
بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

Endometrial ablation

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Endometrial ablation

- Endometrial ablation is the surgical destruction of the endometrium down to the basalis layer, 4 to 6 mm deep.
- first-generation ablation
- Resectoscopic techniques are performed under hysteroscopic visualization, using resectoscopic instruments to ablate or resect the endometrium.
- Second-generation ablation
- Non-resectoscopic endometrial ablation with a device that is inserted into the uterine cavity and delivers energy to uniformly destroy the uterine lining.

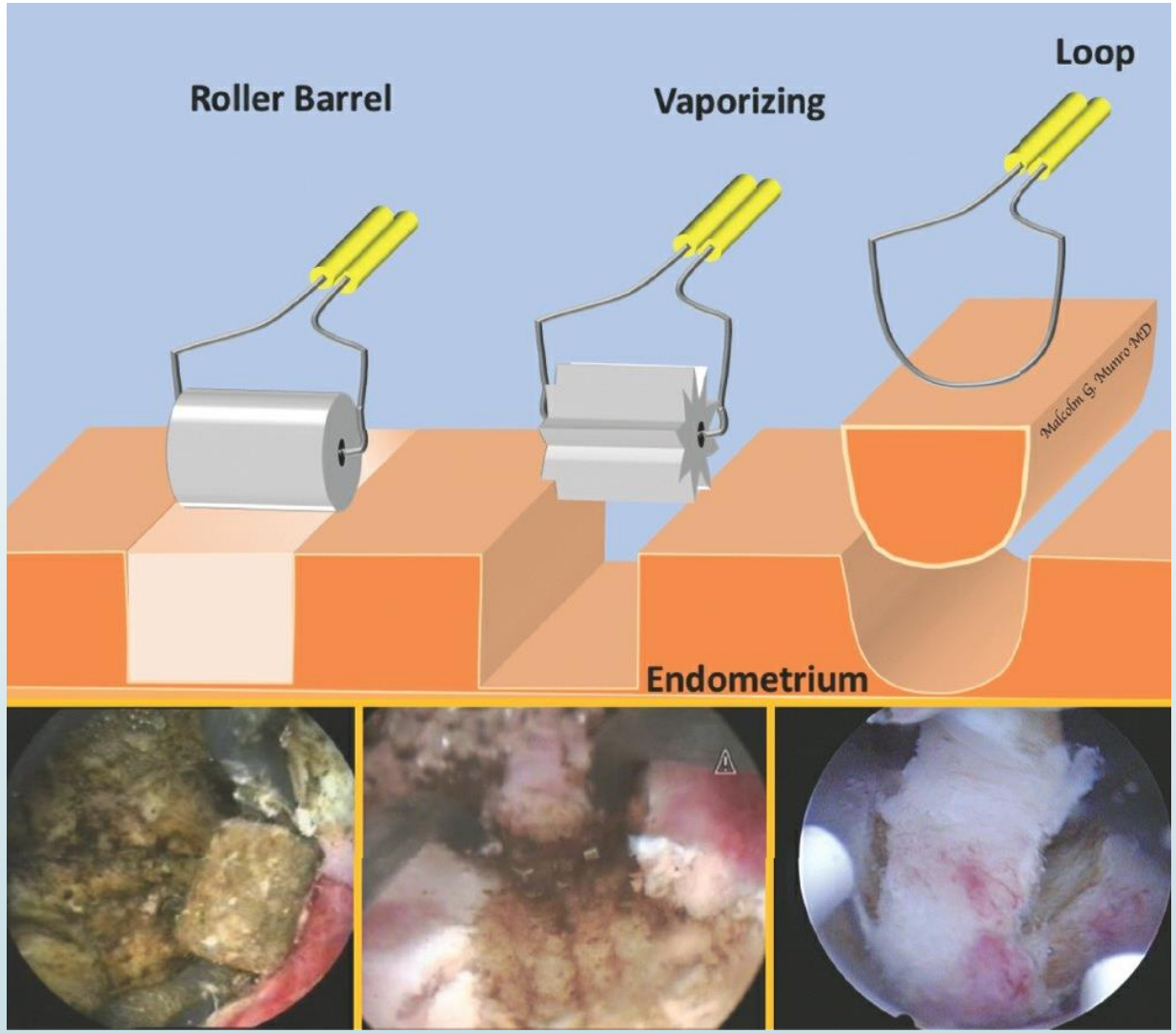
