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SPECIAL ARTICLE

Endometrial ablation

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ABSTRACT

Endometrial ablation is a new procedure. Correct patient selection is essential in producing good results. Patients must be counseled carefully about the advantages, disadvantages, and potential complications of this approach to the management of menstrual disorders. Excessive uterine size, the presence of active pelvic infection, and evidence of malignant and premalignant endometrium are absolute contraindications. There are two approaches for endometrial ablation: hysteroscopic approach and nonhysteroscopic approach. Hysteroscopic ablation can be produced by electrosurgical resection, rollerball ablation and Nd-YAG laser ablation. However, several complications can occur including, uterine perforation, hemorrhage, and excessive fluid absorption. In skilled hands, hysteroscopic endometrial ablation can be a safe and effective treatment for menorrhagia. Hysteroscopic endometrial ablation has some practical limitations. Nonhysteroscopic endometrial ablation has been developed to minimize the complications and less training is required. Therefore, it has potential for clinical use and is very attractive.

Key words : endometrial ablation, menorrhagia

The choice of the treatment of menorrhagia depends first on the future fertility, second on severity and chronicity of bleeding, and third on any coincident complaints. Surgical treatment may be suggested for women who have failed medical treatment, have chronic persistent menorrhagia, do not desire further pregnancies, and have significant anemia. Previously, the standard surgical treatment of menorrhagia was hysterectomy. In recent years, new types of uterus-sparing surgery have been introduced (Table 1). With modern advances in operative hysteroscopic technique, a minimally invasive approach to the management of menorrhagia has been developed using the energy to destroy the endometrium called endometrial ablation. The patients can have permanent reduction and hopefully elimination of menstrual bleeding after treatment. The three most important advantages of endometrial ablation over hysterectomy were the avoidance of major surgery, fast return to normal functioning and short hospitalization.[1-5] The purpose of this article is to review the endometrial ablation techniques for the treatment of menorrhagia.

Table 1. The procedures available for the surgical management of menorrhagia

Hysterectomy

- Standard abdominal (laparotomy) hysterectomy
- Vaginal hysterectomy
- Laparoscopic hysterectomy (complete and incomplete)
- Combined abdominal-vaginal hysterectomy (laparoscopy assisted vaginal hysterectomy)

Endometrial ablation

- **Hysteroscopic methods for endometrial ablation**
  - Endometrial laser ablation (Nd:YAG laser)
  - Electric endometrial ablation
    - Loop endometrial resection
    - Rollerball endometrial ablation
- **Nonhysteroscopic methods for endometrial ablation**
  - Radiofrequency-induced thermal endometrial ablation
  - Microwave endometrial ablation (MEA)

Uterine balloon therapy
    Balloon endometrial ablation (Thermachoice®)
    Thermo-regulated radiofrequency endometrial ablation (VestaBlate®)
Photodynamic therapy
Other nonhysteroscopic techniques

Although curettage is the fastest method to stop acute bleeding in menorrhagic patients with hypovolemia, it does not usually prevent the recurrence of excessive uterine bleeding. A D&C is a blind endometrial scraping procedure which is similar to mowing a lawn with the eyes closed, therefore, large areas may be missed. In addition, a D&C only scrapes the surface, similar to mowing a lawn without the soil removal. Therefore, there will not be any long lasting effect and it needs additional treatment.

Hysterectomy

Hysterectomy is one of the most common surgical procedures performed. However, the disadvantages and the risks associated with hysterectomy have prompted a search for the alternatives. In menorrhagia, the problem lies within the endometrium and not with the body of the uterus per se. Thus, endometrial ablation techniques that selectively destroy the endometrium have been developed. Nowadays, endometrial ablation is an acceptable alternative to hysterectomy in the treatment of menorrhagia for many women with no other serious disorders.[6-9]

Endometrial ablation

Endometrial ablation is the removal or destruction of the endometrium by delivery of various forms of energy directly to the endometrium. Endometrial ablation is an alternative to hysterectomy for women with menorrhagia who wish to avoid hysterectomy. Most women who have had a successful endometrial ablation will have little or no menstrual bleeding. There are two approaches for endometrial ablation: hysteroscopic approach and non-hysteroscopic approach. Originally, it was done using a hysteroscope or resectoscope and found that it was a safe, successful, and cost-effective treatment of menorrhagia.[10-13]

Hysteroscopic methods for endometrial ablation

Once the hysteroscope permitted clear access to the uterine cavity, the application of energy to completely resect or destroy the endometrium. Many energy sources currently used including the neodymium, yttrium, aluminum garnet (Nd:YAG) laser and electric energy. This wide range of therapies requires the availability of sophisticated equipment and properly trained surgeons experienced in these highly technical procedures. Therefore, some of the procedures are quite simple to learn, such as rollerball endometrial ablation; others are quite complex.

