Endometrial Ablation Rectoscope/Myomectomy Techniques and Complications

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By Joseph R. Feste, MD [7]

It has been reported that approximately 670,000 hysterectomies are performed each year in the United States. Close to one third (more than 200,000) of these operations are done because of intractable menorrhagia not responsive to medical therapy or to dilation and curettage. The Nd:YAG laser was first used by Goldrath and colleagues showing that this laser can photocoagulate the endometrium and the menstrual flow reduced to little or none.

Endometrial Ablation/Resection

It has been reported that approximately 670,000 hysterectomies are performed each year in the United States. Close to one third (more than 200,000) of these operations are done because of intractable menorrhagia not responsive to medical therapy or to dilation and curettage. The Nd:YAG laser was first used by Goldrath and colleagues showing that this laser can photocoagulate the endometrium and the menstrual flow reduced to little or none. They reported their findings with 22 patients and currently have personal experience with more than 380 patients. Their experience has been supplemented by additional cases reported by Lomano and Loffer, with more than 550 cases now reported and followed up. DeCherney and Polan have described the use of the resectoscope for ablation of the endometrium. Townsend, and Vancaillie all reported like results by using electrocoagulation, and some instances resection of the endometrium, to induce hypomenorrhea or amenorrhea. Whether using laser or electrosurgery, the advantages are that the patient can avoid major surgery, maintain ovarian function, and can have permanent reduction and hopefully elimination of menstrual bleeding after appropriately applied energy.

Indications

With all the experience gained in performing this procedure, we have now been able to define the indications without any difficulty. Clearly, the foremost indication is intractable menorrhagia that has failed to respond to standard therapy, i.e., hormone replacement therapy and dilatation and curettage (D&C). It is also of utmost importance that there are not other pathologies such as polyps or submucous fibroids that would be solely responsible for the menorrhagia. However, if a patient has polyps or submucous fibroids as has no desire for further children, one may perform an ablation in addition to treating the pathology. Since there could be a chance the patient would have persistent menorrhagia following the removal of the pathology, a concomitant ablation would prevent the need for any additional surgery. The procedure is contraindicated in any patient with a premalignant or malignant endometrium. Lastly, the patient must realize that she will be infertile.

Preoperative Preparation

It is extremely important to counsel the patients regarding the possibility hypomenorrhea and not total amenorrhea as an end point. Also, there are some failures, especially in patients with adenomyosis. Therefore, if a patient is complaining of menorrhagia and dysmenorrhea and physical findings of a boggy, tender uterus, it is very likely this patient has adenomyosis and may not respond totally to the ablation. If there are submucous fibroids rather than intra-cavitary fibroids, an ablation may not completely cure the menorrhagia. These patients may opt for a hysterectomy as a definitive therapy. Another important consideration is the fact that this procedure may not prevent pregnancy. There have been reported pregnancies, both intrauterine and ectopic. Therefore, one should consider sterilization on patients who are at risk for pregnancy. An important preoperative consideration is that of suppression of the endometrium to ensure successful destruction of the basalis membrane. The objective of the ablation is to cause thermal damage to the basalis layer of the endometrium to prevent regrowth. Because the unprepared endometrium is on the average of 10 mm or more in thickness, it is difficult, especially for the
inexperienced hysteroscopist to destroy the total thickness of the endometrium, down through the basalis layer. This can be accomplished by using one of several methods. There is a definite marked atrophy and thinning of the endometrium with GnRH analog therapy more than with danazol, medroxyprogesterone acetate or progestin therapy. Several articles have been written concerning the use of these preoperative preparations. The most successful are the GnRH analogs because of the marked decrease in estradiol, which produces excellent atrophy. Serdan and Brooks adequately proved that the pre-operative use of the GnRH analog Lupron produced significantly higher rates of amenorrhea following the procedure, more so than danazol or no preparation. The progestins were discontinued in their study because of the high rate of side effects.

