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AAGL 2021 Endometriosis Classification: An Anatomy-based Surgical Complexity Score

Mauricio S. Abrao, MD, Marina Paula Andres, MD, Charles E. Miller, MD, Julian A. Gingold, MD, PhD, Mariona Rius, MD, Joao Siufi Neto, MD, and Francisco Carmona, MD

From the Gynecologic Division, BP-A Beneficência Portuguesa de São Paulo (Drs. Abrao, Andres, and Neto), Department of Obstetrics and Gynecology, Division of Gynecology, Faculty of Medicine, University of São Paulo (Drs. Abrao and Andres), São Paulo, São Paulo, Brazil, Department of Clinical Sciences, Rosalind Franklin University of Medicine and Science, North Chicago (Dr. Miller), Department of Minimally Invasive Gynecologic Surgery, Advocate Lutheran General Hospital, Park Ridge (Dr. Miller), Illinois, Department of Obstetrics and Gynecology and Women's Health, Montefiore Medical Center, Bronx, New York (Dr. Gingold), Department of Gynecology, Institute Clinic of Gynecology, Obstetrics, and Neonatology, Hospital Clínic de Barcelona (Drs. Rius and Carmona), and Department of Gynecology, August Pi i Sunyer Biomedical Research Institute (Dr. Carmona), Barcelona, Spain

ABSTRACT **Study Objective:** To develop a new endometriosis classification system for scoring intraoperative surgical complexity and to examine its correlation with patient-reported pain and infertility.

Design: Multicenter study of patients treated at 3 recognized endometriosis centers.

Setting: Three specialized endometriosis surgical centers in São Paulo, Brazil and Barcelona, Spain.

Patients: Patients aged 15 to 45 years with histologically proven endometriosis and no history of pelvic malignancy underwent laparoscopic treatment of endometriosis.

Interventions: Demographic data and clinical history, including dysmenorrhea, noncyclic pelvic pain, dyspareunia, dysuria and dyschezia, were prospectively recorded. All patients were staged surgically according to the new 2021 American Association of Gynecologic Laparoscopists (AAGL) and revised American Society of Reproductive Medicine (ASRM) classification systems. The staging for each system was compared against a 4-level surgical complexity scale defined by the most complex procedure performed.

Measurements and Main Results: A total of 1224 patients undergoing surgery met inclusion criteria. The AAGL score discriminated between 4 stages of surgical complexity with high reproducibility ($\kappa = 0.621$), whereas the ASRM score discriminated between the complexity stages with poor reproducibility ($\kappa = 0.317$). The AAGL staging system correlated with dysmenorrhea, dyspareunia, dyschezia, total pain score, and infertility comparably with the ASRM staging system.

Conclusion: The AAGL 2021 Endometriosis Classification allows for identifying objective intraoperative findings that reliably discriminate surgical complexity levels better than the ASRM staging system. The AAGL severity stage correlates comparably with pain and infertility symptoms with the ASRM stage. Journal of Minimally Invasive Gynecology (2021) 28, 1941−1950. © 2021 AAGL. All rights reserved.

Keywords: Endometriosis; Infertility; Laparoscopy; Pelvic pain; Staging

Multiple endometriosis classification systems have been proposed in the last 40 years [1−7]. The American Fertility Society 1979 classification [6], subsequently revised as the 1985 and 1996 American Society for Reproductive Medicine (ASRM) classification systems [2,3], were motivated by a desire to score the impact of endometriosis on fertility. Although the 1996 ASRM classification [3] remains the most widely used endometriosis classification system, it does not address surgical skill and effort required for endometriosis removal. Because large lesions fully infiltrating the rectum, ileum, ureter, vagina, or bladder receive comparable scores to a solitary 3-cm−deep lesion on the anterior peritoneum in ASRM classification, surgical complexity seems poorly correlated to ASRM stage [8]. The lack of a reliable surgical complexity score has complicated equitable reimbursement [9−11]. The ASRM classification

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Corresponding author: Mauricio S. Abrao, MD, Clinica Medicina da Mulher, Rua Colombia, 332, São Paulo, SP 05403-000, Brazil.
E-mail: msabrao@mac.com

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system also has limited correlation with pain symptoms [8]. Since 1996, additional endometriosis classification systems have been developed, including the Endometriosis Fertility Index in 2010 [4], designed to predict pregnancy rates after surgical staging, and the Enzian classification system [5,12], to facilitate classification of deep infiltrating endometriosis without a points-based score. Surgeries for deep infiltrating endometriosis, defined as endometriosis penetrating >5 mm beneath the peritoneal surface [13,14], are notable for their high complexity as well as high complication rate [15].

In 2010, the American Association of Gynecologic Laparoscopists (AAGL) Special Interest Group in Endometriosis recognized the limitations of existing endometriosis classification systems and assigned a task force to develop a new one. This article reports for the first time the creation of the AAGL 2021 Endometriosis Classification System stemming from the efforts of this task force.

The primary objective of this study was to develop an anatomy-based and user-friendly scoring system that correlates with surgical complexity. The secondary objective was to determine its correlation with preoperative pain symptoms and infertility. In addition, we aimed to compare the performance of the new classification with the 1996 revised ASRM classification system.

Materials and Methods

Development of the AAGL Endometriosis Classification Score

A survey was sent to 31 internationally recognized endometriosis specialists (acknowledged at the end of the manuscript) who were asked to estimate the complexity of surgical excision of endometriosis involving a series of anatomic sites (listed in Table 1) from 0 to 10 (0, not complex at all to 10, most complex). Scores were linearly scaled and normalized across surgeons, with the exclusion of individual scores >2 standard deviations from the mean, before computing an average "difficulty score" for each anatomic site (Table 1).