Indication

The indication is intractable menorrhagia that has failed to respond to medical treatment. The patients should not have the lesions, such as, polyps or submucous myoma which may be the cause of menorrhagia. However, if a patient has polyps or submucous myoma, one may perform an ablation in addition to treating the pathology. Since an endometrial ablation destroys the lining of the uterus, the procedure is not for anyone who desires to keep her fertility. Women who have a malignancy or premalignant condition of the uterus are not candidates for ablation.

Preoperative preparation

Preoperative suppression of the endometrium to ensure successful destruction of the basal layer of the endometrium to prevent regrowth is very important. Because the unprepared endometrium is on the average of 10 mm or more in thickness, it is difficult to destroy the total thickness of the unprepared endometrium, down through the basal layer. Both danazol and the progestins are effective for endometrial suppression if started early in the menstrual cycle and will usually lead to a significant degree of endometrial atrophy within 10-15 days. Gonadotropin releasing hormone agonists (GnRHa) acting at the level of the pituitary by downregulating gonadotropin receptors, however, are much more predictable. Their effect is profoundly anti-estrogenic, producing pronounced endometrial atrophy. The endometrial ablation procedure is scheduled 2-3 weeks after endometrial thinning is started. This can be accomplished by using one of several methods. There is a definite marked atrophy and thinning of the endometrium with GnRHa therapy more than with danazol, medroxyprogestrerone acetate or progestin therapy.[14]

The preoperative preparation with GnRHa 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 Secondly, GnRHa 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 GnRHa treatment. This effect would logically seem to decrease the blood loss at the time of surgery. Moreover, pretreatment with GnRHa may decrease the absorption of distention medium, prevent fluid overload, and improve the outcome possibly by causing hypovascularity and decreased endometrial growth.[15-17] GnRHa in combination with endometrial ablation was confirmed to be superior to endometrial ablation alone for the treatment of menorrhagia. GnRHa pretreatment facilitates endometrial resection and increases the rate of amenorrhea and scanty bleeding postoperatively.[18-19]

Preoperatively, the patients should be screened for any medical problems such a cardiovascular or kidney dysfunction as fluid overload is a potential complication. The patient should be instructed before the procedure about what she might expect after surgery. Postoperative pain is limited to cramping and may be controlled with antiprostaglandin agents. There is usually a watery, bloody, discharge for 3-4 weeks. The first spontaneous menses, if any, occurs 4-6 weeks after surgery. Those patients who continue to have menses may find that the first one or two are heavy, but by the third month the final results should be apparent.

Instruments

Instruments required to perform endometrial ablation include:

1. A light source/ viewing system
2. An uterine distention system, and
3. An energy source with its ablative attachments

Light source and viewing system

Visualization is achieved using a standard 150-watt cold light source, fiber optic cable, and a hysteroscopic endoscope that is compatible with the operative external sheath required to carry the ablative attachments.

Distention system

To obtain satisfactory distention and continuous irrigation and inflow pressure of 80-110 mmHg is required.[20] The ideal distention medium should be isotonic, nonconductive, clear, electrolytically normal, and if absorbed, metabolized in the bloodstream to nontoxic products. Carbon dioxide is not suitable for operative hysteroscopy because of the risk of gas embolization. Therefore, operative hysteroscopy should only be carried out with an appropriate liquid distention medium.

Glycine is used as a 1.5% solution of the amino acid. It is slightly hypotonic and electrolyte-free, which allows its use with electrosurgically and it is metabolized to serine and glyoxylic acid, which seldom cause any clinical problems, although hyponatremia/hypokalemia is a concern.

