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Hysteroscopic myomectomy: The guidelines of the International Society for Gynecologic Endoscopy (ISGE)

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ABSTRACT

Objective: With this publication, the International Society for Gynecologic Endoscopy (ISGE) aims to provide the clinicians with the recommendations arising from the best evidence currently available on hysteroscopic myomectomy (HM).

Study design: The ISGE Task Force for HM defined key clinical questions, which led the search of Medline/PubMed and the Cochrane Database. We selected and analyzed relevant English-language articles, published from January 2005 to June 2021, including original works, reviews and the guidelines previously published by the European Society for Gynecological Endoscopy (ESGE) and the American Association of Gynecologic Laparoscopists (AAGL), in which bibliographies were also checked in order to identify additional references, using the medical subject heading (MeSH) term "Uterine Myomectomy" (MeSH Unique ID: D063186) in combination with "Myoma" (MeSH Unique ID: D009214) and "Hysteroscopy" (MeSH Unique ID: D015907). We developed the recommendations through multiple cycles of literature analysis and expert discussion.

Results: The ISGE Task Force did develop 10 grade 1A-C and 4 grade 2A-C recommendations. For planning HM, evaluation of the uterus with **saline infusion sonohysterography (SIS)** or combined assessment by **transvaginal ultrasound (TVUS)** and diagnostic hysteroscopy is recommended (Grade 1A). The use of **STEPW (Size, Topography, Extension of the base, Penetration and lateral Wall position)** classification system of submucosal **leiomyoma (LM)** is recommended to predict the complex surgeries, incomplete removal of the LM, long operative time, fluid overload and other major complications (grade 1B). For type 0 LMs, in addition to resectoscopy (slicing technique), morcellation is recommended, being faster and having a shorter learning curve with respect to resectoscopy (grade 1C). For type 1–2 LMs, slicing technique is currently recommended (grade 1C). A fluid deficit of 1000 mL also in case of bipolar myomectomy with saline solution, in healthy women of reproductive age, contains low risk for major complications. Lower thresholds (750 mL) for fluid deficit should be considered in the elderly and in women with cardiovascular, renal or other co-morbidities (Grade 1B).

Conclusion: HM is the most effective conservative minimally invasive gynecologic intervention for submucous LM. The set of 14 ISGE recommendations can significantly contribute to the success of HM and the safety of patients for whom the choice of appropriate surgical technique, as well as the surgeon's awareness and measures to prevent complications are of the utmost importance.

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Introduction

Submucosal leiomyomas (LMs), myomas or fibroids represent 5.5–10% of all uterine LMs which have a prevalence as high as 70–80% at the age of 50 [1] and cost annually, in the USA, more than breast, ovarian and colon cancer [2,3]. Protruding into the uterine cavity, submucosal LMs may induce excessive uterine bleeding, usually during menses, and colicky dysmenorrhea, being also thought to predispose patients to reproductive failure [4]. Hysteroscopic myomectomy (HM) is the first-line minimally invasive and conservative surgical treatment for submucosal LMs, thus appropriate in women that have not completed their reproductive path. With this publication, the ISGE aims to provide the clinicians with the recommendations arising from the best evidence currently available on HM.

Material and methods

The ISGE Task Force for HM defined key clinical questions (Table 1), which led the search of Medline/PubMed and the Cochrane Database. We selected and analyzed relevant English-language articles, published from January 2005 to June 2021, including original works, reviews and the guidelines previously published by the European Society for Gynecological Endoscopy (ESGE) and the American Association of Gynecologic Laparoscopists (AAGL). Using the GRADE approach (http://www.grade-wor-kinggroup.org; Table 2), we graded the available information by the level of evidence for each clinical question and developed the recommendations through multiple cycles of literature analysis and expert discussion. The ISGE Ethical Committee ruled that approval was not required for this study.

Results and discussion

Literature review, considerations and recommendations

Preoperative evaluation

Submucous LMs are clinically suspected by abnormal uterine bleeding (AUB), while the diagnosis is generally established by imaging techniques – ultrasonography (US), saline infusion sonohysterography (SIS), magnetic resonance imaging (MRI), and/or by diagnostic hysteroscopy [1,2,4]. Histological confirmation provides the final diagnosis [5]. Detailed characterization of the patient and thorough characterization of the myometrial lesion (s) aim to identify the right candidate for HM and assess the surgical risks, reduce the complications and contribute to the successful completion of the surgery.