A worksheet constructed from these component difficulty scores at each anatomic site was used to assign points to each patient during surgery (Fig. 1). The sum of the component scores across all anatomic sites defined the total score, which was used to determine the complexity stage during surgery (described in later text) (Fig. 1).

Surgical Validation Cohort

From February 2018 to 2020, patients with endometriosis treated at 2 centers in São Paulo, Brazil and 1 center in Barcelona, Spain (participating sites are listed at the end of

Table 1

Mean surgical complexity rating for each site of endometriosis

Site of endometriosis	N of endometriosis specialist evaluations	Mean	Standard deviation	Median	p25	p75
Superficial <3 cm	30	1.8	1.3	1.0	1.0	2.0
Superficial ≥3 cm	29	3.8	2.0	3.0	2.0	4.0
Superficial ovarian endometriosis	30	1.9	1.5	2.0	1.0	2.0
Ovarian endometrioma <3 cm	30	4.5	2.0	5.0	3.0	5.0
Ovarian endometrioma ≥3 cm	30	6.7	2.0	7.0	5.0	8.0
Retrocervical <3 cm	30	5.4	1.9	5.0	4.0	7.0
Retrocervical ≥3 cm	30	7.6	1.8	8.0	6.0	9.0
Vaginal endometriosis <3 cm	30	5.4	1.9	5.0	4.0	6.0
Vaginal ≥3 cm	30	7.7	1.6	8.0	6.0	9.0
Bladder (muscularis) <3 cm	29	5.2	1.9	5.0	4.0	6.0
Bladder (muscularis) ≥3 cm	29	7.3	1.7	8.0	6.0	8.0
Rectum/Sigmoid (muscularis) <3 cm	30	6.8	1.7	7.0	5.0	8.0
Rectum/Sigmoid (muscularis) ≥3 cm	30	9.0	1.5	10.0	8.0	10.0
Extrinsic ureter	29	5.7	1.6	6.0	5.0	7.0
Intrinsic ureter	28	8.2	1.7	8.5	7.0	10.0
Hydroureter	29	9.2	1.4	10.0	9.0	10.0
Appendix	28	4.6	1.9	4.0	3.0	6.0
Small bowel/Cecum <3 cm	30	5.6	2.0	5.0	4.0	7.0
Small bowel/Cecum ≥3 cm	30	7.7	2.1	8.0	6.0	9.0
Tubes - slight serosal injury	29	2.0	0.9	2.0	1.0	3.0
Tubes - moderate serosal injury	30	4.1	1.4	4.0	3.0	5.0
Tubes - severe immobility	29	6.0	1.9	6.0	5.0	7.0
Tubes - complete obstruction	30	7.1	2.4	7.5	6.0	9.0

p25 = 25% quartile; p75 = 75% quartile.
Endometriosis specialists were asked to score the complexity of surgical management of endometriosis at a series of sites, with 0 representing negligible complexity and 10 representing most complex. Summary statistics of mean, standard deviation, median, and 25% and 75% quartiles (labeled as p25 and p75, respectively) are presented. Cronbach $\alpha = 0.892$.

Fig. 1

(A and B). AAGL 2021 Endometriosis Classification System. AAGL = American Association of Gynecologic Laparoscopists.

[a]The size corresponds to the sum of the major diameter of the cysts in the affected ovary.

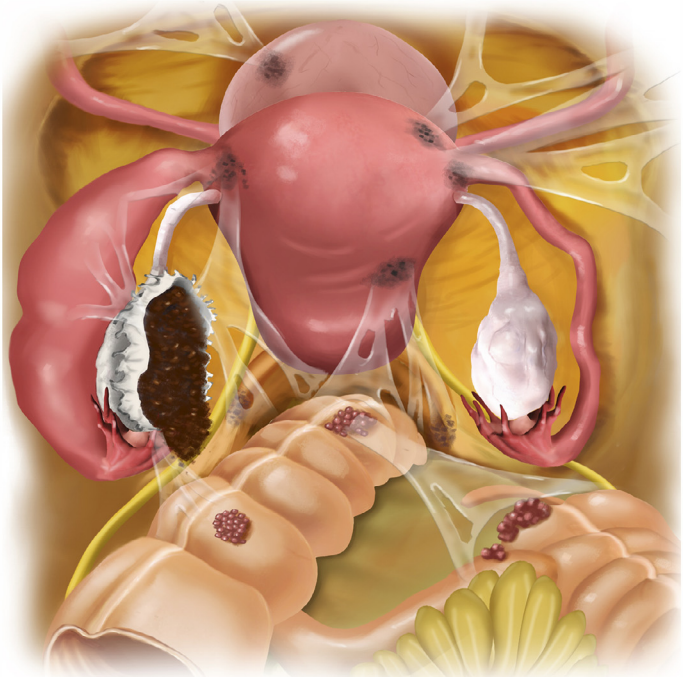
[b]Refers to retrocervical, uterosacral ligaments (part of retrocervical region), paracervical, or *torus uterinus* lesions.

[c]Refers to the lesions of the rectovaginal space below the line passing along the lower border of the posterior lip of the cervix (under the peritoneum) [27]. If the patient has an anterior low rectal lesion compromising the rectovaginal septum, score here and also under rectum/sigmoid endometriosis.

[d]If more than 1 bowel lesion, add up the total sum of the major longitudinal diameters of each of the lesions.

Scores for each anatomic site were generated from unscaled surgical complexity ratings (Table 1) after excluding individual scores >2 standard deviations from the mean and scaling values.