The article by Gimpelson and Kaigh suggested that mechanical preparation with a suction curette was equally effective as preparation with various drugs. However, Gimpelson's failures were mostly those patients early in his series. Those patients with atrophy or anovulation had the best results, a fact he did not acknowledge. It is difficult to explain the total amenorrhea in those patients with atrophy while the patients placed on the GnRH analogs who develop the same atrophy had not as good of a result. Mixing different methods of treatment and different anatomical problems make his conclusions marginal at most. The decreased fluid absorption and operating times as well as success rates in the mechanically prepared were further swayed by the improved skill of the operator after several years of experience as well as the use on continuous flow irrigation. It is supported in the literature that preoperative analogs are the treatment of choice for preoperative preparation. This is especially important for those hysteroscopist not familiar with the procedure.

I have found that preoperative office hysteroscopy and endometrial biopsy will provide the best evaluation of the endometrium prior to starting the patient on Lupron-depot. GnRH analog therapy is particularly helpful, if the patient is anemic, by allowing the hemoglobin to build up during the two months she is not having a menstrual period. The dose I recommend is 3.75 during the 3rd week of the cycle followed by a second dose 4 weeks later, operating two weeks after the last injection. This gives the patient another two weeks of atrophy postoperatively which presumably will enhance the scarring in the uterus.

It is equally important to have patients screened by an internist if they have any medical problems such a cardiovascular or kidney dysfunction as fluid overload is a potential complication.

**INSTRUMENTATION**

The necessary equipment for endometrial ablation rather performed with a laser or electrosurgery, includes a good light source, a video camera, (either with a direct coupler or beam splitter, depending on the preference of the operator), and a fluid infusion system. The distention media preferred by most gynecologist is glycine (1.5-% solution) or 3% sorbitol urologic irrigation solution, both allowing the use of either cautery or Yag lasers. Hyskon (32% Dextran- 70 ) can be used, particularly if bleeding is a problem. If Hyscon is used, volumes greater than 300 cc should be avoided because of the problems associated with overload on the circulatory system. Careful monitoring of the patient's circulatory system and pulmonary status during the anesthesia is an important safety measure with all procedures and with all irrigating solutions.

In patients undergoing endometrial ablation with the Nd:Yag laser the use of a four-channel hysteroscope is preferred. This allows constant infusion of distending media and constant drainage of fluid. A fourth channel is used to introduce the 600-um ND:Yag fiber. With the Nd:Yag laser, an eye filter should be used at all times to protect the operator. If it is desired to perform an elective sterilization procedure or laparoscopy for other indications, simultaneous laparoscopy could be helpful when first beginning endometrial ablation.

Instrumentation used for electrosurgery includes a rectoscope, usually 8 mm in outer diameter with a roller bar or ball, to perform the ablation. Wire loops have been used by some gynecologist who are experienced hysteroscopist. A newer technique using the OperaStar resectoscope and morcellator, allows the resection of the endometrium and the chips are morcellated thereby preventing passing the instruments in and out of the cervix. The electric generator must deliver at least 150 watts for excision and 150 watts for coagulation in a blended current.

A foley catheter is used to keep the bladder empty as well as measure urinary output. A system for accurately measuring all the fluid used for uterine cavity distension must be used. With constant monitoring of the intake and output, the exact amount of fluid absorbed can be determined. Several fluid measuring devises are on the market. One of the most dependable is the FlowStat manufactured by FemRx. Intravenous diuretics can be given after consultation with the anesthesiologist, either electively before surgery or intraoperatively if fluid absorption is high.

**Preoperative Preparation**

The preoperative preparation with GnRH analogs provides several potential benefits especially when
endoscopic surgery is proposed. The analog may reduce uterine bleeding and allow for a normalization of hemoglobin by the time of surgery in patients who are anemic. GnRH analogs, secondly, decrease the uterine volume and the size of myomas, which may allow them to be removed more easily. Thirdly, uterine blood flow has been shown to decrease with GnRH analog treatment. This effect would logically seem to decrease the blood loss at the time of surgery. If preoperative suppression of fibroids is chosen for medical therapy, one should treat for 3 months before surgery. Most studies have shown maximum reduction in size is achieved after three months of treatment. GnRH analog therapy may be particularly useful in patients who have an intracavitary or submucous myoma where the most difficult step is to bring the resected myoma out thought the cervix.