Anamnestic data should be taken and analyzed, physical examination performed, pregnancy and gynecological malignancy

Table 1
Hysteroscopic myomectomy – key clinical questions.

Question 1:	How should a patient be evaluated before HM?
Question 2:	Which is the best classification system for submucous LMs in relation to the surgical outcome?
Question3:	Are there any indications for preoperative medical treatment?
Question 4:	What is the best resection technique and what are the most suitable instruments for resection of type 0 submucosal LMs?
Question 5:	What is the best resection technique and what are the most suitable instruments for resection of type 1 and type 2 LMs?
Question 6:	Which measures can reduce the perforation rate in HM?
Question 7:	Which measures can reduce bleeding during and after HM?
Question 8:	Which limit should be considered for fluid deficit and which measures cam reduce the rate of distention fluid-related complications?
Question 9:	Which measures can reduce cervical trauma, infections and adhesions?

Abbreviation: **HM**, hysteroscopic myomectomy; **LMs**, leiomyomas.

Table 2
GRADE approach – grading of recommendations, risk/benefit and quality of supporting evidence.

Grade of recommendation	Risk/benefit	Quality of supporting evidence
1A. Strong recommendation, high quality evidence	Benefits clearly outweigh risk and burdens, or vice versa.	Consistent evidence from well performed randomized, controlled trials or overwhelming evidence of some other form. Further research is unlikely to change our confidence in the estimate of benefit and risk.
1B. Strong recommendation, moderate quality evidence	Benefits clearly outweigh risk and burdens, or vice versa.	Evidence from randomized, controlled trials with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence of some other research design. Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate.
1C. Strong recommendation, low quality evidence	Benefits appear to outweigh risk and burdens, or vice versa.	Evidence from observational studies, unsystematic clinical experience, or from randomized, controlled trials with serious flaws. Any estimate of effect is uncertain.
2A. Weak recommendation, high quality evidence	Benefits closely balanced with risks and burdens.	Consistent evidence from well performed randomized, controlled trials or overwhelming evidence of some other form. Further research is unlikely to change our confidence in the estimate of benefit and risk.
2B. Weak recommendation, moderate quality evidence	Benefits closely balanced with risks and burdens, some uncertainly in the estimates of benefits, risks and burdens.	Evidence from randomized, controlled trials with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence of some other research design. Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate.
2C. Weak recommendation, low quality evidence	Uncertainty in the estimates of benefits, risks, and burdens; benefits may be closely balanced with risks and burdens.	Evidence from observational studies, unsystematic clinical experience, or from randomized, controlled trials with serious flaws. Any estimate of effect is uncertain.

(cervical and endometrial cancer) excluded in accordance with the guidelines [6], and adequate uterine evaluation accomplished. The objectives of preoperative uterine assessment are: to identify all uterine lesions; to confirm the number and submucous location and position of LMs, size, myometrial penetration and minimal distance between the nodule and serosa for each identified submucous LM; to distinguish LMs from other uterine lesions (*e.g.*, adenomyomas).

US is the first-line imaging tool for assessing the myometrium because of its availability, reliability and cost-effectiveness [7]. The Morphological Uterus Sonographic Assessment (MUSA) paper from 2015 provides a consensus statement on terms, definitions and measurements that can be used to describe and report normal and pathological myometrial findings during an ultrasound examination [8,9]. In accordance with the study of Pereira et al. (2021) that evaluated the accuracy of transvaginal US (TVUS) in the diagnosis of intrauterine lesions using hysteroscopy as the gold standard, sensitivity for LMs was 46.7%, specificity 95.0%, accuracy 87.9% and Kappa index 0.46 [10].

High-quality evidence supports that SIS is equally performant as hysteroscopy to diagnose submucous LMs, being both SIS and hysteroscopy superior to TVUS [11,12]. By defining the extent to which LMs protrude into the uterine cavity and, in the same time, the depth of myometrial penetration, SIS provides information analogue to that from the combined use of hysteroscopy and TVUS [13].