Indications

- This procedure is ideally performed in patients who have chronic, ovulatory, heavy menstrual bleeding.
- Ablation has also been used to treat acute, abnormal uterine bleeding in women who have failed, or who have contraindications to, medical therapy.
- **Preoperative evaluation:** with SIS, office diagnostic hysteroscopy, or MRI should be performed to evaluate for other causative pathology such as polyps, submucosal fibroids, and/or adenomyosis, as these conditions may alter treatment recommendations, outcomes, or counseling.

RESECTOSCOPIC ABLATION

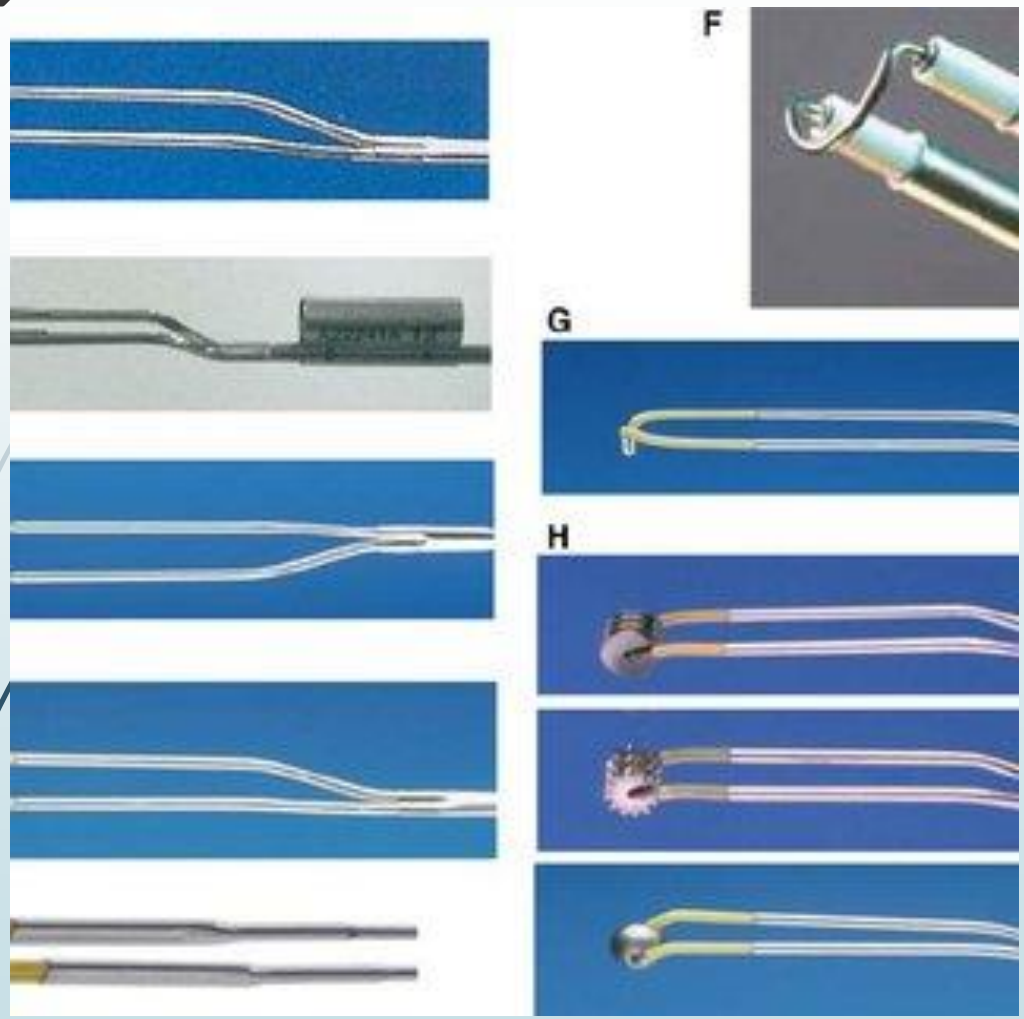
There are currently **four** techniques:

