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Original Article

Hysteroscopic Myomectomy

RICARDO BASSIL LASMAR[1, 2, 3 e 4]; ROGÉRIO DIAS[4]; PAULO ROBERTO MUSSEL BARROZO[2 e 3]; WALDIR PEREIRA MODOTTE[4]; DANIELA BALTAR DA ROSA[2]; RAPHAEL CÂMARA MEDEIROS PARENTE[1 e 5]; BERNARDO PORTUGAL LASMAR[2 e 6]

[1] Discipline of Gynecology of Universidade Federal Fluminense – UFF; [2] Ginendo Gynecological Service; [3] Post-graduate Program in Gynecological Endoscopy of Instituto Fernandes Figueira; [4] Departament of Gynecology, Obstetrics and Mastology of UNESP; [5] Hospital dos Servidores do Estado; [6] Instituto Fernandes Figueira.

ABSTRACT

Hysteroscopic myomectomy is the indicated technique for the treatment of submucous fibroid. The main indications are abnormal uterine bleeding, abortion, infertility, and pain. The surgery has an excellent result when only the fibroid is the cause of the symptoms. The hysteroscopic myomectomy is excellent for the patient but has a moderate or a high complexity for the surgeon. This paper shows recent data about submucous fibroid diagnosis and classification, surgical techniques and frequent complications, always considering the patient's target and desire. The aim of this paper is to make an updating on fibroids, pre-surgery treatment, application of submucous fibroid classification for previewing the surgical complexity, surgical techniques and its complications, and how to manage them.

Key words: Fibroids, Classification, Hysteroscopic myomectomy.

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INTRODUCTION

Hysteroscopic myomectomy was first reported in 1978, when Neuwirth successfully resected four fibroids from the uterine cavity.

In 1986, Goldrath approached intracavitary submucous fibroids using only a grasping forceps through the vagina.

Lasmar, in 2001, reported the possibility to remove submucous fibroid with intramural component by hysteroscopy handling it also mechanically with direct mobilization.

Leiomyomas are the most common tumors of the uterus and the female pelvis. They are benign tumors consisting of smooth muscle cells associated with variable amount of fibrous connective tissue. According to Muller and Ludovici (1955), they tumors of smooth muscle cells origin, and according to Townsend (1970) they are of unicellular origin. They are well-defined, but non encapsulated lesions.

Although they are mentioned and accepted as present in 50% of autopsies, it is difficult to determining the real incidence of leiomyomas. In gynecology, leiomyomas account of one-third of the cases of hospitalization. They are usually present in family history and the highest incidence rate is in nulliparous and African-American women. Regarding the etiology, there are controversial studies suggesting that either estrogen or progesterone may perform a role in the development and growth of leiomyomas. They are all intramural fibroids at the beginning of their development; nevertheless as they grow they might continue to be intramural, or they may develop towards the inside or the outside of the uterus, thus becoming submucosal or subserosal, respectively. The incidence of leiomyosarcoma is of 0,1%, nevertheless the sarcomatous degeneration is arguable.

It is more common during menacme when symptoms and dimensions are significant. In postmenopausal women, the volume of the fibroid decreases. The majority of the patients are asymptomatic; therefore, treatment is not necessary though the patient need a periodical follow-up. The symptomatology is significant in submucous fibroids thus surgery is frequently necessary. The most frequent complaint is abnormal uterine bleeding (AUB) associate with anemia in some cases.

AUB is frequently caused by the rupture of dilated vessels on the surface of the nodule. Other causes of bleeding would be: the augment of the uterine cavity with a greater surface of exfoliation; intramural fibroid complicating the venous return and the production of local endometrial factors, such as the prostaglandins. Falcone (2005) has as a theory a

vascular change in the endometrium and myometrium. The leiomyoma would cause vascular ectasia, through compression of the veins and the local action of growth factors.

There are also dyspareunia, abdominal discomfort and sensation of weight in the pelvis, besides pain in the lower abdomen such as cramps during the menstrual period or not. They may also be a cause of infertility (Indman,2006).

When by any reason a degenerative process of the submucous fibroid occurs, characteristics signs and symptoms of the inflammatory process such as pain, fever, fetid vaginal discharge and abdominal distension are observed.

INDICATION FOR SURGERY

The fibroids, even the submucous, only have indication for surgery when symptomatic.

Medicamentous treatment may be performed with gestrinone, danazol and GnRH analogs during the premenopausal period, in order to improve bleeding until menopause.