In the diagnosis of LM, Stamatopoulos *et al.* determined MRI sensitivity of 94.1%, specificity of 68.7%, positive predictive value of 95.7% and negative predictive value of 61.1% [14]. MRI has been considered superior to the other techniques in providing exact information about the submucous LMs [7,14–17], but its routine use for all patients is not cost-effective. It is adequate to engage MRI in the patients with high body-mass-index, numerous leiomyomas, very enlarged uterine size, coexistence of LMs and other uterine or pelvic lesions [7]. MRI has been found to have equal specificity, but better sensitivity than US for the diagnosis of adenomyosis/adenomyomas [1,18], which should be distinguished from LMs preoperatively, since the therapeutic strategies differ. MRI with gadolinium contrast represents an appropriate step for preoperative assessment of the likelihood of myometrial malignancy, when US indicates an atypical lesion [5]. Uterine sarcomas in patients undergoing operative hysteroscopy have been reported in 0.13% [19,20].

The use of computerized tomography (CT) [21], virtual CT hysteroscopy [22] and hysterosalpingography [23] is limited in women planning HM, since these do not provide precise information.

Office hysteroscopy allows direct uterine cavity observation, characterization of the endometrium, confirmation of the presence of submucous LMs and other intracavitary pathology. In addition to the direct vision, a biopsy of the endometrium and observed lesions can be performed. Dueholm *et al.* found hysteroscopy, SIS and MRI to be equally effective and superior to TVUS for the characterization of intracavitary lesions [15]. To correctly define the depth of myometrial penetration, office hysteroscopy should be combined with TVUS. Such a combined diagnostic strategy does not only represent an adequate and recommendable preoperative assessment modality, but also, when feasible, a see-and-treat approach [4].

Recommendation 1: The preoperative evaluation of patients planned to be submitted to HM should start with detailed history and physical examination (**Grade 1A**).

Recommendation 2: Ultrasonographic examination should be offered to all patients with uterine LMs (**Grade 1A**) while MUSA terms, definitions and measurements are recommended to be used for the description of scanning and sonographic findings (**Grade 1B**).

Recommendation 3: For planning HM, evaluation of the uterus with SIS or combined assessment by TVUS and diagnostic hysteroscopy is recommended (**Grade 1A**). MRI evaluation is appropriate when ultrasound-based assessment faces its limitations (e.g., patients with high body-mass-index, numerous LMs, very enlarged uterine size, coexistence of LMs and other uterine/pelvic lesions and uncertain nature of the uterine tumor) (**Grade 1A**).

Recommendation 4: Proper informed consent has to be given to the patient explaining alternative therapeutic strategies, the potential risks of HM, eventual need for a second intervention, and the likelihood of LM recurrence (**Grade 1A**).

Classification of submucous LMs

Adequate classification of LM is important to guide the treatment choices, including the surgical options. Ricardo Lasmar proposed so called **STEPW classification** [24], using a score that is assigned on the basis of five submucosal LM features: **S**ize, **T**opography, **E**xtension of the base, **P**enetration and lateral **W**all position (Table 3). Prospective multicenter studies have demonstrated that the STEPW classification allows a better prediction of complex HM, operative time, incomplete removal of the myoma, fluid balance, probability and severity of complications than the system previously developed by the ESGE does [25,26]. Since HM may require two or more procedures to be accomplished, importantly, the STEPW scoring system is able to predict the risk of surgery in two or more steps better than an estimate based only on LM size and wall penetration [27–29].

Modified from Wamsteker et al. [30], above mentioned **ESGE submucosal LM classification** includes *type 0* (entirely within endometrial cavity), *type I* (with < 50% myometrial extension and < 90-degree angle of myoma surface to uterine wall) and *type II submucosal LM* (with ≥ 50% myometrial extension and ≥ 90-degree angle of myoma surface to uterine wall). **The classification of the International Federation of Gynecology and Obstetrics (FIGO)** uses the same definitions for submucosal LM and includes the categorization of intramural and subserosal LM as well [31].

