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Sonohysterographic Predictors of Successful Hysteroscopic Myomectomies

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ABSTRACT

Background and Objectives: The purpose of this study is to assess the rate of persistent submucosal myomas and intrauterine scarring after hysteroscopic myomectomy, as well as to evaluate the preoperative and intraoperative sonohysterographic findings that will predict persistence of myomas, scarring, and the need for repeat surgery.

Methods: Charts from all hysteroscopic myomectomies performed by a single surgeon between 2003 and 2011 were reviewed for preoperative, intraoperative, and postoperative sonohysterographic findings. Predictors included myoma number, diameter and percent extension into the cavity of the largest fibroid, and percent surgically resected. These predictors were assessed with postoperative sonohysterography. Statistics included *t* test, logistic regression, χ^2 test, and Fisher exact test.

Results: Among the 79 cases with postoperative sonohysterograms, 17 (21.5%) had persistent submucosal myoma, and 9 (11.4%) had intrauterine scarring on postoperative sonohysterogram. Repeat hysteroscopic myomectomy was required in 11 (13.9%), but none required lysis of adhesions. The myoma number was not a significant predictor. A higher percentage of myoma within the cavity (63.35% vs 44.89%, $P < .05$) and smaller myoma size (2.22 cm vs 3.31 cm, $P < .01$) were significant predictors of a complete resection, a normal postoperative sonohysterogram, and avoidance of repeat surgery. On regression analysis, the percent of the myoma resected was the most significant outcome predictor ($P < .001$).

Conclusion: Larger myomas with a lower percent found within the uterine cavity are less likely to be completely resected. Percent resection at the time of surgery is the most significant predictor of a normal postoperative sonohysterogram, as well as the best predictor of the need for repeat surgery.

Key Words: Hysteroscopic myomectomy, Submucosal fibroid, Sonohysterography.

INTRODUCTION

Hysteroscopic myomectomies have become first-line surgical therapy for the treatment of most submucous fibroids.[1–3] This procedure, first described by Neuwirth in 1976, was introduced as a way to avoid major abdominal surgery.[4] The European Society of Hysteroscopy classifies submucosal fibroids based on the percentage of intramural component of the fibroid. Type 0 includes pedunculated fibroids completely within the cavity. Type I fibroids have <50% extension within the myometrium. Type II includes fibroids with 50% or greater extension into the myometrium.[5] This classification system, as well as other factors including myoma size, location, and parity of the patient, has been used to help predict the success of hysteroscopic myomectomies. Several other factors have been reviewed and found to be less predictive, including number of myomas, preoperative hormone treatment, and age at the time of surgery.[6]

Diagnostic hysteroscopy, transvaginal ultrasonography, magnetic resonance imaging, and sonohysterography (SHG) have been used to delineate the size, location, and other details of submucosal fibroids. Diagnostic hysteroscopy enables visualization of the submucosal portion of the myoma; however, its measurement is an estimate, it is operator dependent, it requires cervical dilation, and it is an invasive office procedure.[7] Ultrasonography can give detailed measurements of fibroids but without cavity distension, and it is limited in assessing the submucosal location and extent within the cavity. Adding saline solution into the cavity, as performed with SHG, allows for more exact measurements of the percentage of fibroid in the cavity, as well as the depth of myometrial involvement of submucosal myomas.[5,8] Although magnetic resonance

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Dr. Robert Neuwirth provided the inspiration for this work. He is the father of hysteroscopic myomectomy. He is deeply missed, but his legacy lives on at St. Luke's Roosevelt Hospital Center.

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imaging is valid and reproducible, it may not correspond to findings at hysteroscopy because the images are taken with an undistended cavity.[7] SHG best mimics the appearance of the submucosal fibroid in hysteroscopy while having the additional benefit of evaluating its myometrial extension.[8,9] Leone et al[8] used SHG to assess preoperative submucous myomas and found that the type of myoma was accurately graded and 100% concordant with hysteroscopic findings.

This study was designed to evaluate the preoperative sonohysterographic findings that would predict a successful hysteroscopic myomectomy, with either complete resection or no need for further resection. We hypothesized that fibroids >3 cm in diameter and with <60% extension into the cavity would have a higher rate of incomplete resection, resulting in an abnormal follow-up SHG study, sometimes necessitating further surgery.