- Resection with a monopolar or bipolar loop electrode.
- Radiofrequency vaporization.
- Laser vaporization.
- Endometrial desiccation with an electrosurgical rollerball or rollerbarrel.



mechanisms

- All methods **desiccate** the **endometrium** to the level of the **basalis**.
- The **rollerball and rollerbarrel** use thermal energy for heating the tissue to a temperature between **60 to 90°C**, which **desiccates and destroys** the tissue. **No tissue** is removed.
- Thermal energy is also used with the **monopolar and bipolar** loop electrodes. However, the loop electrodes **also resect** the **endometrium beyond the basalis** layer to the myometrium. The resected tissue is sent to pathology for histologic diagnosis.
- The **vaporizing electrodes** and **laser fibers** use high energy to rapidly heat the **intracellular water** to **100°C**, causing vaporization of tissue. No tissue is removed.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ROLLERBALL OR ROLLERBARREL OPERATIVE TECHNIQUE

- Rollerball (or rollerbarrel) endometrial ablation is usually performed using monopolar electrical energy.
- The radiofrequency generator is set to 50 to 80 watts of coagulation or cutting current in order to desiccate the endometrium.
- We prefer cutting current, since coagulation current may result in vaginal burns caused by arcing and capacitance coupling.
- Position the rollerball at one of the uterine cornu.
- It is helpful to start the desiccation at the cornua and then move to the anterior fundal wall due to bubble formation in the uterine cavity. Complete the ablation on the posterior wall since the bubbles formed will be anterior.