Recommendation 5: The use of STEPW submucosal LM classification system is recommended to predict the complex surgeries, incomplete removal of the LM, long operative time, fluid overload and other major complications (**grade 1B**).

Preoperative medical treatment

Gonadotropin-releasing hormone analogues (GnRH-a) have been preoperatively used to decrease the LM size and vascularization with the aim of making surgery faster [32,33]. They induce a state of hypoestrogenism that shrinks LMs, but also has side effects such as hot flushes and night sweats. These compounds are combined with hormonal add-back therapy to minimize the resultant hypoestrogenic side effects, including bone loss [34]. In a recent systematic review and meta-analysis focused on the preoperative use of GnRH-a, following outcomes were studied: complete resection of submucous LMs, operative time, fluid absorption and complications such as excessive intraoperative bleeding, uterine perforation and bowel injury [32]. No advantage of administering GnRH-a before HM has been found.

Low-quality evidence exists on the impact of **ulipristal acetate (UPA)** treatment before HM [35]. The LM treatment by UPA was suspended throughout the European Union pending the completion of an ongoing review of its hepatotoxicity by the European Medicines Agency (EMA) [36]. On 12 November 2020, EMA's human medicines committee (CHMP) recommended restricting use of medicines containing ulipristal acetate 5 mg. The medicines must not be used for controlling symptoms of uterine fibroids while awaiting surgical treatment.

Recommendation 6: The preoperative treatment with GnRH analogues is not routinely recommended because it has not been proved to be useful to facilitate a complete resection of submucous LM, reduce operative time and fluid absorption, and avoid major complications (**grade 2B).**

Type 0 LMs

The key goal of HM is the complete submucous LM removal, respecting the anatomical integrity of the uterus. The operating hysteroscope is the instrument that allows submucous myomectomy under direct and constant visual control. It includes a telescope with final lens (0°–12°–30°), an internal and an external sheath of 1–27 French (Fr) outer diameter that provide a constant inflow and outflow of distension fluid for generating a continuous and efficient lavage system of the uterine cavity. The operating hysteroscope permits the use of working elements: electrosurgical instruments (thermal loops and vaporizing electrodes or laser) and mechanical instruments (scissors, forceps, cold loops) for the traditional resectoscopic or office surgery. Small-diameter office instruments used through the working channel (5 Fr) of standard hysteroscopes (12–15 Fr) can be used for removal of small LMs.

Depending on the instrument used, different techniques for hysteroscopic type 0 LM removal are applicable: slicing, morcellation and cutting the pedicle in office setting [4,37]. The classic resectoscopic excision of intracavitary LMs is performed using the slicing technique, which consists of repeated and progressive passages of the cutting loop through the lesion. Excision usually begins at the top of the LM and progresses evenly towards its base. The loop is placed beyond the lesion, while cutting is performed only during the return movement towards the lens.

Although the slicing technique is generally presented as the gold standard for type 0 myomectomy, there is no solid evidence in the literature to support its superiority over other techniques [38]. Intra Uterine Morcellation (IUM) with hysteroscopic tissue removal systems [39], was compared to resectoscopy in a limited number of studies, often conducted on LMs and polyps interchangeably. IUM was demonstrated to be superior in terms of operative time and learning curve. A randomized controlled trial (RCT) reported a shorter learning curve among residents in training for morcellation compared to resectoscopy [40]. A systematic review assessing the feasibility of IUMs in submucous LMs showed positive outcome for type 0 and 1 lesions, unlike type 2 LMs [41]; however, the evidence provided by the studies reviewed in this paper is extremely limited. While IUM is able to remove the submucous LM once it is completely exposed into the uterine cavity,

Table 3
STEPW classification system of submucosal LMs (adapted from (24)).