MATERIALS AND METHODS

Using billing codes, we identified 240 subjects who underwent 269 hysteroscopic myomectomies by a single reproductive surgeon between 2003 and 2011. Among these 240 subjects, 178 charts were able to be obtained from long-term storage, and 69 patients who underwent 79 hysteroscopic myomectomy procedures were included in our analysis. Inclusion criteria included patients with histologically confirmed submucosal myomas and documented preoperative SHG, as well as a postoperative SHG study within 3 months of the procedure (range, 6–12 weeks). Twenty-five patients who underwent an endometrial ablation along with the hysteroscopic myomectomy did not undergo follow-up SHG, and in 89 cases, follow-up SHG within 3 months of the procedure was not found in the record.

The study was reviewed by the institutional review board and deemed exempt. Data collected for this study included historical information from the chart, findings at the preoperative SHG study, intraoperative findings, and postoperative SHG findings. The historical data assessed included age, gravity, parity, history of menorrhagia, and history of myomectomy. The preoperative SHG study was assessed for the number, location, and size of all submucosal myomas. To determine the percent of any submucosal fibroid within the cavity, images of the preoperative SHG study were reviewed along with the percentage documented in the SHG report. This was estimated from the percent of the spherical myomas that was seen within the fully distended cavity.

All hysteroscopic myomectomies were performed with the Gynecare Versapoint bipolar loop resectoscope (Ethicon, Johnson and Johnson, Somerville, New Jersey), with 0.9% normal saline solution as the distension medium. Laparoscopic guidance was used either when laparoscopy was otherwise indicated or when the intramural portion of the fibroid came within 1 cm of the uterine serosa. All procedures were completed with patients under general anesthesia, as a same-day ambulatory surgery in a hospital setting. Regardless of intramural extension of the myoma, an attempt was always made to remove the entire myoma. This was not true of planned combined endometrial ablation cases, but such cases were excluded from these data. The number and size of submucosal myomas seen and the percentage of each myoma resected were obtained from the operative report.

In all subjects a postoperative sonohysterogram was obtained after their first menses after surgery and within 3 mo of the surgical procedure. The postoperative SHG findings were categorized as either normal, abnormal with residual submucosal myoma, or abnormal with new-onset intrauterine scarring. When a residual intracavitary fibroid was considered clinically significant because of either persistent menorrhagia or concern about the remaining cavitary defect before planned conception, the patient was offered a second hysteroscopic procedure to remove any residual submucosal portion of the original submucosal myoma. Likewise, if postoperative SHG showed significant intrauterine scarring, a hysteroscopy for lysis of adhesions was offered.

Historical data, preoperative SHG findings, and intraoperative findings were used as predictors to assess whether the postoperative SHG study was normal, whether there was residual myoma, whether there was new scarring, and whether a repeat hysteroscopy was either recommended or performed. Statistics included t test, logistic regression, χ^2 test, and Fisher exact test performed using Systat 13 (Systat Software, Chicago, Illinois) and SAS software (SAS Institute, Cary, North Carolina). A receiver operating characteristic (ROC) curve was plotted to select the optimal myoma size and intracavitary percent cutoff values for predicting a normal sonohysterogram after hysteroscopic myomectomy.

RESULTS

Sixty-nine patients underwent 79 hysteroscopic myomectomies. Of these, 17 (21.5%) had persistent submucosal myoma, and 9 (11.4%) had intrauterine scarring based on postoperative SHG. A greater percentage of myoma within the cavity (63.01% vs 47.10%, $P < .05$) was a significant predictor of a normal postoperative sonohysterogram and complete resection (**Table 1**). On regression analysis, the percent of the myoma resected at the time of surgery was the most significant outcome predictor ($P < .0001$) of a normal postoperative sonohysterogram. Percent of fibroid resected was statistically significant for predicting normal postoperative SHG findings, repeat surgery, and persistent fibroid (**Table 1**).

