25 (69.44)	97 (74.05)	
FIGO classification			
Type 0	17 (47.22)	91 (69.47)	0.018
Type 1	20 (55.56)	44 (33.59)	0.020
Type 2	4 (11.11)	2 (1.53)	0.020
Number of myomas			
1	29 (80.56)	119 (90.84)	0.015
2	1 (0.278)	8 (6.11)	
>3	6 (16.67)	4 (3.05)	
Complete resection	22 (61.11)	123 (93.89)	<0.001
Fluid input	10,000 (8000–20,000)	10,000 (5400–16,000)	0.155
Fluid deficit	400 (0–500)	300 (0–500)	0.383
Total operative time (min)	83.5 (55–121)	63 (44–85)	0.017
Estimated blood loss (cc)	50 (50–200)	80 (50–150)	0.870
Complication rate	6 (16.67)	9 (6.87)	0.095
Need for transfusion	13 (36.11)	46 (35.11)	1.000
Preoperative	13 (36.11)	43 (32.82)	0.696
Intraoperative	1 (2.78)	1 (0.76)	0.386
Postoperative	4 (11.11)	6 (4.58)	0.225

IQR: Interquartile range, FIGO: International Federation of Gynecology and Obstetrics, GnRH: Gonadotropin-releasing hormone

Table 6: Comparison of outcomes pretreated with other hormonal therapy and those not pretreated with other hormonal therapy

Operative findings	Pretreatment with other hormonal therapy, frequency (%); median (IQR)		*P*
	With (*n*=131; 78%)	Without (*n*=36; 22%)	
Size of myoma (cm)			
<3	34 (25.95)	11 (30.56)	0.672
>3	97 (74.05)	25 (69.44)	
FIGO classification			
Type 0	83 (63.36)	25 (69.44)	0.559
Type 1	51 (38.93)	13 (36.11)	0.848
Type 2	6 (4.58)	0	0.342
Number of myomas			
1	117 (89.31)	31 (86.11)	0.741
2	7 (5.34)	2 (5.56)	
>3	7 (5.34)	3 (8.33)	
Complete resection	112 (85.5)	33 (91.67)	0.415
Fluid input	10,000 (6000–17,000)	10,500 (6400–15,500)	0.916
Fluid deficit	300 (0–500)	300 (200–500)	0.337
Total operative time (min)	67 (44–90)	62.5 (50–104)	0.636
Estimated blood loss (cc)	80 (50–150)	50 (50–300)	0.567
Complications encountered	10 (7.63)	5 (13.89)	0.320
Need for transfusion	41 (31.3)	18 (50)	0.038
Preoperative	38 (29.01)	18 (50)	0.027
Intraoperative	1 (0.76)	1 (2.78)	0.386
Postoperative	7 (5.34)	3 (8.33)	0.451

IQR: Interquartile range, FIGO: International Federation of Gynecology and Obstetrics

and 82.55% for Grade 2 myomas.[6] This study showed that a diameter >3 cm in Grade 2 myomas is associated with a higher risk for multistep procedure. Both myoma size and grading significantly correlated to the feasibility of a single-step procedure for hysteroscopic myomectomy.[6] Submucous myomas – Types 0, 1, and 2 – measuring up to 4–5 cm can also generally be removed using a hysteroscopic approach by more

experienced surgeons.[17] However, our study did not show an association between the myoma size and the completeness in resection.

Preoperative hormonal treatment, specifically GnRH analogs has also been used as an adjunctive treatment for myomas. The combination with hysteroscopic myomectomy has offered an appealing option in managing submucous myoma.[13] Its administration preoperatively was found to result in a significant reduction in the volume of fibroids.[13] This was corroborated by a study by Perino *et al*. showing a significant reduction in operative time, bleeding, the total volume of fluid infused, and decreased failure rate among patients pretreated with GnRH analogs.[14] These can be attributed to the reduction in the size of the myoma after treatment with GnRH analogs.[14] In addition, hormonal therapy may facilitate the surgical procedure through increase in visibility and decrease in fluid absorption and blood loss due to the induced endometrial atrophy, and decreased vascularization in the endometrium.[11,12] The decreased blood flow in the endometrium in patients who received hormonal therapy may explain the finding in our study showing a decreased need for transfusion, specifically preoperatively, in patients who received other hormonal therapy compared to those without. However, this was not observed in patients with pretreatment with GnRH agonist compared to those without.

Our study also showed that pretreatment with GnRH agonists was associated with a lower frequency of complete resection and increased operative time. These findings were not consistent with the study by Perino *et al*.,[14] as mentioned above. Our study was in agreement, however, with a study by Campo *et al*. that showed a significantly longer surgical time in patients treated with GnRH analogs compared to untreated patients.[16] This was attributed to a longer time needed during cervical dilatation due to cervical resistance to dilatation, as frequently reported by the surgeon.[16] In addition to this, our study also showed that those given GnRH agonists had more Grade 1 and Grade 2 myoma and also had a higher frequency of at least 3 myoma to be treated compared to those without pretreatment with GnRH agonist. This could also explain the increased operative time and lower frequency of completeness in resection.