Superficial	Score
< 3 cm	2
≥ 3 cm	4
Vagina (muscularis)	**Score**
< 3 cm	5
≥ 3 cm	8
Left Ovary	**Score**
Superficial	2
< 3 cm	5
≥ 3 cm	7
Left Ureter	**Score**
Extrinsic	6
Intrinsic	8
Hydroureter	9
Left Fallopian Tube	**Score**
Slight serosal involvement /damage	2
Moderate immobility	4
Severe immobility	6
Complete obstruction	7
Cul-de-sac obliteration	**Score**
Partial	6
Complete	9
Rectum/ Sigmoid colon	**Score**
< 3 cm	7
≥ 3 cm	9
Rectovaginal septum	**Score**
Present	8



Retrocervical	Score
< 3 cm	5
≥ 3 cm	8
Bladder/ detrusor	**Score**
< 3 cm	5
≥ 3 cm	7
Right Ovary	**Score**
Superficial	2
< 3 cm	5
≥ 3 cm	7
Right Ureter	**Score**
Extrinsic	6
Intrinsic	8
Hydroureter	9
Right Fallopian Tube	**Score**
Slight serosal involvement /damage	2
Moderate immobility	4
Severe immobility	6
Complete obstruction	7
Small bowel/ Cecum	**Score**
< 3 cm	6
≥ 3 cm	8
Appendix	**Score**
Present	5

AAGL Endometriosis Stage	Total Score
Stage 1	≤8
Stage 2	9 to 15
Stage 3	16 to 21
Stage 4	>21

the manuscript) were prospectively evaluated for study inclusion. The purpose of this cohort was to determine the cut points along the AAGL Endometriosis Classification score (built from an assessment of endometriosis at a series of anatomic sites) that would generate a 4-level surgical complexity scale that closely matched with a surgical complexity level (defined by the most complex procedure performed).

Female patients aged 15 to 45 years with histologic confirmation of endometriosis, without clinical signs of menopause, and undergoing laparoscopy owing to infertility or pelvic pain were included. Patients with a history of any gynecologic, colorectal, and/or urinary tract malignancy were excluded. Patients were also excluded if their medical or surgical records were incomplete. Institutional review board approval from each of the participating centers was obtained (Barcelona Hospital under the number HCB/2019/1152 and São Paulo, Brazil numbers 3079709/2018 and 4232258/2020). Patient informed consent was not required as this was a nonintervention study, with all patients receiving standard-of-care surgical treatment.

Demographic data of age, parity, and pain-related symptoms, including dysmenorrhea, deep dyspareunia, noncyclic pelvic pain, cyclic dyschezia, and cyclic dysuria, were

Table 2

Levels of surgical complexity

Level	Surgical procedures involved
A	- Excision or desiccation of superficial implants
B	- Stripping of ovarian endometrioma - Appendectomy - Deep infiltrating endometriosis not involving the bowel, vagina, ureter, or bladder muscularis - Lysis of dense adhesions not involving the bowel or the ureter
C	- Lysis of dense adhesions involving the bowel or the ureter - Excision of bladder muscularis lesions requiring suturing - Ureterolysis - Excision of bowel lesions by shaving or disk resection only
D	- Excision of bowel lesions requiring full-thickness bowel resection - Excision of ureteral lesions requiring reimplantation or reanastomosis

obtained. Patients were considered to have positive pain symptoms in any domain if the symptoms were present for at least 6 months before surgery. For those patients with positive pain symptoms, pain was rated from 0 to 10 using the visual analog scale (VAS). In addition, a history of infertility, defined as the inability to achieve a pregnancy in the 12 months before surgery in patients aged <35 years or 6 months in patients aged ≥35 years, was recorded.

The anatomic distribution and involvement of endometriosis was determined by laparoscopy. All patients underwent surgical excision of endometriosis, with the surgical technique and management left to the discretion of the primary surgeon. The surgical procedures that treated the identified endometriosis were used to compute the 2021 AAGL Endometriosis Classification score components (i.e., component difficulty scores).

In parallel, the surgical complexity level, defined as the level of the highest-complexity procedure performed, was recorded (Table 2). Finally, for each patient, the surgery was also scored and staged according to the ASRM 1996 classification system.

Study data were collected and managed using REDCap electronic data capture tools (Vanderbilt University, Nashville, TN) hosted at Hospital Beneficência Portuguesa [16].

Determining the Stage Cutoffs for the AAGL Classification Score

We established a 4-level scale of surgical complexity for endometriosis designed to categorize each surgery on the basis of its highest-complexity task (Table 2). This scale was extensively discussed by the AAGL Endometriosis Special Interest Group in 2010 and approved by the 31 recognized international specialists who were asked to estimate the complexity of surgical excision of endometriosis. Thus, a patient who underwent excision of ovarian endometrioma, appendectomy, and ureterolysis was considered to have undergone a level C surgery.

Three cut points along the distribution of the AAGL total score were chosen using receiver operating characteristic curves to create 4 stages within the AAGL scoring system that most closely corresponded with the scale of surgical complexity. Cutoff points in the AAGL total score were established to maximize predictive accuracy in discriminating between the 4 surgical complexity levels (A vs B/C/D, A/B vs C/D, and A/B/C vs D). These cut points thereby established the 4 stages of the AAGL 2021 Endometriosis Classification System (Fig. 1).

Statistical Analysis

Continuous variables were reported as mean and standard deviation or median and interquartile ranges and were compared using the Kruskal-Wallis test and analysis of variance, respectively. Categoric variables were reported as frequencies and compared using chi-square test. Consistency among surgeon-reported surgical complexity ratings for endometriosis management was assessed using Cronbach α. The reproducibility between the AAGL or ASRM staging and surgical complexity was assessed using the weighted kappa agreement coefficient. Reproducibility of numeric scores such as the AAGL score was assessed with the intraclass correlation coefficient. p-values <.05 were considered significant.