Several studies have proven that treatment of women with GnRH will result in a decrease in mean uterine volume by 40% to 60%. Reduction in individual fibroid size is variable, ranging from 0% to 100%, and is probably the result of heterogeneity of leiomyoma composition. Maximal reduction in uterine volume is usually noted after 3 months of treatment. The amount of reduction in uterine volume has been negatively correlated with both week 12 serum estradiol concentrations and the patient's weight.

Friedman reported in a randomized double-blind, placebo-controlled study, eighteen premenopausal women with uterine leiomyomata given intramuscular depot leuprolide acetate, 3.75 mg every 4 weeks for 24 weeks, while twenty women received IM placebo with the same injection schedule. Patients receiving depot leuprolide acetate had a mean reduction in pretreatment uterine volume from 505 +/- 93cm3 to 305 +/- 57 cm3 after 12 weeks on drug therapy and to 307 +/- 57 cm3 after 24 weeks with no drug therapy. No significant change in uterine volume occurred in the placebo-treated women.

The effects of GnRH on uterine size and menstrual cyclically are reversible. Mean uterine volume returned to 88% of the pretreatment size within 3 months of cessation of leuprolide depot therapy. Return on menses occurred within 3-24 weeks (mean: 6-10 weeks) of treatment cessation. The ultimate benefit of analog therapy would be to prevent a decrease in blood loss and decrease in fibroid size, facilitating the removal of the fibroids at laparoscopy, laparotomy or hysterectomy. In addition, it may be possible to treat selected fibroid patients (perimenopausal women, high surgical/anesthetic risk women) with combined GnR/estrogen/progestin therapy, thus potentially avoiding the need for surgery.

**TECHNIQUE**

**Nd:Yag Laser Technique**

Even though the Nd:Yag laser is being used less frequently than the electrosurgical technique, it is important to discuss this method, especially in relation to its safety and method of application. Under direct hysteroscopic view the 600 um Nd:Yag fiber is used to photocoagulate around each tubal ostia. The anterior fundus is coagulated next due to the fact that as the process of coagulation continues, bubbles formed during the ablation tend to accumulate in this area somewhat difficult. The posterior fundus and uterine sidewalls are coagulated last.

If visibility is obscured because of bleeding, the intrauterine pressure can be raised by temporarily blocking out the flow of the glycine or by increasing pressure on the infusion bag. The goal is to have the intrauterine pressure of glycine equal the vascular pressure of the myometrium, so that blood flow is stopped in the basalis layer of the endometrium. This pressure gradient has been well described by Garry et al. They contend that if the intrauterine pressure is controlled at a satisfactory level, neither the size of the cavity, the duration of the procedure, nor the structural state of the endometrium appears to affect the volume of fluid absorbed. This seems to be in the range of 100 mm of mercury.

There are two schools of thought as to how to coagulate the endometrium, the dragging technique and the near contact technique. Neither technique has actually been proven to be better. The skill of the surgeon and proper patient selection probably have as much to do with the results as any other factor. In either technique, it is important for the surgeon to overlap the areas or coagulation to prevent missing active endometrial tissue. Adequate preoperative preparation will also be a factor in the amount of ablation success in the end.

**Electrosurgical Technique (Roller Ball or Barrel)**

The technique and set-up for resectoscope is similar to that of the Yag technique. The only difference is that the cervix usually has to be dilated a bit more because of the larger diameter of the resectoscope. The continuous flow is required to give adequate visualization. The newer hysteroscope has the continuous inflow of clean, distending media in front of the lens and outflow of
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Endometrial Resection

First described in 1983 by DeCherney et al, the use of the resectoscope-cutting loop to perform endometrial ablation is an attractive addition or alternative to ablation. The technique is performed by systematically resecting the full thickness of the endometrium, including the underlying superficial myometrium to the level of the internal os. A blended electrosurgical waveform is typically chosen to more efficiently coagulate transected blood vessels and to destroy missed areas of endometrium. Many clinicians preserve a rim of untreated endometrium above the internal os to help prevent the formation of a hematometra. Resected chips of tissue are periodically removed or evacuated at the end of the procedure by mechanical means such as curettes or suction catheters. A rollerball electrode can then be used to coagulate bleeding points and destroy any untreated areas of the cavity. The shape and size of the rollerball provides the operator a more controlled access to the cornu, where the thin myometrium makes perforation with the loop electrode more unlikely, and can be used to ablate the lower uterine segment where the nearby large isthmic vessels may appropriately restrict use of the cutting loop. The more innovative technique for ablation is the use of the OperaStar, which allows continuous morcellation of the chips thereby decreasing the operating time by one third to half the time. The convenience of the morcellator prevents the need to remove the chips mechanically and increase the likelihood of bleeding within the endometrial cavity.