The GnRH analog may be a therapeutic option for 3 to 6 months, when its administration is necessary for a longer period of time it should be associated with gonadotropic hormones to minimize the effects of bone demineralization. However, its administration is more frequent to reduce the size of the myoma and the uterus at preoperative preparation. According to Falcone(2005), during suppressive therapy with analogs, in spite of decreasing the myoma size, they can also decrease vascularity and consequently fluid absorption is less.

Patient's desire for pregnancy, age, the interest to perform conservative surgery to treat benign diseases and the patient's option for minimally invasive interventions are important data to determine the surgical approach. The hysteroscopic myomectomy may be also indicated to patients that have contraindications to undergo major surgery.

DIAGNOSIS

At anamnesis, the most frequent complaint was AUB during menstruation or not, as well as dysmenorrhea. Infertility and, especially repeated abortions may be associated with submucous fibroid.

Ultrasound examination provides the possibility to identify the tumor inside the uterine cavity, though in some cases suspicion occur when hysterosalpingography is performed to evaluate infertility. Transvaginal sonography (TVS) indicates the number, the size and location of nodules, the possibility of an intramural component of the submucous fibroid, besides it investigates the uterine adexa (Bronz et al., 1997).

Hysteroscopy (HSC) confirms the diagnosis of intracavitary nodules (Figure 1), with a detailed description of the fibroid, its size, the extension of the base, location, number, and suspicion of degeneration and intramural component. Investigation by HSC may identify other diseases that might be associated, and mainly, the endometrial aspect that is frequently hypertrophic. Guided or oriented biopsy of the endometrium or of the associated lesion fulfills the research and confirms the existence of a benign uterine disease. It is not necessary to perform biopsy of a myomatous nodule, thus the hysteroscopic vision is enough for the diagnosis.

Hysterosonography adds an important data to preoperative investigation of submucous fibroid with intramural component revealing the level of penetration of the fibroid into the myometrium and the distance of free myometrium between the nodule and the serosa(Bernard et al., 1997). Nevertheless, it does not allow the anatomopathological study when there is association with other pathologies such as polyps or endometrial hyperplasia.

Magnetic resonance imaging (MRI) of the pelvis may help the diagnosis of other causes of AUB, especially the adenomyosis. It is able to determine

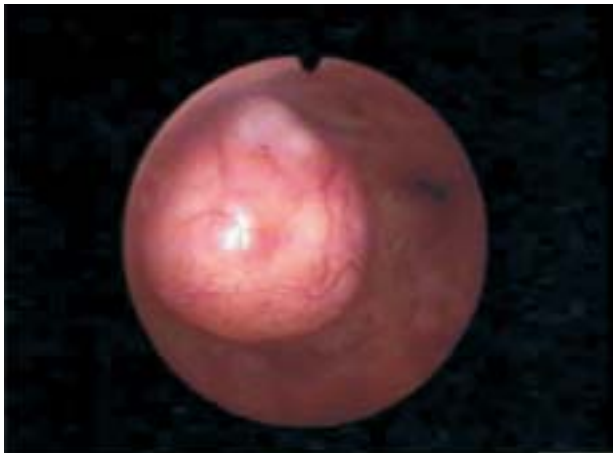

Figure 1- *Submucous myoma.*

with greater accuracy all the nodules, the level of penetration of the fibroid into the myometrium and the distance of free myometrium until the uterine serosa. As it is accurate in the study of the uterine walls, it allows the adenomyosis diagnostic through the evaluation of the junctional zone, depicting, in this case, that the AUB may continue even after the myomectomy is performed (Werner at al., 2003). RMI, may anticipate the recurrence of an extra or intracavitary lesion when small fibroids are detected. This would demonstrate that this new fibroid would exist at the moment of the surgery and that it did not appear after therapy.

HSC enables the differential diagnosis of submucous fibroid and intramural fibroid compressing the uterine cavity, fibrous endometrial polyp, embrionary remnants and endometrial adenocarcinoma. The texture, consistency, surface, vascular aspect and color of the submucous fibroid are characteristics data that may confirm a diagnosis, even when biopsy is not performed. Hysteroscopy depicted the fibroid as a white and hard tumor with the surface smooth or bosselated with dilated and numerous vessels.