Statistical analysis was performed using SPSS v.25 (IBM, Armonk, NY).

Results

AAGL Score Determination

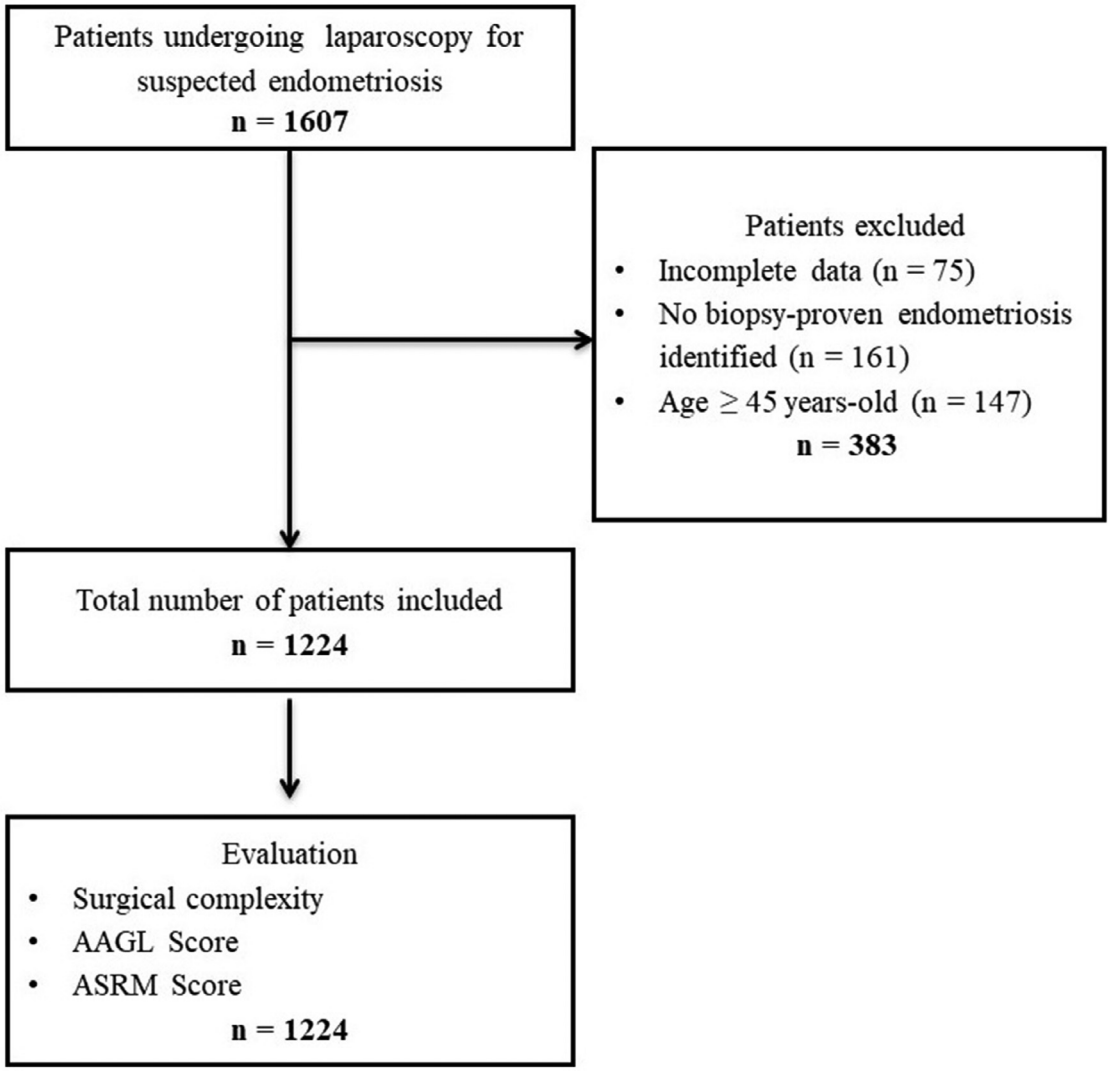
Expert-surgeon–rated surgical complexity for treating endometriosis was calculated and summarized for each anatomic site (Table 1). There was high internal consistency in ratings between physician respondents (Cronbach $\alpha = 0.892$). Normalization of these surgical complexity ratings (described in the Materials and Methods section) defined the point value of endometriosis at each anatomic site (Fig. 1, top).

Validation Cohort

During the study period, 1607 patients with suspected endometriosis underwent laparoscopy and were screened for eligibility. Of these, 75 were excluded for incomplete data, 161 for lack of biopsy-proven endometriosis, and 147 for age >45 years (Fig. 2). A total of 1224 patients across 3 centers were thus included in the final analysis. Complete clinical and surgical data were recorded for all included patients.

Fig. 2

Flowchart of included patients. AAGL = American Association of Gynecologic Laparoscopists; ASRM = American Society of Reproductive Medicine.



The mean age of patients was 34.6 ± 5.6 years (Table 3). Patients in the surgical cohort reported high rates of severe (VAS ≥7) dysmenorrhea (n = 941, 76.9%), dyspareunia (n = 546, 44.6%), acyclic pelvic pain (n = 453, 37.0%), dyschezia (n = 394, 32.2%), and dysuria (n = 124, 10.1%). Among the 789 (64.4%) female patients trying to conceive, 525 (66.5%) reported a history of infertility. Patients underwent surgeries across a wide range of complexities, with 669 (54.6%) undergoing extensive (level C or D) surgeries.