Points	Size	Topography	Extension of the base	Penetration	Lateral wall
0	<2 cm	Low	<1/3	0	+1
1	2–5 cm	Middle	1/3–2/3	<50%	
2	>5 cm	Upper	>2/3	>50%	
Score	_____+	_____+	_____+	_____+	_____
Score 0–4	**Group I**	Low complexity HM			
Score 5–6	**Group II**	High complexity HM, two-step HM, GnRH agonist use			
Score 7–9	**Group III**	An alternative to HM to be considered			

Abbreviation: **GnRH**, gonadotropin-releasing hormone **HM**, hysteroscopic myomectomy; **LMs**, leiomyomas.

for small pedunculated lesions, office myomectomy can be also considered as an alternative option.

Recommendation 7: For type 0 LMs, in addition to resectoscopy (slicing technique), morcellation is recommended, being faster and having a shorter learning curve with respect to resectoscopy (**grade 1C**).

Type 1 and 2 LMs

Slicing technique vs. morcellation

Currently, there is a lack of high-quality data indicating the most appropriate technique and instruments for the removal of type 1 or 2 LMs. While slicing technique is feasible and provides reproducible results [1], most of the papers about intrauterine morcellation analyze the technique without discriminating LMs from other intrauterine lesions. In 2017, Vitale *et al.* did publish a review about hysteroscopic morcellation of submucous LMs [41]. The authors analyzed eight prospective randomized, not-randomized and retrospective studies, but could not provide conclusive information concerning the exclusive use of morcellators for type 1–2 LMs. For this reason, until new good quality studies and data appear, the slicing technique is recommended, because it is practicable and reproducible. At this moment of time, there are no data concerning safety in comparing the two techniques.

Slicing – cold vs. thermal loop

The cold loop slicing technique, first proposed and described by Dr. Ivan Mazzon, has been thought to be less aggressive than thermal loop slicing, in terms of the risk of thermal spreading into the surroundings tissues, *i.e.* the healthy endometrium and myometrium [42]. However, when performing a myomectomy in the correct plane (pseudocapsula) with a thermal loop, even in the case of a type 2 LM, there should be limited collateral damage.

The main complication to be avoided during myomectomy is the intravasation syndrome. There is no high-quality information in the literature accurately estimating the intravasation rates in patients submitted to myomectomy accomplished by the cold loop technique.

Most of the studies focusing the cold loop technique are retrospective or cohort studies, developed by the same group of researchers/surgeons [42,43]. The technique's theoretical superiority with respect to fertility or pregnancy outcome has never been studied in RCTs.

The Mazzon's technique is traditionally performed by the combination of a cold- and monopolar loop [42]. Di Spiezio Sardo *et al.* published a paper where the technique was used in combination with a bipolar loop [43]. Well-designed randomized trials are needed in order to compare cold loop technique and monopolar/bipolar slicing technique for feasibility, reproducibility and safety.

For above presented set of reasons, no recommendations can be currently formulated concerning cold - or thermal loop's superiority.

Slicing – bipolar vs. monopolar electrosurgery

A sole small RCT was published comparing monopolar with bipolar myomectomy in infertile women with menorrhagia [44]. In both groups, a significant improvement in the menstrual symptoms was observed after myomectomy. Pregnancy-related outcomes were similar as well. In conclusion, there is no proven difference between monopolar and bipolar resection in terms of the resolution of symptoms and reproductive outcomes.

Alternative techniques

5.4.1. Hydro-massage and bimanual uterine massage, performed in order to obtain extrusion of the intramural part of the LM into the uterine cavity and reduce, in this manner, the risks of the lesion removal, have been evaluated in a prospective study [45]. This technique could be interesting, but RCTs are necessary to demonstrate its reliability.

5.4.2. Leaving submucous myomas in the uterine cavity after office hysteroscopic enucleation can be an option for small grade 0–1 LM (1,2–2,5 cm) with 89% success rate, as demonstrated in a small prospective multicenter study by Tanvir *et al.* Larger studies are needed to establish this technique [46].

Intra-operative ultrasound guidance can be considered. Performed by transabdominal or transrectal probe, in accordance with some authors, it may help to perform the myomectomy in a single-step and/or avoid complications, such as perforation [47,48].

