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Original Article

# A New System to Classify Submucous Myomas: A Brazilian Multicenter Study

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**ABSTRACT**

**Objective:** To evaluate 2 different predicting scores of submucous myoma removal, fluid balance, and operative time in woman undergoing hysteroscopic myomectomy.

**Design:** A multicenter and prospective study (Canadian Task Force classification II-2).

**Setting:** Six hysteroscopy centers in Brazil.

**Patients:** A total of 191 women who underwent hysteroscopic resection of 205 submucous myomas.

**Intervention:** Resection of submucous myomas (hysteroscopic myomectomy). Myomas were scored according to the European Society for Gynaecological Endoscopy (ESGE) and STEPW (size, topography, extension, penetration, and wall) classifications. The validation of the 2 classifications was assessed with sensitivity and specificity of each classification, with their best cutoff point.

**Main Outcome Measures:** To correlate ESGE and STEPW classifications with complete or incomplete removal of submucous myoma, length of surgery, surgical complications, and fluid balance.

**Results:** Removal of the myoma was complete in 190 (92.7%) of 205 myomectomies, and incomplete in 15 (7.3%). All 140 (100%) of 140 myomas with a score $\leq 4$ in the STEPW classification were completely removed, and 50 (76.9%) of 65 myomas with a score $>4$ were removed. All 15 (100%) cases of incomplete hysteroscopic myomectomy had a STEPW score $>4$. With the ESGE classification, 156/164 (95.1%) cases of type 0 and type 1 myomas, and 34/41 (82.9%) of type 2 were completely resected. STEPW scores $>4$ were statistically associated with longer duration of surgery, surgical complications, higher levels of fluid balance, and use of gonadotropin releasing hormone analogue if compared with lower scores. The ESGE scores were not associated with any of these variables.

**Conclusion:** Classifying submucous myomas with the STEPW classification allows better prediction of myoma removal, fluid balance, length of surgery and surgical complications in hysteroscopic myomectomy than ESGE classification. Journal of Minimally Invasive Gynecology (2012) ■, ■–■ 

*Keywords:* Submucous fibroids; Myoma; Classifications; Fluid balance; Operative time; Hysteroscopy

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Leiomyomas are the most common tumors of the uterus and female pelvis. Benign nodules are composed mainly of smooth muscle cells associated with fibrous connective tissue in varying amount. It is difficult to determine accurately their incidence, although it was reported in about 50% of autopsy specimens [1]. The submucous myoma has the lowest prevalence in the general female population, ranging from

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**Table 1**

ESGE classification of submucous myomas

| Type | Degree of intramural extension |
|---|---|
| 0 | No intramural extension |
| 1 | Intramural extension <50% |
| 2 | Intramural extension ≥50% |

Wamsteker, K (1990).

5% to 10% of all myomas, and unlike intramural and subserous myomas, it can lead to uterine bleeding even when small. It can also cause dysmenorrhea and interfere with the reproductive process of women, resulting in recurrent pregnancy loss, premature birth, and infertility [2]. Hysteroscopic myomectomy is the treatment of choice for patients with symptomatic submucous myomas [3]. However, among hysteroscopic procedures, myomectomy has the highest complication rate, is considered an advanced surgery, and must be performed by experienced surgeons [4]. The complications associated with hysteroscopic myomectomy are uterine perforation, injury to adjacent organs, excessive bleeding, and fluid overload. In rare cases, excessive fluid absorption can cause pulmonary edema or death [5,6].

Some classifications were developed for submucous myomas aiming to predict difficulty and complexity of hysteroscopic myomectomy. The most used classification is that by the European Society of Gynaecological Endoscopy (ESGE), proposed by Wamsteker and De Blok, in 1993 (Table 1). This classification takes into account only the degree of penetration of the myoma into the myometrium and does not present a good correlation with the difficulty of the surgical procedure [7]. In 2005, Lasmar et al [8] developed a new classification for hysteroscopic myomectomy (size, topography, extension, penetration, and wall [STEPW]) that uses 5 parameters to classify submucous myomas. This classification is distinguished by a higher correlation with complexity and degree of technical difficulty in performing the procedure, and it is directly related to operative time, water absorption, and rate of complications and is validated to predict complete or partial resection of myomas [9] (Fig. 1).