Sorbitol solution (3%) is a clear solution that is metabolized to nontoxic$CO_2$and water. It is moderately hypotonic and carries a risk of hyperglycermia.

Normal saline and Ringer's lactate are isotonic, crystalloid solutions that are clear and relatively safe if absorbed in moderate amounts.

32% Dextran-70 (Hyskon®) is a viscous solution with a molecular weight of 70,000. It does not contain electrolytes. The advantages include its high viscosity, which effects good uterine distention with very small retrograde flow, and its immiscibility with blood, which makes it particularly valuable in operative hysteroscopy. Absorption of relatively small volumes of Hyskon® may result in dilutional hyponatremia and pulmonary edema because of its high osmolarity.

The distention media preferred by most gynecologist is 1.5% glycine solution or 3% sorbitol urologic irrigation solution, both allowing the use of either cautery or Nd:YAG lasers. Hyskon® (32% Dextran-70) can be used, particularly if bleeding is a problem. If Hyscon R is used, volumes greater than 300 cc should be avoided because of the problems associated with overload on the circulatory system. Absorption of irrigating solution may involve serious complications during hysteroscopic surgery. This absorption occurs mainly into the vessels opened during the procedure. 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. A system for accurately measuring all the fluid used for uterine cavity distension must be used. A foley catheter is used to keep the bladder empty as well as measure urinary output. With constant monitoring of the intake and output, the exact amount of fluid absorbed can be determined. Significant absorption seems to be connected with the development of discrete cerebral edema and nausea, secondary to dilutional hyponatremia and elevation of several amino acids.[21]

Energy source and ablative attachments

Both lasers and electrical energy can be used to ablate the endometrium. Both require an energy generator, an energy delivery system, and an operative sheath for the hysteroscope. Laser and electrosurgical endometrial ablations are similarly effective treatment for menorrhagia.[22] This sheath must accommodate the hysteroscope, inflow and outflow channels for continuous flow of distention medium, and a mechanism allowing the energy delivery system to be introduced into the uterus.

Endometrial laser ablation

There are two techniques for applying laser energy to the endometrial cavity: the touch and the nontouch. The touch technique is accomplished by allowing the quartz fiber to be in actual contact with the endometrium during the application of laser energy.[23] In the nontouch technique, the end of the fiber is brought as near to the lining of the uterus as possible without touching it. The angle of the fiber is directed as perpendicular as possible to the uterine wall to decrease the amount of reflection and to increase absorption.[24] Neither technique has actually been proven to be better. The skill of the surgeon and proper patient selection are probably more important than any other factors. With good techniques endometrial laser ablation can be a safe and effective treatment for menorrhagia. For effective intrauterine surgery it is important to control the intrauterine environment during the procedure to ensure safe operating conditions. This can best be achieved by using a continuous flow hysteroscope and pressurecontrolled fluid infusion pump. In either technique, it is important for the surgeon to overlap the areas or coagulation to prevent missing active endometrial tissue. Safe ablation will be achieved if the three golden rules are followed and the laser is activated only when the tip of the fiber is visible, only when it is being drawn towards the operator and only when the fiber is being moved across the endometrial surface. With a high power Nd: YAG laser at 80 W power, a treatment time is about 20 min.

After endometrial laser ablation, amenorrhea rate, satisfactory/ reduced menses rate and unsatisfactory/ failure rate are 5 5.4% 3 6. 1 % and 8.5 %, respectively.[25] These satisfactory results can be achieved with minimum morbidity but the potential for serious complications still exists so these techniques should not be undertaken without adequate training and good equipment.[26]

Electrosurgical endometrial ablation

Loop endometrial resection

Electrosurgical resection aims not only to remove the basal layer of endometrium, but also to remove the first few millimeters of myometrium, thereby ensuring endometrial destruction. A 6-mm loop electrode, when fully imbedded, will resect to a depth of 3 mm. The first incision should expose the base of the endometrial glands. The second should remove 2-3 nun of myometrium while attempting to leave a smooth resection line. Resection always in started in the fundus and carried down toward the internal os and, as always, only when drawn toward the operator to reduce the risk of uterine perforation. If the aim of treatment is to achieve only a decrease in menstrual blood flow, the area just above the internal os should be preserved. In the hands of an experienced operator, the total operating time is 30-60 minutes. The advantage of loop endometrial resection is that it can remove the submucous mymoma during endometrial ablation.(Figure 1)

After loop endometrial resection, amenorrhea rate, satisfactory/ reduced menses rate and unsatisfactory/ failure rate are 29.4%, 58.7% and 11.9%, respectively.[25] The use of a cutting loop to deeply resect the endometrium requires greater hysteroscopic skill and a keen sense of intrauterine anatomy. Uterine perforation causing intraoperative hemorrhage or direct thermal injury to adjacent viscera is more likely to occur with the loop technique.