The intramural fibroid, distorting the uterine cavity, has a similar aspect of focal endometrial thickening. At HSC the movement of the tip of the hysteroscope over the endometrium that cover the bulging identifies a white and hard nodule. Hysteroscopy shows the degenerative submucous fibroid as a yellowish-white fibroelastic lesion with soft and irregular areas, sometimes friable, that depicts aspects similar to endometrial cancer and infected embryonary remnants. Anatomopathological examination is essential.

The most difficult differential diagnosis in HSC is the adenomyoma. It depicts a white color with hard consistency similar to the fibroid. Fibroid and adenomyosis coexist in almost 30% of the cases, usually a diffuse adenomysis, which contribute to the globular aspect of the uterus.

Fibroids may be located in any part of the uterus. The complexity of myomectomy and the risk of complications increase depending on their location.

The main examples are: cervical fibroid where the distension is restricted; fibroids located in the fundus and cornua where the difficulty is due the limited mobility of the resectoscope which represents the ones with highest surgical complexity.

CLASSIFICATION

The classification of submucous fibroids intends to unify the diagnosis, allowing the evaluation of therapeutics outcomes and the surgical prognosis. The most used classification system is the European Society for Gynaecological Endoscopy (ESGE) that has as evaluation factor the degree of the penetration of the submucous fibroid into the myometrium (Wansteker et al., 1993). The more the submucous nodule mass is within the myometrium, the higher is the degree on the table and consequently, more difficult is the surgical treatment. This evaluation allows the consideration of one or more surgical interventions, of the addiction to the use of analogs, as well as the surgical prognosis and, at last, the viability of hysteroscopic myomectomy. This classification is simple and objective, it is divided in:

Level 0 – myomas that are completely within the uterine cavity.

Level 1 – more than 50% of the nodule is in the uterine cavity.

Level 2 – more than 50% of the fibroid is within the myometrium.

In 2005, Lasmar et al. published a new classification of submucous fibroid, called "STEP-W" *classification*. This classification proves to be more efficient to evaluate the degree of difficulty and viability of hysteroscopic myomectomy (Table 1). The 5 parameters used are:

1 – SIZE

This is considered the largest diameter. When the nodule measure up to 2 cm, it is given a score zero; if it is between 2 and 5 cm, it gets a score of 1; and if it measures more than 5 cm, it gets a score of 2.

2 – TOPOGRAPHY

This is defined by the third of uterine cavity where the fibroid is situated, the score is 0 in the lower third, it gets a score 1 in the middle third, and in the upper third the score is 2.

3 – The extension of the base of the nodule with respect to the affected wall

When the myoma affects 1/3 or less of the wall, it is given a score of zero; when the base of the nodule occupies between 1/3 and 2/3 of the wall the score is 1; and when it affects more than 2/3 of the wall, the score is 2.

Table 1 – *Parameters used to classify the submucous myoma.*

	Size	Topography	Extension	Penetration	Lateral Wall	
0	= 2 cm	lower	= 1/3	0		
1	> 2 a 5 cm	medium	>1/3 a 2/3	= 50%	**+ 1**	
2	> 5cm	upper	> 2/3	> 50%		
Score		+	+	+	+	=

Score	Group	Suggested Treatment Process:
0 a 4	I	Low complexity hysteroscopic myomectomy.
5 e 6	II	Complex hysteroscopic myomectomy, consider preparing with GnRH analog and / or 2-stage surgery.
7 a 9	III	Recommend an alternative non- hysteroscopic technique.

4 – Penetration of the nodule into the myometrium

This uses the same classification system as the European Society of Endoscopic Surgery, scores 0,1 and 2.

5 - WALL

The anterior and posterior wall fibroid gets a score 0, whereas for the fibroid situated in the lateral wall, the score is 1.

All of those parameters are placed in a worksheet with their respective scores the results are added reaching a total final score of the fibroid. The classification is for each nodule individually and the final score will indicate the possibility of a technically feasible myomectomy, a complex myomectomy or the impossibility to perform the procedure. Schematically, it is possible to describe the table of submucous fibroid classification using the abbreviation **STEP-W.**

The preoperative evaluation is similar to other surgical procedures, complete hemogram, coagulogram, urine test, thoracic X-ray and surgical risk. Some authors preconize the preoperative use of GnRH analogues (Lethaby et al., 1999). However, for some authors the use of analogues before surgery would be associated with a greater recurrence of fibroids and a high risk of uterine perforation (Murakami et al., 2005). Despite the benefits of preoperative preparation with analogs, there is not a consensus that it should be recommended to all patients, thus it should be reserved for patients with anemia and/or increased uterine volume.