Nulliparity, younger age, percent of myoma within the cavity, and size of the largest fibroid were all individually statistically significant preoperative predictors of a normal postoperative sonohysterogram. However, after we adjusted for all preoperative variables using a multiple logistic regression model, only percent of fibroid within the cavity remained significant (**Table 1**). When the outcome assessed was the need for a second hysteroscopy, we found that the size of the largest fibroid and nulliparity were significant once adjusting for other preoperative variables and interpreting as an odds ratio. Looking at persistent fibroids as the outcome, we found that the size of the largest fibroid was also significant (**Table 1**).

Age and percent of fibroid within the cavity were statistically significant predictors of postoperative scarring of the cavity after we adjusted for all other variables (**Table 1**). The odds of scarring increased by 23% per year of patient age ($P < .01$). As the percent of fibroid extension into the cavity increased, the odds of scarring decreased ($P < .05$).

When comparing myomas >3 cm with <60% intracavitary extension (n = 20) with smaller or more cavitary submucosal myomas (n = 59), 55% versus 23.7% ($P < .001$) of these larger substantially intramural myomas were significantly associated with an abnormal postoperative SHG study. In addition, 50% versus 13.5% ($P = .001$) of these larger predominantly intramural myomas were significantly associated with residual submucosal myoma at follow-up SHG, and 30% versus 8.5% ($P = .012$) of these myomas were associated with the need for repeat surgery.

ROC analysis showed that the myoma diameter cutoff value associated with an abnormal postoperative SHG study was 2.6 cm, indicating that fibroids >2.6 cm were more likely to have an abnormal postoperative SHG study. Similarly, the optimal cutoff value for the percent of the myoma in the cavity was 65%; fibroids with <65% extension into the cavity were associated with an abnormal postoperative SHG study.

Table 1.
Preoperative Sonohysterography and Intraoperative Predictors of Abnormal Postoperative Sonohysterography

Significant Predictors	Uterine Cavity				Persistent Fibroid				Postoperative Scarring				Need for Repeat Surgery			
	Abnormal (n = 25)	Normal (n = 54)	*P* Value	Adjusted *P* Value	No (n = 61)	Yes (n = 18)	*P* Value	Adjusted *P* Value	No (n = 70)	Yes (n = 9)	*P* Value	Adjusted *P* Value	No (n = 67)	Yes (n = 11)	*P* Value	Adjusted *P* Value
No. of fibroids on SHG[a]	1.64 ± 1.15	1.43 ± 0.88	NS[a]	NS	1.41 ± 0.86	1.78 ± 1.26	NS	NS	1.50 ± 0.99	1.44 ± 0.88	NS	NS	1.40 ± 0.84	2.09 ± 1.51	NS	NS
Largest fibroid size (cm) on SHG	2.91 ± 1.46	2.37 ± 0.90	NS	NS	2.35 ± 0.90	3.18 ± 1.54	.0343	.0107	2.56 ± 1.15	2.40 ± 0.94	NS	NS	2.35 ± 0.90	3.64 ± 1.74	.0142	.0111
% in cavity on SHG	47.10 ±32.8	63.01 ± 32.3	.0486	.0190	61.02 ± 33.58	47.64 ± 29.93	NS	NS	60.07 ± 32.18	41.67 ± 37.42	NS	.0272	61.83 ± 33.00	37.95 ± 25.76	.0336	NS
% resected intraoperatively	74.13 ± 27.25	98.70 ± 4.87	< .0001	.0041	98.83 ± 4.64	65.00 ± 26.10	< .0001	.0019	91.38 ± 18.88	91.25 ± 21.00	NS	NS	96.27 ± 11.82	58.50 ± 25.17	< .0001	.0079
No. of fibroids intraoperatively	1.83 ± 1.90	1.55 ± 1.05	NS	NS	1.55 ± 1.03	1.89 ± 2.11	NS	NS	1.62 ± 1.39	1.71 ± 0.95	NS	NS	1.51 ± 0.99	2.36 ± 2.62	NS	NS

Data are presented as mean ± SD. $P < .05$ is considered significant. Adjusted *P* values are adjusted for all other variables, including nulliparity and age.
[a]NS = not significant; SHG = sonohysterography.