Recommendation 8: For type 1–2 LMs, slicing technique is recommended at this moment in time, being feasible and reproducible with respect to morcellation alone **(grade 1C).**

Recommendation 9: No recommendation can be advanced concerning cold and thermal loop myomectomy for type 1–2 LMs **(grade 2C).**

Recommendation 10: Monopolar compared to bipolar type 1–2 LM resection is equivalent in terms of menstrual symptom relief and reproductive outcome **(grade 2B).**

Principal HM specific complications and preventive measures

Cervical trauma and cervical/uterine perforation

The complication rates in operative hysteroscopy, Table 4, are mainly dependent on the difficulty of the procedure, the equipment/technique used, the expertise of the surgeon and the characteristics of the patient [49]. About half of all complications are so-called 'entry-related' – cervical trauma and cervical or uterine perforation. Risk factors include anatomical variation (extreme ante- or retroversion) and narrow/stenotic cervical canal due to nulliparity, post-menopause, caesarean section or excision of the transformation zone.

Perforation can occur during the cervical dilatation, placement of the hysteroscope/resectoscope or myomectomy itself. A short LM-serosa distance (*i.e.,* myometrial free margin) is an important risk factor. When perforation occurs with an activated electrode, there is a high risk of injury to adjacent anatomical structures.

Table 4
Complications of operative hysteroscopy (based on [63]).

Complication	Incidence (%)
Hemorrhage requiring red blood cell transfusion or hemostatic intervention	0.00–0.16
Uterine perforation	0.12–3.00
Infection	0.01–1.42
Operative hysteroscopy intravascular absorption syndrome (using isotonic solutions)	
Mild (absorption of 1000–2000 mL) 5–10%	5.00–10.00
Sever (absorption of > 2000 mL) < 1%	<1
Intrauterine adhesions unknown	Unknown
Resection of multiple *vs.* singe myomas	45.50 *vs.* 31.30*

* Information based on a limited number of cases studied.

Sometimes thermal injury to adjacent organs may be discovered days after surgery, even without perforation [50].

A conservative approach, with observation and antibiotics, is sufficient in most cases of blunt perforation. However in the case of 'hot loop perforation' a laparoscopic (or laparotomic) exploration is mandatory to fully assess and treat possible damage to adjacent anatomical structures [50].

Different studies give conflicting results regarding the benefit of the vaginal or oral application of misoprostol prior to hysteroscopy, as a ripening agent, to facilitate cervical dilatation and hysteroscope placement [51–53]. Although its use seems promising [51,52], further studies are needed before conclusions can be drawn.

Recommendation 11: The use of vaginal misoprostol prior to HM is not routinely recommended in order to reduce cervical trauma and perforation **(grade 2B)**.

Distention fluid-related complications

To achieve the necessary visualization for diagnosis and treatment of intrauterine pathology the cavity needs to be distended by a medium. During operative hysteroscopy systemic absorption of important volumes of distension solution can occur leading to serious complications (Table 4). The amount of absorption, but also concomitant patient morbidity, such as cardiovascular or renal disease, determine the presenting symptoms and the severity of complications. Fluid overload can lead to heart failure, pulmonary edema, hyponatremia and cerebral edema with seizures, coma and respiratory arrest. The continuous and accurate monitoring of the amount of systemic absorption, the so-called 'fluid deficit', is of the utmost importance for the prevention of complications [54].

Fluid overload with normal saline solution or with hypotonic, nonconductive, low-viscosity fluids (glycine, sorbitol or mannitol) may result, because of supplementary osmotic imbalance, in additional hypoosmolality, hyponatremia and hypokalemia that require multidisciplinary involvement of anesthetists and intensivists in the Intensive Care Unit [55].

Dyrbye *et al.* found that intravasation exceeding 1000 mL was associated with more extensive gas embolism during bipolar diathermia with saline solution [56]. However, this association is not causal, since the electrons cause the gas bubbles leading to an embolism and not the volume of distention fluid. In bipolar resection, the electrons travel from the active to the passive electrode, just some mm away; the heating of the distension medium is very intense causing "bubbles". In unipolar resection, the electrons travel through the fluid and through the body of the patient causing less heating and hence less "bubbles". Reduced wattage in bipolar resection results in less heating, less "bubble" formation and less embolism in the same amount of intravasated fluid. This is the reason why using small barrel resectoscopes with saline distension medium, with the same wattage, causes the same number of "bubbles" and the same amount of gas embolism as the larger loops.