Since Lasmar et al [8] published the STEPW classification, other studies have been conducted comparing STEPW with the ESGE classification. It was shown that accurate preoperative evaluation of outcome is of paramount importance for treatment; assessing only the penetration degree of the myoma is insufficient, and the STEPW classification has greater correlation with the results. In 2011, Lasmar et al [9] published an international multicenter study with 465 cases of hysteroscopic myomectomy and showed higher correlation of this classification in predicting complete removal of submucous myomas. In this new trial only Brazilian cases are included, in which other cases were added to the published in *Fertility & Sterility* [9]. We also evaluate the complete removal of submucosal myomas, fluid balance, and operative time. With these 3 data it was possible to assess more accurately the complexity and difficulty of the hysteroscopic myomectomy and therefore know whether there is difference between the 2 classifications. The aim of this study was to evaluate the ability of both classifications to predict complete or partial removal of uterine myomas, operative time, and fluid balance in hysteroscopic myomectomy performed in Brazil.

## Material and Methods

### *Sampling Procedures*

This is a prospective multicenter study, carried out between January 2008 and December 2010, with 191 patients who underwent 205 hysteroscopic myomectomies at 6 Brazilian centers. Twelve women presented 2 or 3 myomas; such cases were not excluded because sensitivity analysis showed that inclusion/exclusion did not change the results.

**Fig. 1**

STEPW submucous myoma classification.

| | Size (cm) | Topography | Extension of the base | Penetration | Lateral Wall | Total |
|---|---|---|---|---|---|---|
| 0 | ≤ | Low | ≤ 1/3 | 0 | + 1 | |
| 1 | > 2 to 5 | Middle | >1/3 to 2/3 | ≤ 50% | | |
| 2 | > 5 | Upper | > 2/3 | > 50% | | |
| Score | + | + | + | + | + | |

| Score | Group | Complexity and therapeutic options |
|---|---|---|
| 0 to 4 | I | Low complexity hysteroscopic myomectomy. |
| 5 to 6 | II | High complexity hysteroscopic myomectomy. Consider GnRH use? Consider Two-step hysteroscopic myomectomy. |
| 7 to 9 | III | Consider alternatives to the hysteroscopic technique |

The research protocol was approved by the Institutional Review Board of the Hospital Universitário Pedro Ernesto, Universidade Estadual do Rio de Janeiro, Brazil. Each participant was responsible for the protocol in their centers. All surgeons participating in this study have extensive experience with hysteroscopic surgery.

Prospective subjects invited to take part in the study were informed before surgery about their participation and of the risks and benefits of hysteroscopic myomectomy. Those who agreed to participate were asked to sign an informed consent form. Subjects received no financial compensation for their participation.

The inclusion criterion was planned hysteroscopic resection of submucous myoma. Exclusion criteria were presence of severe cardiovascular diseases, decompensated diabetes, or severe hematologic disorders.

Ten patients had 2 myomas removed. In 2 patients 3 myomas were removed. In data analysis each myoma was treated as a separate case.

White women comprised 64.3% of the sample, mixed race 20.0%, and black 12.2%. Seven patients (3.5%) had no ethnicity reference. The mean age was 42.3 years (range of 23–76 years). Sixty-seven (32.7%) reported using combined oral contraceptives, and 59 (28.8%) used gonadotropin releasing hormone (GnRH) analogue before surgery. A total of 129 (62.9%) subjects reported 1 or more pregnancies; 76 (37.1%) subjects had never gotten pregnant. The clinical indications were abnormal uterine bleeding in 147 cases (71.7%), infertility in 14 (6.8%), bleeding and infertility in 11 (5.4%), some abnormality in a pelvic ultrasound scan ordered for screening in 25 (12.2%), pelvic pain in 1 (0.5%), and other complaints in 7 (3.4%).

### *Data Collection*

A spreadsheet was prepared for the medical team performing the procedure to enter the necessary parameters in the database. The STEPW classification score was automatically calculated in the spreadsheet according to the point system in Fig. 1. Procedures to evaluate the internal consistency of the data and quality control were carried out during the data analysis.