Postoperative hysteroscopic evaluation of the uterine cavity after endometrial resection has demonstrated a spectrum of residual effects ranging from a patent cavity to complete obliteration and marked fundal fibrosis. Amenorrhea after endometrial resection does not necessarily reflect total resection of endometrial tissue. In one study, postoperative endometrial sampling demonstrated islands of viable endometrium in 25% of amenorrheic patients. Those who advocate endometrial resection or resection/ablation believe these techniques have several advantages over using the rollerball electrode alone. The endometrium is extensively sampled and histopathologically evaluated, lessening the risk of concealing undiagnosed endometrial hyperplasia or malignant neoplasia. Hormonal preparation of the endometrium may be less important, obviating the expense, necessary delay for therapy, and side effects suffered by some patients from these medications. Because -part of the myometrium is resected, superficial endometriosis may be treated. For patients desirous of continued menses, a small area of endometrium can be carefully preserved at the lower uterine segment. furthermore, submucous myomata and polyps, commonly encountered in patients with abnormal bleeding, can be simultaneously resected without the need to change instrumentation or to abort the procedure. However, there are some disadvantages to the technique. The use of a cutting loop to deeply resect the endometrium requires greater hysteroscopic skills and an extensive understanding of uterine anatomy. Uterine perforation causing intraoperative hemorrhage is more likely to occur and direct thermal injury to adjacent structures (treat pelvic vessels, the ureter) has been reported more often than for ablation. This danger is greatest at the isthmus and cornu where the thickness of the myometrium leaves little margin for error. Used alone, resection is more likely to result in incomplete treatment at the fundus and cornua, where the size and angle of the cutting loop make it difficult to correctly conform to the uterine cavity. Such an effect risks the entrapment of endometrial tissue by postoperative synechiae, potentially leading to a symptomatic hematometra. The likelihood of intravascular absorption of distention media and intraoperative hemorrhage are potentially increased by the extensive transection of superficial vessels as the endometrium is systematically shaved. Collectively, these concerns have lead to the misconception that electrosurgical loop resection of the endometrium is more difficult to perform and potentially more dangerous than the ablative techniques.

Hysteroscopic Resection of Submucous Fibroids

media from the uterine cavity. (figure 3)

Those surgeons using the wire loops should have a laparoscope in the abdominal cavity to visualize the external uterine surface since it is difficult to judge the depth of penetration accurately with the wire loops electrode. If one uses the roller bar or ball, laparoscopy is not routinely performed as the roller bar merely rolls along the surface of the endometrium. The use of 75 to 100 watts on cutting current, blend 2, adequately treats the endometrium to the basalis membrane and spares the myometrium. The coagulation with the roller ball is continued in the same fashion as the Yag laser fiber, being extra careful when coagulating the cornu since this is the thinnest portion of the uterine wall and the most likely area to perforate. The rows of coagulation should overlap each other to avoid skip areas. The electrode must be cleaned occasionally to remove tissue debris. A clean electrode will transmit energy more effectively.
The methods of treating submucous or intracavitary leiomyomata hysteroscopically has become the gold standard. It must be emphasized that for both intracavitary and most submucous fibroids, hysteroscopic resection should be considered the sole method of treatment. Gynecologists that do not perform operative hysteroscopy should develop the skills to perform hysteroscopic resection of submucous fibroids. Even though these can be removed by laparotomy, there is rarely an indication for such an approach. Occasionally one may find a submucous fibroid that will be through and through all three layers of the uterus. This type of fibroid can usually be delineated on ultrasound and inevitability be removed by a laparotomy approach. As far as the instrument of choice, I prefer to use a OperaStar with a cutting current at 150 watts. Even though there have been several articles written using the yag laser for resection, the electrosurgical, loop excision is faster and easier to work with within the uterine cavity. I would also recommend monitoring the hysteroscopic resection by laparoscopy, particularly if the fibroid is submucous or located in the cornu area. Even though perforation is unlikely, the consequences of bowel injury would be so grave, monitoring laparoscopically would be extremely beneficial.