Furthermore, diathermy produces waste products including carbon monoxide. During HM using bipolar diathermy, carbon monoxide may enter the circulation with fluid intravasation, leading to the formation of carboxyhaemoglobin [57,58]. There is a statistically significant correlation between carboxyhaemoglobin levels and the maximum ST-segment change, also between these levels and the amount of intravasation. This situation can lead to myocardial ischemia. The anesthesiologist must be involved in the complication management. Electrocardiogram changes should prompt discontinuation of the intervention.

Recommendation 12: A fluid deficit of 1000 mL also in case of bipolar myomectomy with saline solution, in healthy women of reproductive age, contains low risk for major complications. Deficits of 1000 mL–2500 mL using saline solution need careful monitoring and termination of surgery at the slightest sign of possible embolism. Deficits of over 2500 mL need immediate termination of surgery (grade 1C).

Recommendation 13: Lower thresholds (750 mL) for fluid deficit should be considered in the elderly and in women with cardiovascular, renal or other co-morbidities (Grade 1B).

Infections

The rate of infection after hysteroscopic surgery appears to be very low (Table 4). No conclusion can be drawn regarding the routine antibiotic prophylaxis until randomized high-powered trials are conducted in the future [59].

Adhesions

HM can be complicated by postoperative intrauterine adhesions (IUA) of different levels of severity. For this reason, different anti-adhesive gels have been developed with the aim of primary prevention. The incidence of postoperative adhesions in patients who have received auto-crosslinked hyaluronic acid gel was reduced versus no treatment group [60,61].

Second look office hysteroscopy is an easy procedure that could be considered, in particular for patients with fertility problems, for diagnosing and removing newly formed IUA [62].

Recommendation 14: Routine hyaluronic acid gel application is recommended after HM, particularly in case of multiple myomectomies (Grade1B).

Table 5. integrates the information on the studies and sources used to establish and grade the ISGE recommendations.

Table 5
Sources of supporting evidence for the ISGE recommendations.

Recommendations	Information sources (references)
Preoperative evaluation:	
Recommendation 1	1, 4
Recommendation 2	1, 7–10
Recommendation 3	5, 11–13, 15–17
Recommendation 4	1, 4
Classification of submucous leiomyoma:	
Recommendation 5	24–26
Preoperative medical treatment:	
Recommendation 6	32, 33
Hysteroscopic myomectomy – type 0 leiomyomas:	
Recommendation 7	40, 41
Hysteroscopic myomectomy – type 1 and 2 leiomyomas:	
Recommendation 8	1, 41
Recommendation 9	42, 43
Recommendation 10	44
Complications and preventive measures:	
Recommendation 11	51–53
Recommendations 12 & 13	54–58
Recommendation 14	60, 61

Note: In the case of meta-analyzes, guidelines and review articles, reference lists of these publications were analyzed and cited relevant papers were assessed.

Conclusions

HM is the most effective conservative minimally invasive gynecologic intervention for submucous LM. The evaluation of the uterus with combined TVUS and diagnostic hysteroscopy or SIS is strongly recommended as well as the use of STEPW submucosal LM classification system, in order to predict difficult or incomplete surgeries and the likelihood of major complications. For type 0 LMs, in addition to classic resectoscopic slicing technique, morcellation is recommended, being faster and having a shorter learning curve. Instead, for type 1 and 2 LMs, slicing technique is recommended, being more feasible and reproducible with respect to morcellation. The awareness and care to prevent complications are of the utmost importance, in particular, a continuous and accurate measurement of the amount of the absorbed distension-fluid. A fluid deficit of 1 L should be taken as the security limit in all HMs (*i.e.*, not only during monopolar myomectomy with hypotonic fluids, but also in case of bipolar myomectomy with saline solution) in healthy women of reproductive age. Lower thresholds (750 mL) for fluid deficit should be considered in the elderly and in women with co-morbidities. The evidence-based ISGE recommendations presented here serve to promote patient safety through the promotion of good clinical practice and quality training of the residents.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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