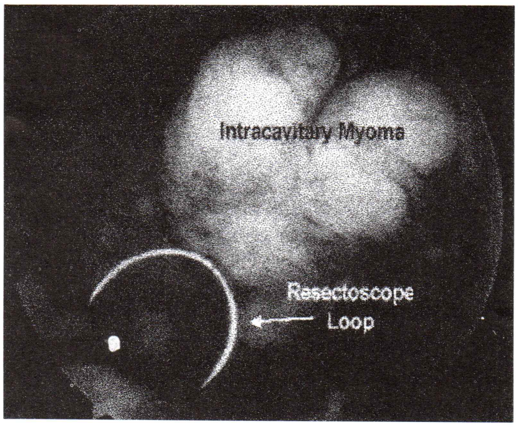

Fig. 1. Submucous myoma and loop endometrial resection.[27]

Rollerball endometrial ablation using resectoscope

In a roller-ball endometrial ablation a ball-shaped electrode is used to deliver energy to destroy the endometrium. This technique is the easiest to master and generally the quickest to perform, with procedure times ranging from 15-50 minutes. Because the rollerball is relatively blunt, the risk of perforation is greatly diminished. The barrel end is rolled along the endometrium under direct vision at a speed of 10-15 mm per second. For prepared endometrium, a 3-4 mm depth of destruction is still necessary to reach the basal layer.

The coagulation with the roller ball is continued in the same fashion as the Nd: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 technique is performed by systematically resecting the full thickness of the endometrium, including the underlying superficial myometrium to the level of the internal os. The rows of coagulation should overlap each other to avoid skip areas.(Figure 2) The electrode must be cleaned occasionally to remove tissue debris. A clean electrode will transmit energy more effectively. 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 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. Comparing with loop endometrial resection, the shape and size of the rollerball provides the operator a more controlled access to the cornu, and can be used to ablate the lower uterine segment where the nearby large isthmic vessels may appropriately restrict use of the cutting loop.

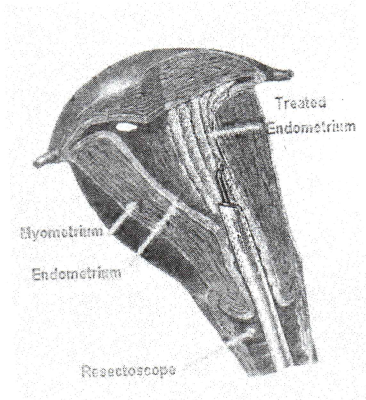

Fig. 2. Overlapping endometrial ablation using rollerball to prevent missing active endometrial tissue.[27]

Endometrial ablation with roller ball electrode appears to be as effective as Nd:YAG laser endometrial ablation and offers gynecologists the advantages of speed, low cost and safety when compared to the laser approach. Amenorrhea is best attained when complete preoperative atrophy is achieved.[28] After rollerball endometrial ablation, amenorrhea rate, satisfactory/ reduced menses rate and unsatisfactory/ failure rate are 3 1.5 %, 5 1 % and 7.5 %, respectively.[25] Both Nd:YAG ablation and resectoscopic ablation of the endometrial cavity produce good results in most patients. There was no clear difference in clinical outcome between endometrial laser ablation and electrosurgical endometrial ablation. Most hysteroscopic surgeons choose the resectoscope with rollerball because it is much faster and easier and the results are comparable or bette.[29] Endometrial laser ablation was the more costly procedure.