Information provided by patients and data about the submucous myoma(s) were collected before myomectomy. After surgery, data on the procedure and its results were recorded. The following pieces of information were recorded in the spreadsheet: patient's initials; age; numbers of previous pregnancies; deliveries; cesarean sections; miscarriages; history of tubal ligation; ethnicity; history of hormone replacement therapy use; chief complaint; information about the submucous myoma (size [dimensions according to measurements obtained by ultrasound or magnetic resonance imaging {MRI}], wall penetration [obtained by hysteroscopy, ultrasonography, or MRI], topography, and extension of the base, lateral versus anterior or posterior wall); information about surgical technique and complications (GnRH analogue use, technique, power used, operative time, distension media, fluid balance, myoma removal, anesthesia, intraoperative and postoperative complications, length of hospital stay, and surgeon's name). Patients were treated according to the surgical protocols of each center.

### *Statistical Analysis*

Data were described in bivariate tables. Differences in percentages were tested with the $\chi^2$ test for homogeneity, and proportion trends in ordered variables were assessed by the $\chi^2$ test for trends. Comparison among continuous variables were tested with the Mann-Whitney nonparametric test because preliminary analysis showed that those were not normally distributed (Shapiro-Wilk test for normality, $p < .01$) and variances of the means were not equal (Barlett's test for equality of variances, $p < .01$) (Altman, 1991). All analyses were carried out with Stata 11.2 (StataCorp, College Station, TX).

## Results

The percentage of myomas incompletely removed was 7.3% (95% confidence interval: 4.2–11.8). The mean age was 42.3 years (range of 23–76 years, standard deviation = ±10.1), and 42% of women were aged under 40 years. Sixty-four percent were white, 20% were mixed race or black, and 12.2% were Indian. A total of 32.7% were receiving hormone replacement therapy. Thirty-seven percent of the sample had never been pregnant, and among those with at least 1 pregnancy, the average was of 2.3 pregnancies (range of 1 to 6). Twenty-seven percent had tubal ligation.

Sensitivity and specificity are presented in Table 2. Sensitivity and specificity of STEPW were, respectively, 100% (95% CI: 78.2–100) and 73.7% (95% CI: 66.8–79.8). Sensitivity and specificity of ESGE score were 46.7% (95% CI: 21.3–73.4) and 82.1% (95% CI: 75.9–87.3), respectively. The comparison of the receiver operating characteristic area between the 2 scores was statistically significant ($p < .01$, STEPW = 86.8% vs ESGE = 64.4%). The agreement between the 2 scores was 66.83% (expected

**Table 2**

Accuracy of two scores for predicting myoma removal in sample of Brazilian women

| | Myoma removal | | |
|---|---|---|---|
| | Complete | Partial | Total |
| ESGE | | | |
| Score 0–1 | 156 (82.1%) | 8 (53.3%) | 164 (80.0%) |
| Score 2 | 34 (17.9%) | 7 (46.7%) | 41 (20.0%) |
| STEPW | | | |
| Scores 0–4 | 140 (73.7%) | 0 (0.0%) | 140 (68.3%) |
| Scores 5–9 | 50 (26.3%) | 15 (100.0%) | 65 (31.7%) |
| Total | 190 (100.0%) | 15 (100.0%) | 205 (100.0%) |

**Table 3**

Clinical and sociodemographic characteristics according to completeness of myoma removal and two scores that predict myoma removal in Brazil