DISCUSSION

Hysteroscopic myomectomy is an effective minimally invasive surgical treatment for submucosal fibroids. It allows for avoidance of major abdominal surgical procedures, including open abdominal myomectomies and hysterectomies.[4,10,11] However, these procedures may not be optimal for all patients with submucosal fibroids. In a review of the literature, the degree of intramural involvement and size of fibroid were noted to be the most important factors in predicting a normal postoperative cavity.[5,12,13] In our study we found similar results. After we adjusted for all preoperative variables, the intracavitary percent extension of fibroid was the only significant predictor of a normal postoperative sonohysterogram. However, the diameter of the fibroid was a statistically significant predictor of repeat surgery and persistent submucosal myoma.

We also examined intraoperative predictors including percentage of fibroid resected and the number of fibroids, subjectively measured by the surgeon. The percent of the submucosal myoma resected at the time of surgery was the most significant predictor of a normal postoperative sonohysterogram (**Table 1**). This finding has not previously been examined as a factor in successful hysteroscopic myomectomy, according to our review of the literature.

The success of hysteroscopic myomectomies is generally measured by 2 outcomes: symptom improvement, including menorrhagia and infertility, and the need for further surgery. Pregnancy rates in women after hysteroscopic myomectomies are generally high when compared with other groups of women seeking fertility treatment.[14] Hart et al[13] performed long-term follow-up of 107 patients after hysteroscopic myomectomies using the need for repeat surgery as the primary outcome. Patients with type II fibroids were 3 times more likely to require further surgery than those with type I or 0 fibroids.[13] When we used repeat surgery as our primary outcome, we found that the diameter of the largest myoma was the most significant predictor. Mavrelos et al[5] reported similar findings when conducting a prospective study including 61 women with symptomatic submucous fibroids. When they compared patients with complete versus incomplete resection, the mean percent extension into the cavity and the maximum fibroid size were statistically significant (P = .001).[5] We also found that nulliparous women were 86% less likely to undergo repeat surgery than parous women. Most studies have not found parity to be a significant factor. Though statistically significant, it may not be clinically relevant.

Postoperative scarring was also used as an outcome in our study. Nine of 79 patients (11.4%) had postoperative scarring on SHG, which is slightly higher when compared with a retrospective study looking at 53 infertility patients after hysteroscopic myomectomy (postoperative scarring rate, 7.5%).[15] However, in that study, there was no significant difference in age or myoma size. We found that younger women were less likely to have uterine synechiae. We conjecture that perhaps we perform more aggressive treatment in older patients who are not undergoing hysteroscopic myomectomies for fertility purposes because the mean age of those with scarring was 42 years compared with 37 years in those without scarring. When adjusted for other factors, greater myometrial extension of the submucous myoma was associated with intrauterine scarring. Type II fibroids with greater myometrial extension may be technically more difficult to resect and therefore lead to postoperative scarring.

Our hypothesis that resection of fibroids >3 cm and with <60% intracavitary extension would increase the risk of an abnormal postoperative sonohysterogram was correct. The ideal cutoff values offered by our ROC analysis (2.6 cm for diameter and 65% for intracavitary extension) would be useful in the preoperative counseling of patients. More than 1 hysteroscopy may be required to safely and completely remove the submucous myoma.

One of the strengths of our study was that the same physician performed all sonohysterograms and operative hysteroscopies. SHG is dependent on observer experience; the more experienced one is, the more accurate one is in evaluating uterine cavities.[7] We also limited the confounding variable of different imaging techniques by using SHG for both the presurgical and postsurgical assessment of the cavity.

There are several limitations to this study. Because we chose to standardize our postoperative evaluation with SHG, we had to exclude 109 patients, which may alter our results. In this study the sample size was relatively small and the data collection was retrospective, both of which come with inherent biases.

In summary, hysteroscopic myomectomies have become a standard for treatment of submucosal fibroids; however, proper patient selection is key to achieving a successful outcome. We would recommend using a fibroid diameter of <2.6 cm and >65% extension into the cavity to predict a high probability of complete resection with a single hysteroscopic myomectomy. The most significant preoperative predictor of a normal postoperative sonohysterogram was greater percent extension of the fibroid into the cavity. The most important overall predictor of a normal postoperative evaluation was the surgeon's intraoperative assessment of a complete resection. Although the surgeon's intraoperative assessment of a complete resection cannot help select candidates for hysteroscopic myomectomy, it can help guide expectations regarding the need for postoperative evaluation and the possible need for a repeat procedure.

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