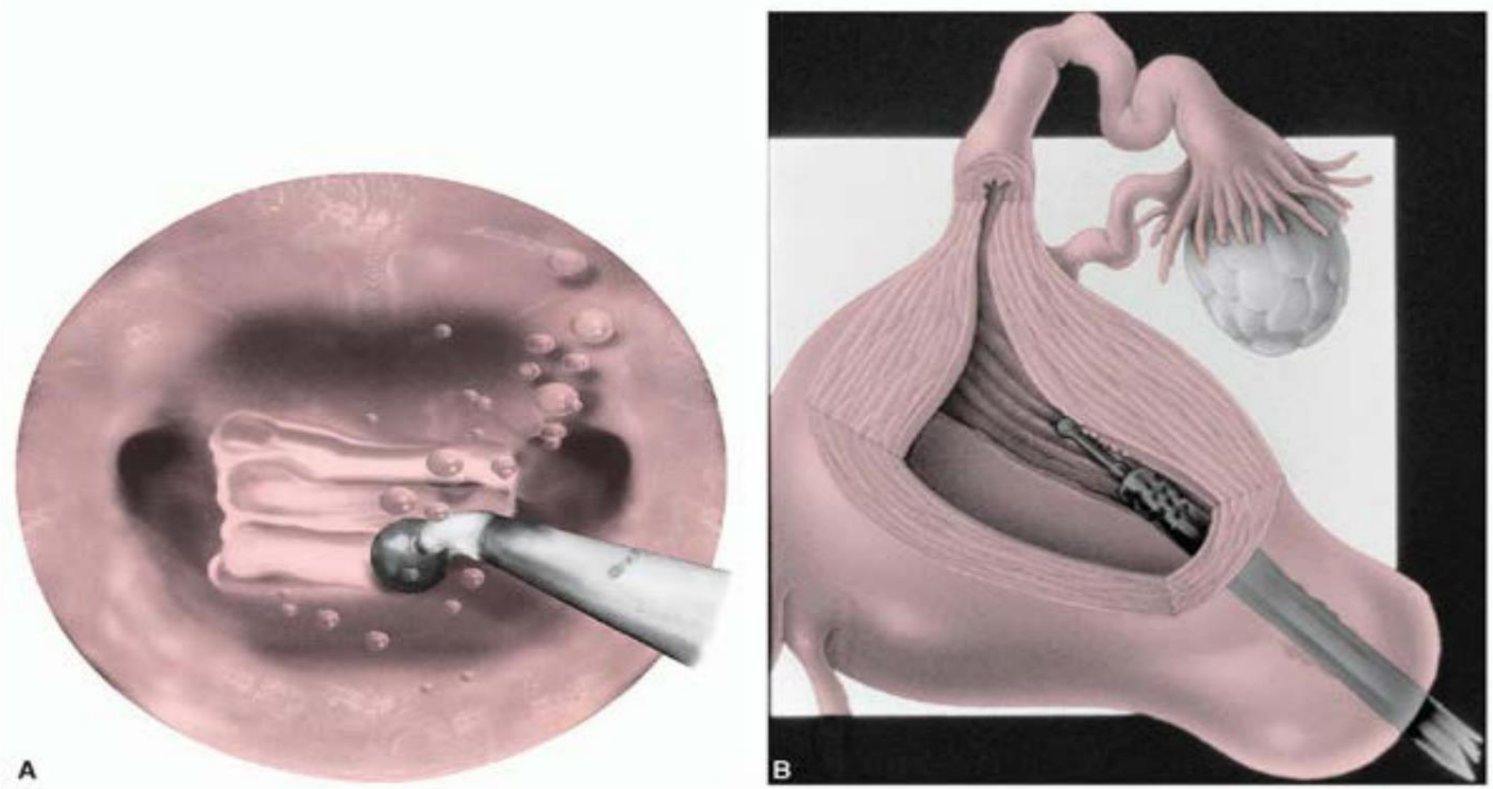

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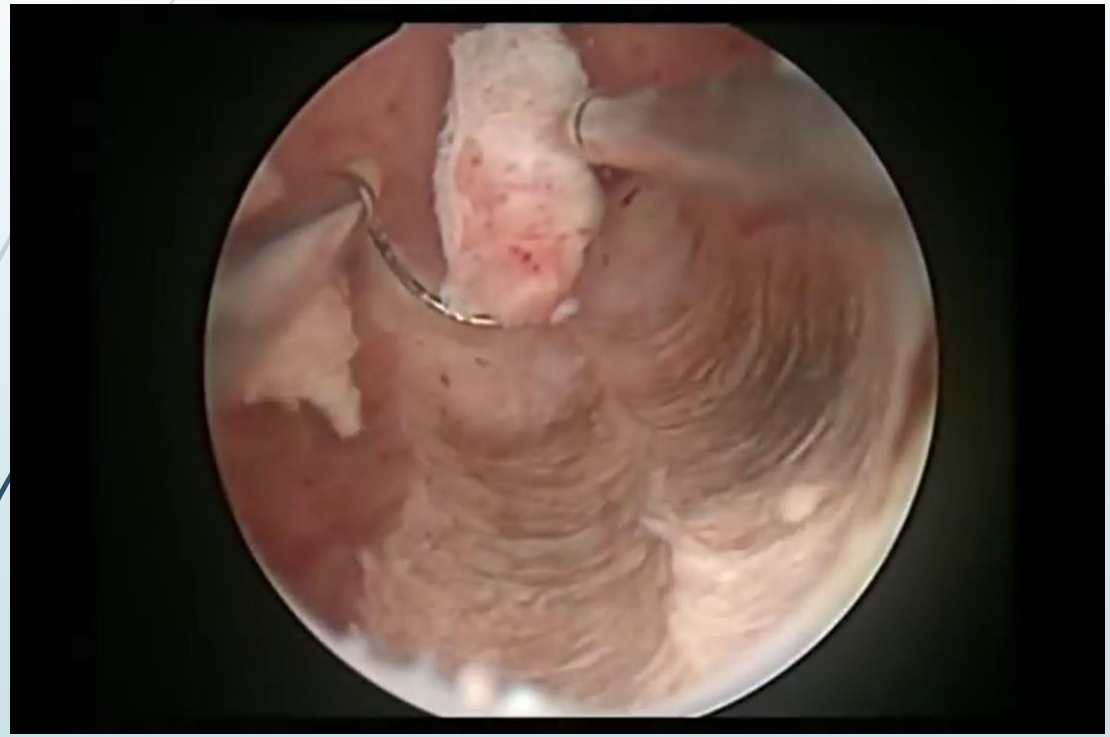
FIGURE 13.18 A: The ball electrode is dragged from side to side via moving the entire hysteroscope, thereby ablating the uterine fundus. **B:** The anterior and posterior walls are ablated by dragging the energized ball electrode from above downward. This creates 2- to 3-mm furrows in the endometrium. Conduction heat damage can extend another 1 to 2 mm. (Reprinted with permission from Baggish MS, Valle RF, Guedj H. ***Hysteroscopy: visual perspectives of uterine anatomy, physiology and pathology***, 3rd ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2007.)