Anesthesia for endometrial ablation

Endometrial ablation can be carried out under general anesthesia or local anesthetic agents administered either by infiltration or regional block. The nerves of the pelvic organs are particularly suited to local or regional block techniques and ablation can be carried out by these methods instead of general anesthesia. The decision is influenced by a number of considerations : patient preference, surgeon preference, length of operation, accompanying laparoscopy, etc.

Complications

There are many complications from endometrial ablation, including uterine perforations,[30] fluid overloads, bowel injuries,[31] genital tract burns,[32] infection, hematometra, and pyometra.[33] Women undergoing elective endometrial ablation can develop severe symptomatic hyponatremia, which can be fatal. The presence of symptoms suggesting hypo-osmolality should lead to immediate measurement of plasma sodium level. If hyponatremia with hypo-osmolality is present, early and appropriate treatment of hyponatremia should be done before respiratory insufficiency occurs.[25]

Postoperative management

Following the surgery, the urine output should be monitored 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, the diuretics may be given in the recovery room to prevent pulmonary congestion. The patient will be discharged after complete recovery 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, a hematometra may be developed with the first period. 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. The resumption of menstruation can occur after a variable interval of amenorrhea following endometrial ablation and myometrial resection. It could potentially be used as a marker of failure of endometrial destruction which is requiring reoperation.[34,35] Success may decline with increasing length of follow-up.[36] Despite the need for further surgery for about one in six women, satisfaction rates were high following both methods.[37] Because pregnancies have been reported after endometrial ablation, patients cannot be assured that this is a sterilization procedure, and the risk potential for a subsequent pregnancy must be explained and sterilization or appropriate contraception should be offered.[38,39]

Nonhysteroseopic methods for endometrial ablation

Hysteroscopic methods for endometrial ablation have some practical limitations. The primary limitation is the technical difficulty in treating the surface of the uterine cavity completely with the device whether it be laser or electrocautery. As a result, incomplete destruction of the endometrium occurs quite frequently which results in an unsuccessful outcome. In addition to the technical problems with hysteroscopic endometrial ablation there have been significant complications associated with the procedure, including fluid overload, pulmonary embolism from gas delivered coaxially through the laser fiber, uterine perforation and inadvertent intestinal injury.

The use of nonhysteroscopic endometrial ablation have been reported.[40,41] These techniques may minimize the risk of uterine perforation and completely avoid the chance of fluid overload from absorption of uterine distention media. Therefore, they are particularly suitable for women with severe cardiopulmonary disease because there is no risk of pulmonary or cerebral edema due to fluid intravasation. Compared to hysteroscopic ablation and resection, less training is required and the procedures are considerably faster to perform. Because they have the potential for office or clinic use, these techniques are extraordinarily attractive. 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-induced thermal endometrial ablation

The radiofrequency-induced thermal endometrial ablation is simple and the heat induced in the endometrium does not penetrate much beyond the inner layers of the myometrium. There is no need for distension of the uterine cavity with flushing media.[42-43] Preliminary studies suggest that over 80% of patients treated will develop either amenorrhea or a significant reduction in flow. The advantages of radiofrequency endometrial ablation over laser ablation or resection are the avoidance of intravascular fluid absorption, simplicity (no special operative hysteroscopic skills are required), speed of operation, and reduced cost compared with the Nd:YAG laser.[44] Radiofrequency endometrial ablation is a technique which requires a minimum of training and appears to be safe so long as a strict protocol is maintained.[45]

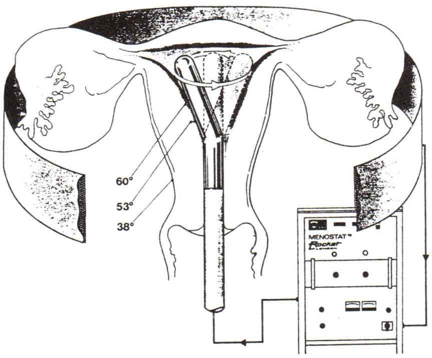

Fig. 3. The radiofrequency thermal probe in situ showing rotation within the uterine cavity.[46]

Microwave endometrial ablation (MEA)