Uterine artery embolization may also precede the hysteroscopic myomectomy of a more complex or inoperable fibroid. This technique interrupts metrorrhagia and reduces fibroid vascularization allowing big nodules to be removed with very little risk of intravasation and bleeding.

Even after the submucous fibroid identification, it is advisable a thorough investigation for patients with AUB and/or infertility, as other casual factors that would not be treated by hysteroscopic myomectomy should be ruled out. The approach of the submucous fibroid should consider two distinct aspects: the case to be treated is infertility with or without AUB, or it is a patient with AUB without desire for future pregnancy.

Another question to be evaluated preoperatively is the limitation of the surgical technique, as not all the fibroids that are partially in the uterine cavity may be withdrawn by hysteroscopy (Mahrizi e Tulandi, 2007). At times, the intramural part of great proportion or even the transuterine fibroid prevent the total resection of the nodule. It is also associated with a greater risk of bleeding during surgery, as well as a fast and excessive absorption of the distension fluid which will lead to a precocious interruption of the procedure or even death.

Polena et al., 2007 analyzed the long-term results of 235 patients submitted to hysteroscopic myomectomy and concluded that it is a safe and efficient procedure for selected cases of women presenting AUB and infertility. They believe that a preoperative evaluation of the uterine cavity by HSC and USG is essential in order to evaluate the size and number of fibroids, the intramural extension and the distance to the serosa. It was observed that the intramural extension of the fibroid affects either the operative time or the number of procedures to a complete myomectomy. It was considered as

contraindication to the procedure a fibroid greater than 5 cm or 5mm of free myometrium until the serosa.

In a practical way prior to the surgical procedure precise information should be obtained during anamnesis and investigation of the uterine cavity

During anamnesis it should be take into consideration primarily the age of the patient, the desire for a future pregnancy and the investigation of hematologic diseases or endocrine abnormalities.

SURGICAL TECHNIQUE

There are two important factors: type of electrosurgical system and the surgical approach. As the use of LASER is not common in Brazil, the electrosurgical system can be monopolar or bipolar.

The surgical technique is linked to the type of the resection loop, it may be performed the slicing or direct mobilization of the nodule.

When the choice is the monopolar electrosurgical system it requires the use of nonionic distension media, such as 1.5% glycine or sorbitol-mannitol, while the bipolar requires a saline solution.

Ambulatory myomectomy may be an option for intracavitary nodules up to 2 cm, using grasping forceps and 5 or 7 French scissors through the operative channel. Another option is the vaporization with bipolar energy, inserting a scope through the operative channel of the 2.9mm hysteroscope, with sedation or paracervical block. The result of using bipolar energy is similar to the use of monopolar energy to slice the fibroid.

According to Advincula(2004), some advantages of fibroid vaporization described are: it is not necessary to remove the fibroid from the uterine cavity; good visualization during the surgical procedure; reduction of intraoperative bleeding and intravasation.

Hysteroscopic myomectomy is usually performed in the operating theater under sedation or blockade. We prefer blockade as it allows us to monitor the level of consciousness of the patient. The procedure starts with a new diagnostic hysteroscopy which allows a more physiological dilation of the cervix, a re-study of the path to be followed by the Hegar dilator and details of the lesion before the dilation trauma. After cervical dilation with Hegar dilator a resectoscope with previously selected semicircle or L-shaped loop and the hysteroscopic optic are inserted. The working tool is connected to an electrosurgical generator with pure cut or blend1 modes monopolar energy, and 70 to 120W.

The bipolar resectoscope may also be used and this would allow the use of saline solution as a uterine cavity distension medium, which would reduce the risk of complications in case of fast absorption of the fluid. The monopolar resectoscope distension medium should be sorbitol-mannitol or 1.5% glycine. Systemic absorption of glycine may lead to nausea and vomiting, elevation of plasma ammonia level, cardiac failure, hyponatremia, encephalopathy and death. The sorbitol-mannitol solution with osmolarity relatively close to the plasma osmolarity would reduce the possibility of absorption and encephalopathy; however, it would have a higher risk of hyperglycemia and caramelization of the loop and connection of the resectoscope.

The hysteroscopist's skilled vision makes him perform the procedure with low pressure and small visible bleeding.