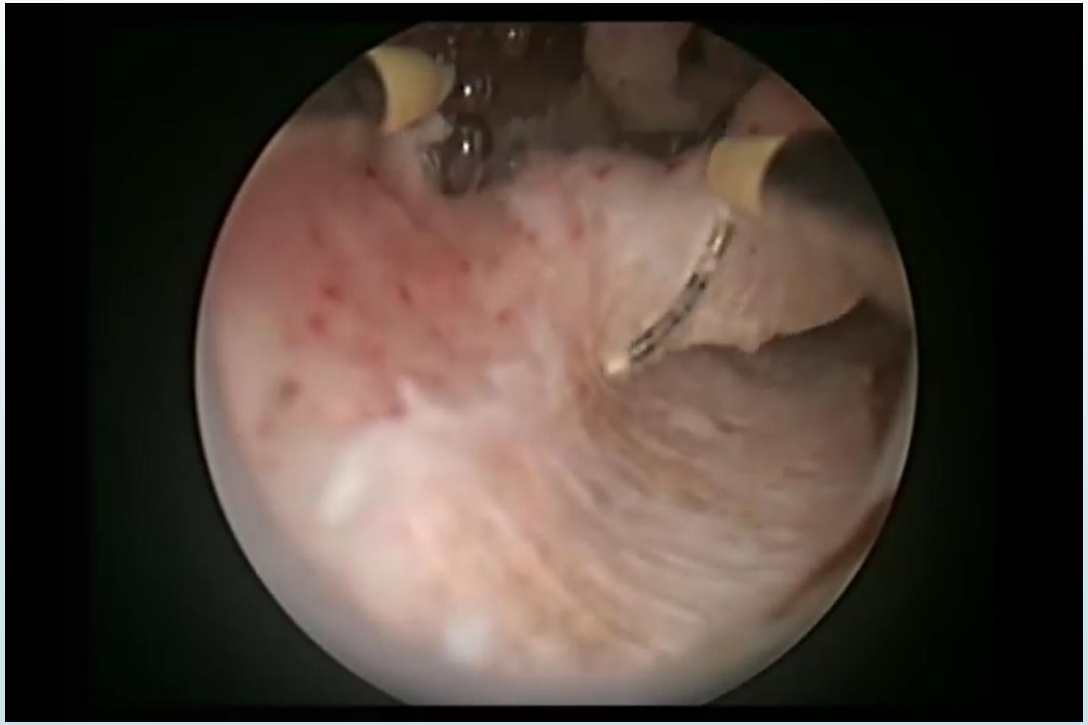
ROLLERBALL OR ROLLERBARREL OPERATIVE TECHNIQUE

- **Activate the current and bring the rollerball towards the surgeon**. To avoid injury, it is important to keep the **rollerball in view** at all times and activate it only when moving it towards the operator.
- Desiccating the endometrium to a depth of **5 to 6 mm** ensures the endometrium is destroyed to the level of the basalis and is **unlikely to regenerate** in the presence of reproductive hormones.
- A **thin endometrium** will be quickly desiccated to this level. When the **myometrium is reached**, the surgeon will note small bubbles forming **around the leading edge of the rollerball.**
- **Avoid** desiccation **of the cervico-uterine junction** since this may result in **cervical stenosis or uterine occlusion.**

Wire Loop Operative Technique

- Resectoscopic endometrial ablation is performed using monopolar electrical energy.
- Typically, the radiofrequency generator is set to 80 to 100 watts of cutting current or blend 1.
- In our practice, we prefer cutting current on 80 watts.
- Cutting loops are available in different sizes, ranging from 4 to 8 mm. We use a 6 mm diameter cutting loop which, when inserted to its full radius, will resect 3 mm of tissue, though some surgeons prefer an 8 mm loop which removes 4 mm of tissue.
- Though the 4 mm loop may decrease the risk of damage, it requires longer resection times. We prefer the 6 mm loop as a good balance of speed and safety.