MEA is a highly effective ablation technique which provides hospitals and clinics with the opportunity to increase overall patient satisfaction and at the same time achieve significant cost savings. MEA can be administered under general or local anesthesia. The cervix is dilated to 9 mm. and the length of the uterine cavity is sounded and measured. The applicator is inserted through the cervix until the tip reaches the fundus and the power is applied to the applicator. When the therapeutic temperature has been reached (90-95°C) the applicator is moved slowly to one side to treat the cornual area, the surgeon waits for the temperature to reach the therapeutic level. The applicator is gradually withdrawn moving slowly form side to side to cover the uterine cavity, maintaining the therapeutic temperature level throughout the procedure. (Figure 4) When the applicator reaches the internal cervical os the power is switched off. This position is indicated by a solid mark on the applicator shaft. The average microwave treatment time for a normal size uterus (sounding of 75-85 mm) is less than 3 minutes. A large uterus (100-110 mm) will take 6-7 minutes. A small uterus (60-70 mm) will take less than 2 minutes.

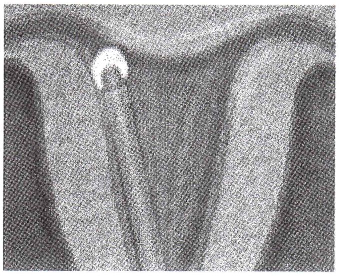

Fig. 4. Cross section of the uterus showing applicator and microwave energy treating the endometrium. (Microsulis PLC, Hampshire, UK)

The penetration of electromagnetic waves into tissue is governed by their frequency and the permittivity of the tissue. The penetration reduces as the frequency increases. In endometrial tissue, microwaves at a frequency of 9.2 GHz are almost fully absorbed at a depth of about 3mm. The amount of microwave energy beyond 3mm is negligible and there is no penetration of microwaves through the myometrium and outside the uterus. The microwaves are transmitted to the tip with minimal loss where the microwaves are radiated in a spherical profile. When the microwaves are absorbed by tissue, the heat which is generated is conducted deeper into the endometrium and basal layer so that tissue is destroyed to a total depth of 5-6 nun. (Figure 5) A thermocouple at the tip measures the temperature at the surface of the endometrium. This temperature is displayed by the control unit and is used by the surgeon to determine the progress of heating and when to move the applicator to an untreated area. This technique is safe, and is easier and quicker to perform than current alternatives.[47]

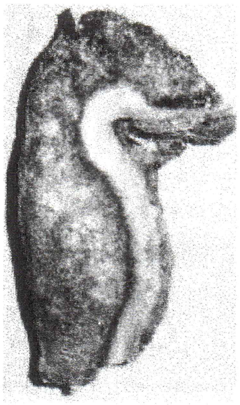

Fig. 5. Typical section of a treated uterus shows the endometrial tissue destroyed to a total depth of 5-6 mm. (Microsulis PLC, Hampshire, UK)

Uterine balloon therapy

Two balloon devices have been extensively investigated: the ThermaChoice®; and the VestaBlate®. The Thermachoice®, device uses a balloon placed in the uterine cavity through the cervix. Hot water is circulated inside the balloon. The VestaBlate®, balloon has metal electrodes on the surface, with thermisters in each electrode to monitor temperature. When the device is activated, radio frequency current is applied to the electrodes, and a computer controls the temperature used to destroy the endometrium. Both devices showed excellent results in well controlled studies.[48,49] The ThermaChoice®, balloon has received FDA approval, while the VestaBlate®, is expected to be approved at the end of 1998.

Uterine thermal balloon therapy (ThermaChoice®)

The ThermaChoice® Uterine Balloon Therapy system is an eight-minute uterine thermal balloon therapy for the treatment of menorrhagia and is intended to be performed in an outpatient setting under local anesthesia.[50]

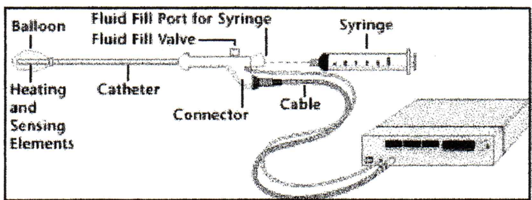

Fig. 6. Basic components of ThermaChoice® Uterine Balloon Therapy system. (Gynecare Inc., Menlo Park, CA)

The ThermaChoice® system consists of two components : a balloon catheter containing heating and sensing elements, and a controller connected to the catheter. (Figure 6) The procedure works by ablating the endometrial lining of the uterus, in three phases: 1) Insertion and balloon inflation; 2) Heating, ablation and monitoring; 3) Deflation and removal.