| | Myomas completely removed (n = 205) | | | ESGE score 0–1 | | STEPW score 0–4 | |
|---|---|---|---|---|---|---|---|
| | No. | (%) | p Value | (%) | p Value | (%) | p Value |
| Age at surgery | | | .25 | | .60 | | .38 |
| <40 years | 87 | 90.80 | | 82.76 | | 66.67 | |
| 40–59 year | 105 | 93.33 | | 77.14 | | 67.62 | |
| 60 or more | 13 | 100.00 | | 84.62 | | 84.62 | |
| Ethnicity | | | .51 | | .47 | | .51 |
| White | 132 | 90.91 | | 80.3 | | 65.15 | |
| Mixed race | 41 | 95.12 | | 75.61 | | 70.73 | |
| Black | 25 | 96.00 | | 88.00 | | 76.00 | |
| Number of pregnancies | | | .69 | | .26 | | .42 |
| 0 | 74 | 93.24 | | 78.38 | | 70.27 | |
| 1 | 36 | 91.67 | | 80.56 | | 69.44 | |
| 2 | 45 | 88.89 | | 75.56 | | 66.67 | |
| 3 | 23 | 91.30 | | 86.96 | | 65.22 | |
| >3 | 21 | 100.00 | | 90.48 | | 61.90 | |
| Tubal ligation | | | .88 | | .47 | | .30 |
| No | 141 | 92.20 | | 79.43 | | 70.21 | |
| Yes | 56 | 92.86 | | 83.93 | | 62.5 | |
| Hormone replacement therapy | | | .55 | | .86 | | .72 |
| No | 132 | 91.67 | | 79.55 | | 68.18 | |
| Yes | 67 | 94.03 | | 80.6 | | 65.67 | |
| GnRH analogue | | | | | .64 | | <.01 |
| No | 146 | 95.21 | .03 | 80.82 | | 77.4 | |
| Yes | 59 | 86.44 | | 77.97 | | 45.76 | |
| Surgical techniques | | | .11 | | .12 | | .02 |
| Slicing | 118 | 93.22 | | 81.36 | | 65.25 | |
| Slicing/mobilization | 57 | 87.72 | | 71.93 | | 63.16 | |
| Other | 30 | 100.00 | | 90.00 | | 90.00 | |
| Complications | | | <.01 | | 1.00 | | .01 |
| No complication | 190 | 95.79 | | 80.0 | | 70.53 | |
| Any complication | 15 | 53.33 | | 80.0 | | 40 | |

agreement: 60.98%) with a kappa value of 0.15 (95% CI: 0.01–0.29).

Bivariate analysis showed that age, skin color, tubal ligation, number of pregnancies, and use of hormone therapy were not associated with success of myoma removal ($p > .05$). STEPW scores >4 were statistically associated ($p < .01$) with longer duration of surgery, surgical complications, higher levels of fluid balance, use of GnRH analogue if compared with lower scores (Tables 3 and 4). ESGE scores were not associated with any of those variables ($p > .05$).

Of the 205 submucous myomas, 94 measured 2 cm or less, 103 between 2.1 and 5 cm, and 8 exceeded 5 cm. With the STEPW classification, 140 (68.3%) of 205 submucous myomas were assigned to Group I, 62 (30.2%) to Group II, and 3 (1.5%) to Group III. In 113 cases the myoma occupied less than one third of the wall, in 63 between one third and two thirds, and in 29 more than two thirds. Thirty-seven myomas were located in the lower third of tuterus, 76 in the middle and 193 in the upper third. A total of 135 myomas were located in the anterior or posterior wall and 70 in the lateral wall. The extent of penetration into the myometrium was stratified according to the ESGE classification: 65 (31.7%) were type 0, 99 (48.3%) were type 1, and 41 (20.0%) were type 2.

Operative time was calculated as the interval between the beginning of surgery and the end of the procedure. Operative times ranged from one to 120 minutes; the mean time was 30.6 minutes. Higher scores of STEPW were associated with longer operative time ($p < .01$), whereas ESGE scores were not statistically associated with operative time ($p = .13$) (Table 4).

The fluid balance ranged from 0 to 6000 mL and the mean was 448 mL. The mean fluid balance in completely removed myomas was 357.3 mL, and 1596.7 mL among those incompletely removed. The ESGE scores were not statistically associated with fluid balance ($p = .30$), whereas higher STEPW scores predicted higher levels of it ($p < .01$).