Cutting the base of the fibroid with an L-shaped loop, after that grasping the fibroid with rotation would be the best option for the level 0 fibroids. Direct and fast approach of the base of the fibroid reduce bleeding, operative time and risk of intravasation, increasing the safety. The fibroid can be easily cut after it is separated from the wall of the uterus, when the fibroid is cut loose into the uterine cavity without any bleeding, the operative time or fluid absorption is the concern. When the L-shaped loop is used for myomectomy of fibroid level 0, it should be parallel to the wall with its tip directed to the nodule, moving from the fundus to the cervix with similar cut in both sides of the fibroid.

The slicing technique in which the nodule is cut in small fragments may be the choice for fibroids with a broad base. For group II fibroids myomectomy may be performed by a two-step procedure, a resection with the slicing technique until the limit of the hysteroscopic view, followed by two or three months of analogs therapy and new surgical intervention. In the second surgical procedure the intramural component of the fibroid would be in the uterine cavity as it was a submucous fibroid; therefore, it would be easily removed.

There are methods and technical options to perform myomectomy of a fibroid with intramural component in only one step procedure.

1 – Intermittent pressure over the fibroid and uterus: After resection of the submucous portion of the fibroid distension and contraction of the myometrium is started by pumping fluid directly over the base of the fibroid, or distension and deflation of the uterus. This movement of the uterine wall makes the intramural portion of the fibroid to protrude into the uterine cavity, due to the progressive decompression of the myometrial fibers compressed by the lesion.

2 – Manual massage of the uterus: Decompression of the myometrium may be obtained by external manual massage of the uterine wall, inducing progressive migration of the nodule to the uterine cavity.

3 – Direct mobilization of the fibroid: Small sections with pure cut current (intermittent cuts)are performed with the L-shaped loop parallel to the wall of the nodule, without sectioning the fibroid pseudocapsule. Between the cuts and coagulations the fibroid mass is mobilized in all directions, which cause the fibroid to move at different rates detaching it progressively, thus reducing the use of electric current, and consequently reducing the risks.

After the nodule of the myometrium is detached it could be sliced by the same loop that could be removed through the cervix of the uterus, with forceps or under direct visualization. At times, the slicing of the nodule precedes its complete detachment, and it occurs when the fibroid is still *in situ*, which makes easy to perform the cutting.

Hemostasis should be checked again, after the fibroid is removed; at this moment rollerball with coagulating current is used only at the bleeding sites. This technique is less aggressive to the myometrium, as coagulation is only performed on the bleeding vessels of the uterine musculature, reducing the area of blood and necrosis, as well as the incidence of fibromuscular synechia.

4 – Injections of PGF-2 alpha and its analogs: Some authors describe the use of injections of PGF-2 alpha and its analogs would induce contraction of the uterus with extrusion of the intramural fibroid into the uterine cavity.

Myomectomy may also be performed with the use of Nd-YAG laser (Donnez et al., 1990). In case of fibroids level 0 and 1, they are easily removed through the dissection of the adjacent myometrium that may be left into the uterine cavity. During the immediate postoperative, careful attention is directed to vaginal bleeding. When this bleeding is significant and it was not possible to control with rollerball electrocoagulation, the intrauterine insertion of a Folley catheter may contribute to hemostasis.

In the cases in which fast and more fluid absorption might have happen the patient remain under medical staff care in the post-anesthetic recovery room. Monitoring arterial blood pressure, ocular fundus, diuresis and dose of plasma sodium is accomplished. Initially, endovenous administration of furosemide may quickly reverse the process, when there is small or moderate fluid absorption. The dose or types of diuretic may vary; however, cardiac and respiratory monitoring of the patient is essential.

The patient may present active bleeding or serohemorrhagic fluid for two weeks, during this period the patient will avoid sexual intercourse and swimming at the beach or swimming pool. The odor of the vaginal discharge may originate from the presence of intracavitary remnants, as well as fever, which is frequently due to urinary infection, may also be caused by retained remnants. On the first postoperative follow-up one month after the surgery a new diagnostic HSC is performed. Synechias section is performed and it is researched the presence of remnant fibroid. The patient should not get pregnant before the complete recovery of the area of the myomectomy.

COMPLICATIONS

Hysteroscopic myomectomy, due to its complexity, is the hysteroscopic procedure that presents a higher incidence of complications at times severe and fatal.