Preoperative Preparation

- The goal of endometrial preparation is to thin the endometrium to facilitate tissue destruction.
- Hormonal suppression with a (GnRH) agonist is the most commonly used method of preparation.
- Hormonal pretreatment should be initiated 30 to 60 days prior to the procedure.
- However, due to the expense, side effects, and delay of surgery, we choose to use ablation techniques that do not require GnRH agonist preoperative thinning (eg, radiofrequency ablation).

Preoperative Preparation

- The **effectiveness** of **other hormonal agents** for endometrial preparation prior to endometrial ablation **is uncertain.** (OCPs, progestins,)
- We prefer **not to use** danazol, since it is poorly tolerated by most patients.
- **Nonhormonal** methods of preparation include: **performing** the procedure during the **follicular phase** of the menstrual cycle and **uterine curettage.**

Efficacy

- With **appropriate patient choice**, all ablation techniques are associated with **high success** and low failure rates.
- Most studies have reported up **to 90% improvement** in bleeding and **20% to 70% amenorrhea** rates.
- However, up to **25%** undergo **hysterectomy within 2 to 5 years**.

Comparison Among Resectoscopic Techniques

- For patients undergoing **resectoscopic endometrial** ablation, we suggest **rollerball endometrial** ablation rather than **wire loop** endomyometrial resection, unless it is advantageous to send tissue for histology.
- Outcomes appear **similar** for these two techniques, but wire loop resection requires **more surgical skill.**
- **Laser and vaporizing** electrode ablation are not commonly performed due to **expense** of the equipment.
- Rollerball endometrial ablation is the **most commonly** used resectoscopic ablation method.

Contraindications (why?)

- Endometrial ablation is not intended a treatment option in women who desire future childbearing, in women with endometrial cancer or hyperplasia, or in postmenopausal women with bleeding, Active pelvic infection, Previous transmyometrial uterine surgery, IUD in place, have congenital uterine anomalies (eg, bicornuate uterus), have a uterine cavity length that is greater than 10 to 12 cm, or have severe myometrial thinning.

- **Desire to preserve fertility:**
  - Endometrial ablation **does not prevent pregnancy**. Patients must be counseled that **contraception** will be necessary following the procedure.
  - A systematic review of 274 pregnancies after endometrial ablation found that **80 to 90** percent of pregnancies occurred in patients who did not use contraception.
  - Pregnancy is contraindicated following endometrial ablation since the destruction of the endometrium may result in **abnormal implantation or placentation.**
- Some patients choose to undergo concomitant ablation and **sterilization.**

- **Uterine anomalies :**
  - Some surgeons with **advanced hysteroscopic skills** may be able to safely and successfully perform ablation in patients with these abnormalities using **resectoscopic** techniques or with non-resectoscopic devices such as the hydrothermablator.
  - Acute retro- or anteflexion or retro- or anteversion of the uterus **are not contraindications** to endometrial ablation. In patients with these uterine characteristics, **incomplete ablation** may result if the fundus cannot be reached with a non-resectoscopic ablation device.
  - Thus, resectoscopic ablation may **be preferable in this population**.

- **Myometrial thinning following uterine surgery:**
- Endometrial ablation in patients with thinning of the myometrium may result in injury to the adjacent viscera (bladder, bowel) if the energy used for ablation passes through the uterine tissue.
- There are no data to establish the minimum myometrial thickness required to prevent such complications.
- Microwave Endometrial Ablation system advise a minimum myometrial thickness of 10 mm as documented by ultrasound
- Because non-resectoscopic ablation typically ablates 4 to 6 mm into tissue, our practice is to avoid performing non-resectoscopic ablation in cases where there is known thin tissue, such as when an isthmocele has been identified in the lower uterine segment.
- Attenuation of the myometrium is usually due to a prior uterine surgery (eg, cesarean delivery, myomectomy).
- There is no evidence that prior cesarean delivery increases the risk of complications associated with endometrial ablation.