AAGL Staging Cutoff Determination

The optimal cutoff points in the total AAGL score that maximized sensitivity and specificity for the 4 surgical complexity stages were determined as 8, 15, and 21 points, thereby defining the AAGL 2021 Endometriosis Classification stages as stage I (≤8), stage II (>8 and ≤15), stage III (>15 and ≤21), and stage IV (>21 points), respectively (Figs. 1 [bottom] and 2). These cutoff points discriminated effectively between stage A and stages B to D (area under receiver operating characteristic curve [AUC] = 0.977), between stages A andB and stages C and D (AUC = 0.955), and between stages A to C and stage D (AUC = 0.909) surgical complexity cases (Fig. 3 and Table 4).

Comparison of AAGL with ASRM Staging Systems

All 1224 patients were staged according to both the AAGL and ASRM classification systems (Table 5). When staged according to the AAGL system, 18.7% (n = 230),

Table 3

Baseline characteristics of included patients

Characteristic	Mean ± SD or n (%)
Age, yrs	34.6 ± 5.6
BMI, kg/m^2	23.5 ± 4.0
Ethnicity	
White	1067 (87.2)
Black	42 (3.4)
Asian	21 (1.7)
Other	83 (6.8)
Not reported	11 (0.9)
Comorbidities	453 (37.0)
Smoking history	
Current	65 (5.3)
Former	62 (5.0)
Not reported	45 (3.7)
Prior endometriosis surgery	383 (31.3)
1	271 (22.1)
2	76 (6.2)
≥3	36 (2.9)
Not reported	3 (0.2)
Prior abdominal surgery	392 (32.0)
Age of menarche, yrs	12.4 ± 1.5
Dysmenorrhea, VAS score	7.7 ± 3.0
Deep dyspareunia, VAS score	5.1 ± 3.6
Noncyclic pelvic pain, VAS score	4.1 ± 4.0
Cyclic dyschezia, VAS score	3.5 ± 4.0
Cyclic dysuria, VAS score	1.3 ± 2.8
Infertility	525* (66.5)
Not reported	6 (0.4)

BMI = body mass index; SD = standard deviation; VAS = visual analog scale.
* Among 789 patients trying to conceive.

26.2% (n = 321), 12.0% (n = 148), and 42.9% (n = 525) of the patients had stage I, II, III, and IV disease, respectively. When staged according to the ASRM system, 23.2% (n = 285), 24.4% (n = 299), 17.6% (n = 215), and 34.7% (n = 425) of the patients had stage I, II, III, and IV disease, respectively. There was limited agreement in disease stage between the 2 systems (weighted κ = 0.410) (Table 5), with 57.4% (n = 703) of the patients assigned to the same stage within both systems.

The AAGL stage was concordant with the surgical complexity scale in 847 (69.2%) cases, whereas the ASRM stage agreed in 571 (46.6%) cases (Table 6). The AAGL stages had much higher agreement (weighted κ = 0.621) than the ASRM stages (weighted κ = 0.317) with the surgical complexity scale.

Comparison of AAGL and ASRM Stages and Symptoms

A higher AAGL stage was associated with significantly higher mean VAS scores of dysmenorrhea (p <.001), dyspareunia (p = .004), dyschezia (p <.001), and total pain (p <.001) but not acyclic pain (p = .137) or dysuria (p = .067) (Table 7). A higher AAGL stage was also associated with an increased incidence of severe dysmenorrhea (p <.001), severe dyschezia (p <.001), and infertility (p <.001) but not severe acyclic pain (p = .351) or severe dysuria (p = .083) (Table 7).

A higher ASRM stage was associated with higher VAS scores of dysmenorrhea (p <.001), dyspareunia (p = .003), acyclic pain (p = .004), dyschezia (p <.001), and total pain (p <.001) but not dysuria (p = .075) (Supplemental Table 1). A higher ASRM stage was similarly associated with an increased incidence of severe dysmenorrhea (p <.001), severe dyschezia (p <.001), and infertility (p <.001) but not severe dyspareunia (p = .135), severe acyclic pain (p = .108), or severe dysuria (p = .078) (Supplemental Table 1).