Laceration of the uterine cervix and uterine perforation are two of the most frequent complications, mainly when the use of GnRH analog precede the procedure, causing atrophy and difficulty of cervical dilation with Hegar dilator. The uterine cervix laceration needs suture when it is extensive, or when there is active bleeding. Some institutions have reported fast and easy cervical dilation with the use misoprostol before surgery. Uterine perforation at the moment of dilation or at the insertion of the resectoscope makes the surgery impossible to be performed; therefore, it should be postponed and the patient should only be observed without any surgical intervention in the most

of the cases. The surgery could be rescheduled within two to three months.

When uterine perforation occurred with the use of electric current, either mono or bipolar, it is necessary to investigate the abdominal cavity to investigate injuries on the loop and/or the bladder. The bladder injury has an earlier diagnostic, as hematuria is immediately present. Like all the hysteroscopic myomectomy vesical catheterization usually with a 12 or 14 Folley catheter is necessary. At this moment, cytoscopy is performed using the hysteroscope with a diagnostic sheath investigating all the walls of the bladder. When there is not any injury due to the cutting with electrical current it is common to find urethral or bladder cervix injury caused by trauma of the Folley catheter balloon. The bowel loops injuries may not be notice in most of the cases in the hysteroscopic surgeries. It does not have a sign or immediate symptom, and peritonitis is the late symptomatology. Uterine perforation at hysteroscopic surgeries should be suspected when it is difficult to maintain the intrauterine pressure and/or when there is a very fast negative hydric balance. In these cases of fast escape of fluid distension medium, it is mandatory to interrupt the procedure and investigate the bladder, and in some cases the abdominal and pelvic cavity by laparoscopy or laparotomy.

As the fibroid has large caliber vessels, bleeding is an important issue due to the quantity and duration, which maintain the operative field obscured by blood even during surgery. Coagulation should be performed in all arterial and venous vessels with large caliber. Inserting a Folley catheter with a distending balloon for 6 to 12 hours is an option to control diffuse bleeding, as extended coagulation would lead to major injuries. Although some authors (Wang et al., 2007) suggested that perioperative oxytocin may decrease bleeding during myomectomy, *Cochrane* recent review (Kongnyuy e Wiysonge, 2007) does not depicted effective decrease of bleeding with the use of misoprostol, oxytocin, tourniquet, morcellation, vasopressin and epinephrine with bupivacaine.

Fluid absorption may occur in a very fast way, which could cause intravasation and death. Rigorous control of hydric balance is important, thus it is necessary careful attention from 1L of negative balance, and it should not reach 2L.

Infection is infrequent in hysteroscopic surgeries, with greater incidences in myomectomy. The presence of remnants facilitates the infectious process, in spite of occluding the internal orifice leading to the formation of hematometra. Prophylactic antibiotic therapy is indicated in this procedure.

Gas embolization is rare, but fatal. Room air may be the cause, penetrating into the venous circulation during the dilation of the cervical channel or through solution of continuity into the myometrium, especially with patients in the Tredelenburg position in which the heart is below the level of the uterus.

Some late complications happen such as synechia and mainly in the area of large resections. Some authors have described that the incidence of synechias after hysteroscopic myomectomy vary from 1 to 13%, and it does not seem necessary any treatment during the postoperative time to prevent its formation, thus it is more effective to perform diagnostic hysteroscopy with removal of the synechias.

FINAL CONSIDERATIONS

Hysteroscopic myomectomy is the best way to treat intracavitary uterine disease and potentially preserve its structure (Hamou, 1984). This new technique depends on appropriate instruments and the surgeon ability. It is essential to notice bleeding and control it, to monitor the hydric balance, to know the patient's desire or not a future pregnancy, to recognize the limits of the surgical technique, to know when to stop and to be aware of your own limitation.

Surgical staff integration is extremely important for hysteroscopic myomectomy. The surgeon should be informed about the patient's condition and hydric balance, and the surgeon should inform about the surgical difficulties, the necessary time to end the procedure and the possibility to accomplish complete myomectomy in that operative act.

Submucous fibroid excision by HSC has reduced morbidity, length of hospital stay and postoperative pain, besides it is more economical, with fast recovery and return to daily activities and earlier return to sexual activity than hysterectomy.

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Correspondence address:
RICARDO BASSIL LASMAR
Rua Voluntária da Pátria, 126 / sala 602
Botafogo, Rio de Janeiro, Brasil
CEP 22270-010
Phone: (21) 2537-2321
E-mail: ricardo@lasmar.com.br