A study by Mavrelos *et al*. also showed similar findings to the present study showing no differences in the number of complete fibroid resections between women who received GnRH analogs and those who received placebo and with no significant differences as well in the secondary outcomes – duration of the procedure, fluid deficit, resolution of symptoms postoperatively, and the number of subsequent fibroid related operations.[15] Our study showed no significant differences in terms of fluid input and deficit, estimated blood loss, presence of complications, and need for blood transfusion between those with pretreatment with GnRH agonist and those without. Interestingly, although not significant, there were more patients in the pretreatment with the GnRH agonist group who received preoperative blood transfusion. It is known that GnRH analogs are given to patients with heavy menstrual bleeding to correct anemia before a myomectomy procedure.[19] More studies are still needed to assess the role of preoperative treatment with GnRH analogs for patients undergoing hysteroscopic myomectomy.

Complete resection after an initial or single hysteroscopic myomectomy in our study was 88.46%. This is similar to the study by Mazzon *et al*.[6] which was at 87.62% while it is higher compared to the reported rate by Lima *et al*. at 63.31%.[9] The factors associated with complete resection included age, parity, pretreatment with GnRH agonist, location of myoma, FIGO classification of myoma, number of myoma, total operative time, total fluid input and deficit, presence of complications, and the need for transfusion. In the final multivariate model, only age, pretreatment with GnRH agonist, and total fluid input were associated with complete resection after an initial staged procedure. For every increase in age, the odds of having complete resection increase by 27.55%. Patients with pretreatment with GnRH agonists were 84.91% less likely to have complete resection. For every 1000 unit increase in the total fluid input, the odds of a complete resection decreased by 15.46% after adjustment to other variables.

Patients with FIGO Type 0 were more likely to have complete resection on the initial stage/step procedure, in contrast to FIGO Grade 1 and 2. This is consistent with the findings by Lima *et al*.[9] The odds of complete resection were greater in complete intracavitary myomas or FIGO Grade 0 compared with women with FIGO Grade 2 myomas.[9] The complexity of the procedure is increased with a larger intramural component, such as in FIGO Grade 2 myomas, thereby decreasing the probability of complete resection. Similar findings were seen in the study by Mazzon *et al*. where both grading and size of myoma were directly correlated to multistep procedures.[6] The higher risk of intravasation in Grade 1 and 2 myomas is due to the increase in size of the vessels of the uterine wall deepening into the myometrium.[7] This explains the higher risk of a multiple procedure, especially in Grade 2 myomas.[6] However, our study did not find an association between the size or diameter of the myoma with complete resection in contrast to the studies by Lima *et al*.[9] and Mazzon *et al*.[6] Although it would be expected that larger myomas have a larger surface area and volume and would likewise reduce the odds of complete resection in a single procedure.[9]

A direct association was seen between the age of patients and complete resection, that is, an increase in age increased the odds of having a complete resection. This was similar to the finding in the study by Mazzon *et al*. where there was an inverse correlation between the age of patients and a multiple-step procedure.[6] This was attributed to the reduced uterine vascularization that is typically seen in older women – 40 years or older and this could confer protection against intravasation.[6]

The association between pretreatment with GnRH agonist and the decreased odds of complete resection was also observed in the study. In the study by Lima *et al*.,[9] although there was no association between previous use of GnRH analogs and a greater frequency of complete resection, all women who had previously used GnRH analogs preoperatively had no complete resection in a single-step procedure.[9] This was attributed to the larger mean diameter of the myomas (4.9 cm) even after pretreatment with GnRH analogs compared to the general mean (2.6 cm).[9]

An increase in total fluid input and fluid deficit and the presence of complications were associated with a decrease in the odds of a complete resection. This association may be explained by the fact that a greater amount of total distention fluid used may lead to fluid overload and greater fluid deficit and, in turn, preclude the complete resection of a myoma. The presence of complications such as excessive bleeding and fluid overload could also hinder the completeness of resection since most of these cases are abandoned to prevent further complications and proposed to undergo another hysteroscopic myomectomy procedure in another setting. The complication rate in this study was seen in 8.98% of the procedures. This is smaller than that found in the study by Lima *et al*.[9] and Propst *et al*.,[20] reported a 13.02% and 14% complication rate, respectively.

Strengths and limitations of the study

There is still a lack of studies regarding hysteroscopic myomectomy cases in the local setting. This is one of the first studies in the local setting to determine the factors associated with complete resection after an initial stage procedure. The study had a good sample size since it was done in a tertiary academic government hospital. The results of the study will help in the adequate evaluation and therapeutic planning of patients with submucous myoma since it explores different factors such as myoma size, FIGO grade, and pretreatment with GnRH, among many others.

The study design is a retrospective study; hence, limitations would include covariates and potential cofounders. Although the procedures were performed by senior fellows-in-training on Reproductive Endocrinology and Infertility, which may represent a limitation, they all received their training in the same institution with the same experience and skill level.

Conclusions

Hysteroscopic myomectomy is a generally safe and effective procedure for the treatment of submucous myomas with a low complication rate. About 88.5% of the patients had complete resection after an initial hysteroscopic myomectomy procedure. The odds of complete resection are greater with older age, and decreased with pretreatment with GnRH agonist and more distention fluid used. Larger submucous myoma measuring ≥3 cm in greatest diameter was associated with greater total fluid input used and blood loss, more complications encountered, and a greater need for transfusion. Pretreatment with GnRH agonist had no significant benefit and was associated with longer surgical time and lesser odds of complete resection. All these must be taken into consideration in the therapeutic planning of patients undergoing hysteroscopic myomectomy with proper counseling to the patients. Proper selection of patients who would undergo hysteroscopic myomectomy and an individualized evaluation and treatment approach of submucous myomas must be done.

Author contributions

All authors were responsible for the conception and design of the study, revisions, and final approval of the paper.

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Conflicts of interest

There are no conflicts of interest.

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