Discussion

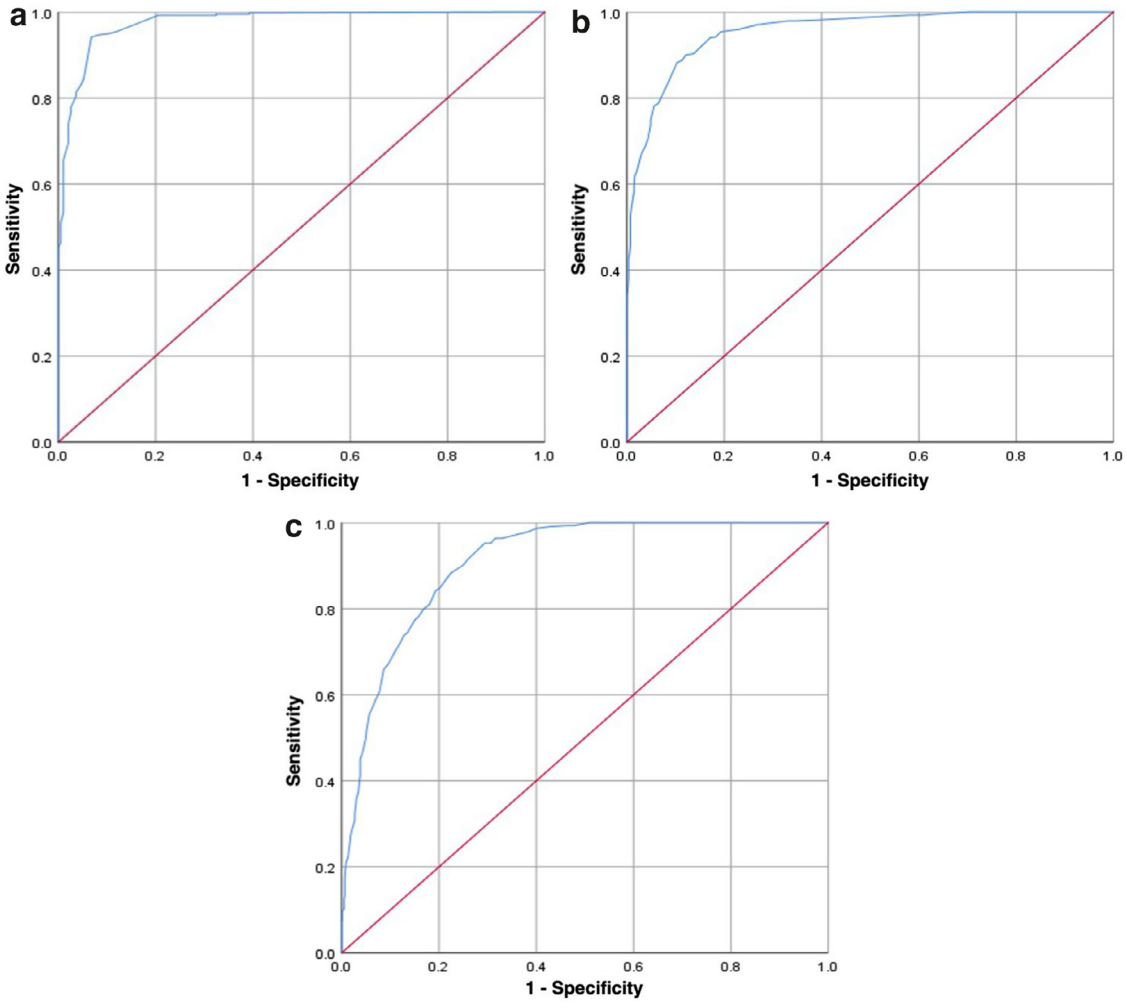
The current study created a scoring system on the basis of expert surgeon-derived complexity ratings and translated these scores into a 4-stage endometriosis scale. The high concordance between the AAGL 2021 Endometriosis Classification System scale and the surgical complexity scale validates the use of the system in scoring surgical complexity. This system is easy to calculate at the time of laparoscopy and is solely derived from intraoperative anatomic findings. We envision the greatest potential application to be in aiding surgeons who are seeking to objectively quantify procedure difficulty. The AAGL 2021 Endometriosis Classification score has the potential to improve clarity in communication within medical records and in clinical research.

The AAGL 2021 Endometriosis Classification score may also find a future application in efforts to capture surgical complexity more faithfully when determining surgeon professional fees. Although this classification system is not designed to perfectly measure the level of surgical skill and effort required for all cases (particularly for upper abdominal or extraperitoneal disease), it places a wide variety of endometriosis-related surgeries on a linear complexity scale. Tying reimbursements more closely to the AAGL 2021 Endometriosis Classification System scores may have the potential to improve financial incentives to completely treat disease, particularly for complex cases requiring significant expert time and effort.

The lack of strong agreement between ASRM [3] and AAGL stages (Table 5) highlights the distinct outcomes represented by the 2 classification systems. The ASRM [3] staging system was designed to predict the probability of pregnancy after surgical management. However, the authors of the 1979 American Fertility Society classification acknowledged that the distribution of points was arbitrarily determined. This limitation remained unaddressed in subsequent ASRM score revisions. Although the Endometriosis Fertility Index [4] was subsequently developed to predict fertility outcomes and shown to have superior results, neither the ASRM score nor Endometriosis Fertility Index were designed to reflect surgical complexity [17].

Fig. 3

Receiver operating characteristic curves between each stage of surgical complexity. Surgical complexity scale A−D are described in Table 2. (A) Surgical complexity A vs B/C/D. (B) Surgical complexity A/B vs C/D. (C) Surgical complexity A/B/C vs D.



By contrast, the AAGL 2021 Endometriosis Classification System makes no deliberate attempt to predict reproductive outcomes but is specifically designed to measure surgical complexity. Although there is some correlation between the ASRM [3] and AAGL classifications (Table 5), the AAGL system is better optimized for scoring surgical complexity (Table 6).

The AAGL and ASRM [3] staging systems had similar correlations with overall pain scores, severe pain symptoms, and infertility. Although a higher ASRM stage but not a higher AAGL stage was significantly associated with higher reported levels of acyclic pelvic pain (Table 7 and Supplemental Table 1), this association was clearly nonlinear; ASRM stage I patients had higher mean acyclic pelvic pain scores than ASRM stage II patients, whereas AAGL stage I patients even had higher mean acyclic pelvic pain scores than AAGL stage IV patients. The lack of a clear linear trend across both scoring systems in this domain is consistent with the wide variation in endometriosis disease severity observed among patients presenting with pain symptoms [18]. Other causes of acyclic pelvic pain may overlap with endometriosis and impair the use of intraoperative findings to predict pain [19,20]. It is likely that any future staging system used to estimate pain symptoms among patients with endometriosis, if even possible to construct, will require a distinct scoring model.