Insertion and Inflation: The balloon catheter is inserted vaginally, through the cervix, into the uterus. Inflation occurs when the catheter is filled with a sterile fluid solution until the pressure reaches 160 to 180 mm of mercury.

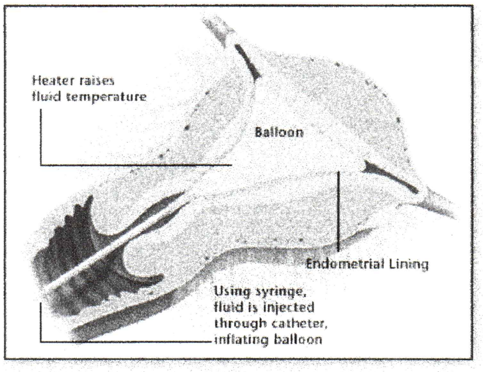

Fig. 7. The balloon catheter is inserted vaginally through the cervix into the uterus. Inflation occurs when the balloon is filled with sterile fluid until the pressure reaches 160-180 mm of mercury. (Gynecare Inc., Menlo Park, CA)

Ablation and Monitoring: A heating element inside the balloon raises the temperature to approximately 87°C and maintains it for approximately eight minutes. The controller continuously monitors and displays catheter pressure, regulates fluid temperature and controls therapy time throughout the procedure. If any of the preset parameters are exceeded, the device is automatically deactivated and the procedure immediately terminated.

Deflation and Removal: When the controller signals that treatment is complete, the balloon is deflated and the catheter is withdrawn and discarded.

The procedure does not require additional training and expertise in operative hysteroscopy and the presently used energy sources. It requires no cervical dilatation (5 mm). Thus it is tolerated well under neuroleptic anesthesia and can be offered as an office procedure under local anesthesia.[51] Success of the thermal balloon endometrial ablation was constant over the year (range 88%-91%). Treatment led to a significant decrease in the duration of menstrual flow and severity of pain. It appears to be safe, as well as effective in properly selected women with menorrhagia.[48] In recent study comparing the clinical efficacy and safety of a thermal uterine balloon system with hysteroscopic rollerball ablation in the treatment of dysfunctional uterine bleeding, uterine balloon therapy is as efficacious as hysteroscopic rollerball ablation and may be safer. Moreover, the procedure time was reduced significantly in the uterine balloon therapy group.[52]

Thermo-regulated Radiofrequency Endometrial Ablation (VestaBlate®)

The VestaBlate system has been developed in order to increase access to this important therapy by substituting technology and automation for skill and experience using a multielectrode intrauterine balloon as a device to create effective and safe endometrial ablation. The surface of the distensible balloon is impregnated with thermistors and thin, platelike electrodes. It is designed to deliver low-power electroenergy to the endometrium. Unlike the resectoscope techniques that require nonelectrolytic fluids for uterine distention, moving electrodes at high power outputs, and other variables that are operator dependent, the VestaBlate® is computer controlled using a standard type electrosurgical generator. The temperature of each individual electrode is constantly monitored to maintain it at a predetermined level. Treatment involved a 3-minute or shorter warm-up period and a 4-minute treatment phase. Thermally induced cell vacuolization extends up to 4 mm into the myometrium, thereby encompassing the regenerative basal layer. The amenorrhea rate was 38%. Bleeding was reduced in 95% of patients.[49] In conclusion, thermoregulated radiofrequency endometrial ablation is capable of dramatically decreasing menstrual loss in more than 80% of patients and should greatly improve access to effective endometrial ablation. The probability of being free of menorrhagia or needing a second procedure after radiofrequency ablation appears comparable to that following endometrial resection out to 18 months.[53]

Photodynamic therapy (PDT)