Complications occurred in 15 (7.3%) cases. No deaths were reported. Seven complications occurred in myomas with STEPW scores ≤4, including two cases of fever, 2 of pain, and 3 of bleeding. Eight complications occurred in myomas with STEPW scores >4:6 cases of bleeding, one

**Table 4**

Associations of operative time and fluid balance according to myoma removal, ESGE and STEPW scores in Brazil

| | Myoma removal | | | ESGE score | | | STEPW score | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | Complete | Partial | p Value* | score 0–1 | score 2 | p Value* | score 0–4 | score 5–9 | p Value* | |
| No. | 190 (92.7%) | 15 (7.3%) | | 164 (80.0%) | 41 (20.0%) | | 140 (68.3%) | 65 (31.7%) | | 205 (100%) |
| Operative time in min (mean [SD]) | 28.0 (24.0) | 63.1 (29.2) | <.01 | 29.1 (25.0) | 36.5 (29.5) | .13 | 22.7 (22.5) | 47.6 (25.1) | <.01 | 30.6 (26.0) |
| Fluid balance in mm (mean [SD]) | 357.3 (414.0) | 1596.7 (1523.7) | <.01 | 414.6 (530.5) | 581.7 (993.1) | .30 | 272.2 (349.0) | 826.6 (932.6) | <.01 | 448.0 (650.2) |

SD = standard deviation.
* Mann-Whitney test.

uterine perforation, and 1 case with STEPW score of 8 had fluid overload. With the ESGE, bleeding occurred in 2 cases of myoma type 0, 5 of type 1, and 2 of type 2; perforation in 1 type 1; fever in 2 type 0; pain in 2 type 1, and overload in 1 type 2.

## Discussion

There was an association between the STEPW classification and likelihood of complete removal of myomas, as corroborated by previous studies [8,9]. All myomas classified as Group I—with score of 0 to 4—were completely removed, as well as 50 of 65 myomas of Group II (76.9%); in that, 50 of 62 had scores of 5 and 6 (80.6%), and none had scores of 7 and 8. When classified according to the ESGE, 156 of 164 type 0 and 1 myomas were removed, and 34 of 41 type 2 myomas, accounting for 95.1% and 82.9%, respectively. This demonstrates weak association of this classification with the parameter myoma removal, and 53.3% of 15 partially resected myomas included in types 0 and 1, and 46.7% in type 2.

The overload is mainly related to great absorption of non-electrolytic solutions [10–13]. The American College of Obstetricians and Gynecologists suggests that absorption of 750 mL of solution should draw attention of the team [14]. The operative time seems to be directly related to fluid absorption [15,16]. Therefore the capacity to predict overload complications in the STEPW classification is more evident, considering the great difference in terms of mean operative time and fluid absorption in groups with score <4 and in those >4, and the latter has a mean fluid balance of 826.6 mL, which is close to the acceptable limit of 1000 mL [14].

Of 15 complications, 11 were considered major: 9 bleedings in the preoperative or postoperative periods, 1 overload, and 1 perforation. When assessed by the ESGE classification, bleeding occurred in 7 myomas classified as types 0 and 1, and in 2 myomas as type 2; the overload in type 2 myomas and perforation in type 1. When the STEPW classification was used, 9 of 11 complications occurred in myomas with score >4, only 2 cases of bleeding were observed in score ≤4. Hence, applying the STEPW classification indicates not only greater likelihood of complications, but also their severity.

The advantages of this study include the high number of myomectomies, performed by very experienced teams. On the other hand, because it is a multicenter study, there was no standardization of surgical techniques, and 3 hysteroscopic myomectomy procedures were used: slicing, slicing with mobilization, and direct mobilization [17]. This fact may have had influence in measuring operative time and fluid balance, even in not demonstrating any difference in complete removal or not of the myoma. Nonetheless, this problem does not hinder comparison between the classifications, because they are paired for the same cases.

The use of the STEPW classification in management of submucous myoma increases safety of the surgery,

indicating the more complex procedures and risks of complications. Thus the level of experience of the surgeon, surgical planning and strict control of fluid balance in cases of scores >4, could be programmed in the preoperative period.

## Conclusion

The STEPW classification demonstrated more capacity to underline complexity of hysteroscopic myomectomy, with greater association with operative time, fluid balance and complete resection of the myoma, as compared with the ESGE classification.

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