Given the improving fidelity of noninvasive methods of diagnosing endometriosis such as ultrasound and magnetic resonance imaging [21−24], we are actively studying the feasibility of preoperative rather than intraoperative prediction of the AAGL Endometriosis Classification score. A reliable preoperative method of determining surgical

Table 4

Performance of optimal cutoff points in AAGL score

Statistic	%		95% CI
A vs B/C/D			
AUROC		0.977	
Optimal cutoff		8.3	
Sensitivity	94.2		92.6−95.5
Specificity	93.2		88.6−96.3
PPV	98.7		97.8−99.2
NPV	74.8		69.8−79.2
Accuracy	94.0		92.6−95.3
A/B vs C/D			
AUROC		0.955	
Optimal cutoff		15.1	
Sensitivity	90.3		87.8−92.4
Specificity	86.3		83.2−89.1
PPV	88.8		86.6−90.7
NPV	88.1		85.4−90.3
Accuracy	88.5		86.6−90.2
A/B/C vs D			
AUROC		0.909	
Optimal cutoff		20.7	
Sensitivity	84.4		80.7−87.7
Specificity	80.2		77.2−82.9
PPV	70.3		67.2−73.2
NPV	90.2		88.1−92.1
Accuracy	81.7		79.4−83.8

AAGL = American Association of Gynecologic Laparoscopists; AUROC = area under the receiver operating characteristic curve; CI = confidence interval; NPV = negative predictive value; PPV = positive predictive value.
Optimal cutoff points are given for the cutoff points that maximize the sum of specificity and sensitivity.

Table 5

Concordance between AAGL and ASRM Endometriosis Classification stages

Stage	ASRM				Total, n	$\kappa = 0.410$
AAGL	I n (%)	II n (%)	III n (%)	IV n (%)		
I	194 (15.8)	16 (1.3)	15 (1.2)	5 (0.4)	230	
II	79 (6.5)	126 (10.3)	84 (6.9)	32 (2.6)	321	
III	9 (0.7)	64 (5.2)	35 (2.9)	40 (3.3)	148	
IV	3 (0.2)	93 (7.6)	81 (6.6)	348 (28.4)	525	
Total	285	299	215	425	1224	

AAGL = American Association of Gynecologic Laparoscopists; ASRM = American Society for Reproductive Medicine.
Included patients were scored according to the AAGL and ASRM systems. Counts and frequencies of each AAGL and ASRM stage pair were calculated.

complexity would provide significant assistance to those contemplating surgery and aid in determining whether subspecialty assistance or referral to a tertiary center would be appropriate [25,26].

Limitations

The 2021 AAGL Endometriosis Classification score has some structural limitations. Similar to all other classification systems for endometriosis [8,9,19,20], the score is constructed from the input of a group of expert surgeons. Although there is a high internal consistency among the respondent scores, the high level of experience among the survey respondents likely minimizes the difficulty experienced by the typical surgeon in practice when confronted with endometriosis. An alternative classification score constructed from survey responses of less specialized surgeons would have potentially reflected surgical difficulty in general gynecologic practice to a greater degree but would have suffered from poor internal consistency.

Although the score is constructed as a linear model (i.e., the total score is a sum of the points assigned from each involved anatomic site), surgeon rankings of difficulty are not likely linear when compressed to a scale of 0 to 10. For example, treatment of 2 lesions worth 4 points each may not be meaningfully "equivalent" in surgical complexity to the treatment of 1 lesion worth 8 points. However, the decision to construct the AAGL score as a linear model was made intentionally to facilitate clinical use among a range of surgeons, including those with only pen and paper on hand.

Although the system is clearly suitable for scoring endometriosis across a range of complexities, it likely provides the most clinically useful information to those treating more advanced disease rather than predominantly AAGL stage I disease. The complexity of cases in the validation cohort was biased toward more advanced disease, reflecting the referral patterns of the participating surgeons and centers in Brazil and Spain. This bias may have increased the correlation to the AAGL stage with pain and infertility scores. In addition, this is, by definition, the first published validation study for the 2021 AAGL Endometriosis Classification System. Future studies will be required to confirm its use in other patient populations/countries and under the care of different surgeons, including general gynecologists, fertility specialists, and endometriosis specialists.

Finally, the system does not capture disease burden at extra-abdominal or upper abdominal sites. Despite several hypothesized pathophysiologic associations between endometriosis and adenomyosis [21], the intraoperative identification of adenomyosis has no bearing on the endometriosis score or stage in the current classification system. A future scoring system will likely benefit from addressing endometriosis involving sites such as the abdominal wall, diaphragm, and upper intestine and may also consider scoring adenomyosis.

Table 6

AAGL and ASRM classification concordance with surgical complexity

Stage	Surgical complexity							
	A		B		C		D	
	AAGL	ASRM	AAGL	ASRM	AAGL	ASRM	AAGL	ASRM
Stage I	171 (89.5)	163 (85.3)	45 (12.4)	99 (27.2)	2 (0.8)	19 (8.2)	0 (0)	4 (0.9)
Stage II	17 (8.9)	21 (11.0)	229 (62.9)	114 (31.3)	33 (9.0)	76 (32.7)	10 (2.3)	88 (20.1)
Stage III	3 (1.6)	5 (2.6)	76 (20.9)	107 (29.4)	98 (42.2)	46 (19.2)	78 (17.8)	57 (13.0)
Stage IV	0 (0)	2 (1.0)	14 (3.9)	44 (12.1)	99 (42.6)	91 (39.2)	349 (79.9)	288 (65.9)
Total	191	191	364	364	232	232	437	437

AAGL = American Association of Gynecologic Laparoscopists; ASRM = American Society for Reproductive Medicine.
Values are given as n (%).
Agreement between surgical complexity and AAGL classification (weighted $\kappa = 0.621$).
Agreement between surgical complexity and ASRM classification (weighted $\kappa = 0.317$).
Surgical complexity stages A to D are described in Table 2.