Photodynamic therapy (PDT) is a technique in which a photosensitizing drug that is selectively retained by a target tissue is administered to a patient and subsequently activated by light of the appropriate wavelength. Once activated, the photosensitizer produces local injury and necrosis of the target tissue, usually through an oxygen dependent chemical reaction.[54] Much of the selectivity of current PDT drugs is due to the preferential uptake and retention of the drugs by blood vessels. The drug then induces vascular injury and thrombosis (clotting) of the vessels which results in ischemic injury to the target tissue. Although PDT is traditionally thought of as a treatment for malignant conditions, there has been recent interest in its use for treating benign conditions. The endometrium is a highly vascular tissue which under goes cycles of neovascularization formation of new blood vessels. Thus, PDT would be preferentially retained in endometrial tissue relative to the other layers of the uterus and that activation of the drug would produce selective necrosis of the endometrium. The endometrium avidly binds and retains the photosensitizer Photofiin. Thus, PDT using Photofrin shows great promise as a relatively non invasive alternative to hysterectomy. Because the light can be delivered in a diffuse manner, the entire surface of the endometrium can be illuminated/ treated without the need for direct visualization thereby simplifying the technical aspects of the procedure and reducing the chances of residual untreated endometrium remaining after the procedure. (Figure 8) Therefore, this technique should permit the selective destruction of the entire endometrium without the need for a hysteroscope, fluid irrigation or exposure to high-powered laser radiation. Because the procedure is relatively simple, it should be possible to perform it as an office (outpatient) procedure.

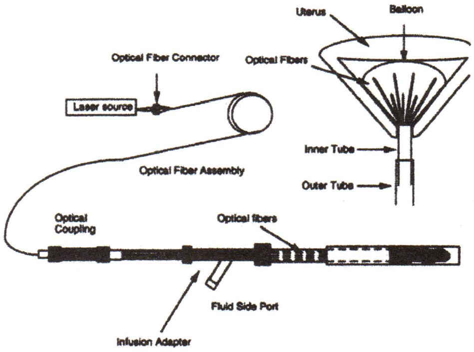

Fig. 8. Uterine light diffuse system.[55]

Studies in animals have demonstrated the safety and efficacy of PDT with Photofrin as a means for ablating the endometrium. A special light delivery device has been designed, built and tested to provide uniform light delivery to the endometrial surface. The approach shows promise for treating dysfunctional uterine bleeding.[55,56] The study of safety and efficacy of PDT using Photofrin for endometrial ablation as an alternative to hysterectomy or endometrial ablation for dysfunctional uterine bleeding has been investigated. Obviously, pregnancy or the desire for future pregnancy are contraindications to participation in the study. Because Photofrin is known to cause skin photosensitivity for as long as 4-6 weeks after injection, precautions to minimize exposure to direct sunlight must be taken. 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.

In conclusion, gynecological photomedicine offers a new therapeutic methods based on the interaction of light with the reproductive organs. Basic experimental and clinical aspects of PDT, such as photosensitizer types, application modes, irradiation parameters, optical properties of tissues and photodegradation of photosensitizers are recently investigated.[57]

Other nonhysteroscopic techniques

The use of chemical agents or physical agents, such as, hot water or cryotherapy to destroy endometrium have been introduced. Some studies have shown the good efficacy of a computer-controlled, continuously circulating, hot irrigating system for endometrial ablation.[58,59] Recently, the effectiveness of endometrial cyroablation for abnormal uterine bleeding was investigated. This study suggests that endometrial cryoablation may be performed simply and effectively.[60] However, cryotherapy was partially successful in previous study, but complications led to disuse.[61] Attempts to ablate the endometrium using other toxic chemicals and physical agents have been disappointing. Quinacrine or urea instillation, cyanoacrylate ester injection and radium packing have all been tried but abandon.

Conclusion

Most women who have menorrhagia that is not controlled by medical treatment, and do not have other problems that require a hysterectomy should consider endometrial ablation. The risk is low in the hands of a physician skilled in the procedure. The procedure is done on an outpatient basis, and most women are able to return to their regular activities in several days. A small percentage of properly selected women having an ablation will eventually need a hysterectomy, but the vast majority will not. Because endometrial ablation costs less, requires a shorter hospital stay, and has a lower morbidity rate, it may be used as an alternative to hysterectomy in patients with excessive uterine bleeding when all other treatment modalities have failed.[62] With the development of these simpler, less expensive techniques and proper patient and physician education, the patients will be able to benefit from these techniques in the near future.

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