**Nonhysteroscopic Methods for Endometrial Ablation**

The use of nonhysteroscopically guided techniques for several investigators have reported destruction of the endometrium. Because they have the potential for office or clinic use, these techniques are extraordinarily attractive. In addition, they may minimize the risk of uterine perforation and completely avoid the chance of fluid overload from absorption of uterine distention media. Compared to hysteroscopic ablation and resection, less training is required and the procedures are considerably faster to perform. A variety of methods have been proposed and demonstrated including electrosurgical technique, thermal transfer, hyperthermia, and photosensitizers, the properties of which may be exploited to destroy the endometrium.

**Radiofrequency ablation:**

Ablation of the endometrium with the energy from radiofrequency alternating current applied using an intrauterine probe electrode was first described by Phipps et al in 1990. In preliminary study, 33 patients underwent this procedure, lasting for 10 to 20 minutes, and were followed for 4 to 10 months after surgery. In early follow-up studies, a significant reduction in menses was achieved in 85% of patients including 30% with amenorrhea and 55% with satisfactory reduction in flow. Postoperatively hysteroscopic examinations revealed patent cavities lined by fibrous scar in those patients with amenorrhea, and islands of endometrium at the cornu in those patients with persistent but controlled menses. Two patients ultimately underwent hysterectomy for persistent bleeding. Both were found to have adenomyosis. In two grossly obese patients, high vesicovaginal fistulae developed secondary to heating of redundant vagina that presumably contacted the conductive probe. The authors subsequently designed a nylon thermal guard to completely retract the vagina.

Further experience with this technique was gathered from several centers in the United Kingdom. Two hundred nineteen women were treated and followed for 4 to 14 months. Satisfactory reduction in menses was achieved in 93%, including 42% with amenorrhea and 51% with reduced menses. Postoperative hysteroscopy revealed a spectrum of findings from no scarring to complete obliteration of the cavity. Despite the newly designed vaginal guard, another patient suffered a vesicovaginal fistula, and two electorsurgical burns occurred a sites of an electrocardiograph electrode and a pulse oximeter sensor, events that should be preventable with suitably designed electrosurgical generators.

Other electrosurgical designs include those that incorporate a series of parallel electrodes on the surface of a balloon that, in turn, can be inflated pressing the electrodes against the endometrial surface. The exact role of these approaches for the treatment of menorrhagia awaits confirmation by long-term follow-up and further refinements of instrumentation and technique.

**Balloon ablation:**

In 1994, Singer et al reported their preliminary experience with thermal ablation system incorporating an intrauterine balloon to treat women with intractable menorrhagia. The latex balloon is filled with a solution of sterile dextrose and water that is heated just below the boiling point of water (about 83°C). The resulting heat is transmitted to the endometrium for 7 to 9 minutes, resulting in thermal injury. Eighteen patients underwent the procedure without complications and were followed for up to 34 months. A significant reduction of menses or amenorrhea occurred in 83% including 44% with spotting or amenorrhea and 39% with light bleeding. Two patients ultimately underwent hysterectomy including one for persistent bleeding at 9 months, who was found to have a normal cavity with residual endometrium, and the other for worsening pelvic pain at 34 months who was found to have significant synechiae without endometrial tissue. One patient underwent a hysteroscopic loop resection at 9 months for persistent bleeding when both extensive scarring and
endometrium was visualized.

**Other Hyperthermic Techniques**

The use of ultrasound and microwaves to induce hyperthermia is tissue models has been disappointing due to asymmetric heating and damage to adjacent structures. The application of low power ND: YAG laser light has been shown to be safer and more predictable. Using a modified quartz fiber tip to symmetrically distribute ND: YAG light to the endometrium, Judd and coworkers successfully produced controlled and symmetric endometrial destruction in the rabbit uterine horn by using overlapping treatments at 2 watts. It has been suggested that a similar technique using an appropriate fiber tip could be passed into the uterine cavity without cervical dilation under ultrasound guidance.