Table 7

Endometriosis symptom prevalence and severity stratified by AAGL 2021 Endometriosis Classification stage

Symptom	AAGL stage				p-value
	I	II	III	IV	
Dysmenorrhea					
Mean ± SD	6.9 ± 3.5	7.3 ± 3.2	7.7 ± 2.8	8.3 ± 2.5	<.001
Median (p25;p75)	8.0 (5; 10)	8 (6;10)	9 (7; 10)	9 (8;10)	<.001
VAS ≥7, n (%)	153 (70.2)	207 (71.6)	195 (76.6)	386 (83.5)	<.001
Dyspareunia					
Mean ± SD	4.6 ± 3.8	5.0 ± 3.7	4.8 ± 3.7	5.5 ± 3.4	.004
Median (p25;p75)	5.0 (0;8.0)	6.0 (0;8)	5.0 (0;8)	6.0 (3;8)	.385
VAS ≥7, n (%)	92 (43.2)	125 (43.7)	105 (41.5)	224 (48.9)	.214
Acyclic pain					
Mean ± SD	4.4 ± 4.0	3.7 ± 3.9	4.0 ± 4.0	4.3 ± 3.9	.137
Median (p25;p75)	5.0 (0;8)	3.0 (0;8)	4.0 (0;8)	5.0 (0;8)	.276
VAS ≥7, n (%)	87 (40.1)	97 (33.6)	90 (35.3)	179 (38.7)	.351
Dyschezia					
Mean ± SD	2.2 ± 3.4	2.7 ± 3.7	3.5 ± 4.0	4.6 ± 4.2	<.001
Median (p25;p75)	0 (0;5)	0 (0;6)	0 (0;8)	5 (3;9)	<.001
VAS ≥ 7, n (%)	42 (19.3)	69 (24.0)	83 (32.5)	200 (43.4)	<.001
Dysuria					
Mean ± SD	0.9 ± 2.3	1.1 ± 2.7	1.3 ± 2.8	1.5 ± 3.0	.067
Median (p25;p75)	0 (0;0)	0 (0;0)	0 (0;0)	0 (0;0)	.08
VAS ≥7, n (%)	15 (6.9)	26 (9.0)	24 (9.4)	59 (12.8)	.083
Total pain score					
Mean ± SD	16.4 ± 11.4	17.4 ± 10.4	18.3 ± 11.0	21.0 ± 10.8	<.001
Median (p25;p75)	15.0 (7;26)	17.0 (10;24)	17.0 (10;25)	20.0 (13;28.3)	<.001
Infertility					
n (%)	61 (49.2)	105 (59.3)	107 (66.0)	252 (77.3)	<.001

AAGL = American Association of Gynecologic Laparoscopists; p25 = 25% quartile; p75 = 75% quartile; SD = standard deviation; VAS: visual analog scale.

Conclusion

The 2021 AAGL Endometriosis Classification System represents an objective, anatomically derived, and user-friendly score constructed from expert-surgeon ratings of difficulty and establishes stage cutoffs that reliably describe the level of complexity of surgery required to completely treat observed disease.

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Participating Sites

Hospital BP-A Beneficência Portuguesa de São Paulo, São Paulo, SP, Brazil.

Hospital das Clinicas Faculdade de Medicina FMUSP, Universidade de Sao Paulo, Sao Paulo, SP, Brazil.

Hospital Clínic de Barcelona, Barcelona, Spain.

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Supplemental Table 1

Endometriosis symptom prevalence and severity stratified by ASRM Classification

Symptom	ASRM Stage				P
	I	II	III	IV	
Dysmenorrhea					
Mean ± SD	6.9 ± 3.5	7.3 ± 3.1	7.0 ± 2.8	8.4 ± 2.4	<0.001
Median (p25; p75)	8 (5;10)	8 (6;10)	9 (7;10)	9 (8;10)	<0.001
VAS ≥ 7, n (%)	198 (69.5)	214 (71.6)	166 (77.2)	363 (85.4)	<0.001
Dyspareunia					
Mean ± SD	4.7 ± 3.8	4.7 ± 3.8	5.5 ± 3.4	5.4 ± 3.5	0.003
Median (p25; p75)	6 (0;8)	5 (0;8)	7 (3;8)	6 (3;8)	0.014
VAS ≥ 7, n (%)	121 (43.2)	123 (41.4)	109 (51.4)	193 (46.0)	0.135
Acyclic Pain					
Mean ± SD	4.0 ± 4.0	3.5 ± 4.0	4.2 ± 3.8	4.6 ± 4.0	0.004
Median (p25; p75)	3.5 (0;8)	0 (0;8)	5 (0;8)	5 (0;8)	0.004
VAS ≥ 7, n (%)	102 (35.9)	96 (32.1)	81 (37.7)	174 (40.9)	0.108
Dyschezia					
Mean ± SD	2.3 ± 3.5	3.5 ± 4.0	3.2 ± 3.8	4.5 ± 4.2	<0.001
Median (p25; p75)	0 (0;5)	0 (0;8)	0 (0;7)	5 (0;8.5)	<0.001
VAS ≥ 7, n (%)	55 (19.3)	95 (31.9)	64 (29.8)	180 (42.5)	<0.001
Dysuria					
Mean ± SD	1.0 ± 2,5	1.1 + 2.7	1.2 ± 2.7	1.5 ± 3.1	0.075
Median (p25; p75)	0 (0;0)	0 (0;0)	0 (0;0)	0 (0;0)	<0.001
VAS ≥ 7, n (%)	23 (8.1)	26 (8.7)	19 (8.8)	56 (13.2)	0.078
Total pain score					
Mean ± SD	16.5 ± 11.1	17.5 ± 11.0	19.1 ± 10/4	21.1 ± 10.7	<0.001
Median (p25; p75)	15.5 (8;24)	17 (9;25)	18 (12;26)	20 (13;28.5)	<0.001
Infertility					
n (%)	84 (50.3)	127 (63.5)	91 (69.5)	223 (76.6)	<0.001

ASRM: American Society for Reproductive Medicine. VAS: visual analog scale. SD: standard deviation