**Photodynamic Therapy**

The potential application of photodynamic therapy for the treatment of menorrhagia is being evaluated by a number of investigators. Successful destruction of endometrium with photosensitive agents has been reported in both rat and rabbit models. The systemic or local pretreatment of target tissues such as endometrium with agents activated by monochromatic light can produce a local cytotoxic effect. For each photosynthesizer molecule, a specific wavelength (usually laser light), accurately matched to the absorption peak, must be used in order to produce local tissue necrosis. The activated photosensitizer molecule is thought to react with tissue oxygen producing singlet oxygen, which is cytotoxic. Further studies are needed in animals to determine safety of this technique for nontarget tissues that bind the photosensitizer molecules and whether endometrial regeneration will be prevented.

**Postoperative Instructions**

Following the surgery, the patient is transferred to the recovery room and her output is watched carefully for three to four hours before discharge. This is especially important if the amount of absorbed fluid was over 2000 cc. In patients with compromised cardiovascular system, it may well be best to give her Lasix 40mg in the recovery room to prevent pulmonary congestion. As soon as the patient is recovered she is discharged and seen in the office in six weeks. At the first office visit, the uterus should be sounded to make sure there is no evidence of cervical stenosis. If stenosis is present and the patient does not have a complete ablation, she may develop a hematometrium with her first period. I recommend the dilatation be done two more times two months apart. At the time of discharge from the hospital, the patient is advised of the likelihood of a serosanguinous discharge for the first six weeks.

**Results**

Results for endometrial ablation with the Nd: Yag laser have now been reported in a large number of cases for over ten years. The initial success rate reported by Goldrath and colleagues was as high as 90% although other investigators have not been able to confirm this and probably reflects the fact that Goldrath used greater power densities and more vigorous application of Nd: Yag laser energy. Reports on endometrial ablation using the resectoscope have been available for a shorter time. However, in most studies, the results have been similar to that obtained with the Nd: Yag endometrium ablation. My personal experience with the Nd: Yag laser and roller bar resectoscope. I have noticed, the complete ablation with amenorrhea is more likely to occur with the resectoscope than Nd: Yag laser. The OperaStar has been the most successful of all instruments achieving over a 90% amenorrhea. The preoperative preparation with GnRH analog has shown significant improvement in the results. Even though the patients would like the end point to be amenorrhea, one should not promise this to the patient. The outcome of this procedure is to give the patient relief from intractable menorrhagia. Amenorrhea is really a luxury and should not be expected. Long-term results are not yet available for endometrial ablation with the resectoscope. However, long-term results with the Nd: Yag laser have demonstrated only a few reported cases of recurrence of bleeding after initial amenorrhea. The majority of the failures in my series have been those patients with adenomyosis. These patients were informed at the onset that they probably had adenomyosis and that hysterectomy would be the procedure of choice. However, they elected to try the conservative procedure first. Recently, DeCherney has reported a case of endometrial carcinoma occurring five years after an ablation. This patient was a high risk for adenocarcinoma in that she was overweight, diabetic and nulliparous. However, the postoperative bleeding was diagnosed early and the results of her treatment at hysterectomy was curative.

**Conclusions**

With the development of the simpler and less expensive technique using electrosurgery, more
surgeons who were initially afraid to use the Yag laser for ablation can now use faster and more complete techniques for both resections of submucous fibroids and ablation/resection of the endometrium. This procedure is certainly for those patients who have intractable menorrhagia and can't undergo a hysterectomy or those who elect to have an ablation or resection of submucous fibroids over a hysterectomy. Unfortunately, many gynecologists are abusing the privilege and performing ablation on patients who have normal periods or metrorrhagia that is not best treated by an ablation. Certainly, the lower cost of the ablation should be an important consideration. If one can treat menorrhagia with a simple, safe outpatient procedure, then those patients with menorrhagia should have this unique application. The liberal use of hysteroscopic resection of submucous fibroids is not only less invasive but very cost effective since it is performed as an outpatient. In time, with proper patient and physician education, both will be able to benefit from this technology.

References:


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