- **Postmenopausal patients:**
- Excluding malignancy is the **primary objective** in the diagnostic evaluation of patients with postmenopausal bleeding.
- Diagnosis of endometrial cancer may be **more difficult** following endometrial ablation.
- Bleeding in postmenopausal patients due to **benign causes** is often managed **expectantly** or the **specific etiology is treated** (eg, removal of an **endometrial polyp**, use of a continuous rather than a cyclic regimen for **hormone therapy**).
- The **American Society for Reproductive Medicine (ASRM)** advised that endometrial ablation **is not indicated for postmenopausal** patients and ACOG states that it has not been rigorously studied in this population.

- **Cavity size:**
- Ablation may **be incomplete** in patients with a cavity larger than the maximum, **minimum (4 to 6 cm) and maximum (10 to 12 cm).**
- **Parity:**
- Nulliparity is **not** a **contraindication** to endometrial ablation. **Grand multiparity** appears to be a risk factor for treatment **failure.**
- **Bleeding disorders or anticoagulation:**
- Most methods of endometrial **ablation are appropriate** for use in such patients.
- **Obesity:**
- There **was no difference** in treatment failure or the need for a subsequent gynecologic procedure between groups during three-year follow-up with the exception of obese patients, with higher failure rates in the **AUB-E group (16.7 versus 9.8 percent).**

Specific considerations

- In the setting of a large uterus (**fibroids or adenomyosis**), consider a **firstgeneration approach** or the **hydrothermal ablation** (circulating hot fluid) to ensure treatment of all surface area.
- **Adenomyosis is not a contraindication to endometrial ablation**. However, the risk of failure is higher since ablation does not treat the underlying pathology and is a risk factor for postablation pain.
- Patients with a previous tubal ligation are at risk for **postablation tubal sterilization syndrome** (PATSS), which presents as cyclic pain secondary to **occult bleeding into obstructed tubes** and is estimated to occur in up to **10% of patients** undergoing ablation with previous tubal ligation.
- For **women less than 45 years** of age at the time of the procedure, there appears to be a higher risk of failure and need for additional intervention than older women.

complications

- uterine perforation (<1.3%)
- hemorrhage (<3%)
- hematometra (<2.4%)
- pelvic infection (<2%)
- Hematometra can occur when scarring of the uterus or cervix occurs post ablation. The overall risk is low (0.3% to 2.4%) but is higher in resectoscopic ablation.
- For this reason, attempts should be made to avoid the cervix and cervicouterine junction when performing an ablation.

Specific Complications

- Specific to the hydrothermal ablation system, skin and vaginal burns have been described.
- Many of the second-generation devices have a built-in safety feature so that energy will not be deployed if there is suggestion of perforation or leak.
- The risk of uterine perforation is higher in resectoscopic ablation (1.3%) versus nonresectoscopic techniques (0.3%).

FOLLOW-UP

- The most common postoperative side effects of endometrial ablation are **cramping and vaginal discharge.**
- Light vaginal bleeding or pink-tinged discharge is often present for **two to three** days.
- Uterine cramping may persist **for 24 to 72 hours**. Most patients can resume normal activities in one to three days.

Endometrial ablation versus other treatments

- Medical therapy
- Levonorgestrel IUD
- Hysterectomy

Non resectoscopic endometrial ablation

Non-resectoscopic endometrial ablation

- Second-generation endometrial ablation devices are **disposable**** and use **nonresectoscopic** techniques to ablate the endometrium.
- With the **exception** of the **hydrothermal ablation**, second-generation devices do not utilize a hysteroscope.
- However if the uterine cavity has not been **evaluated preoperatively** or if preoperative evaluation suggested a polyp or fibroid (with intention to treat), **hysteroscopy will be needed**.
- These devices are intended to require **less surgical skill** than necessary for the first-generation resectoscopic techniques.

FDA approved second-generation ablation devices

- **Bipolar radiofrequency** (NovaSure, Hologic Inc., Marlborough, MA),
- **Cryoablation** (Her Option, CooperSurgical, Trumbull, CT),
- **Circulating hot fluid** (Genesys Hydrothermal Ablation, Boston Scientific, Marlborough, MA),
- **Hot liquid filled balloon** (ThermaChoice) (no longer available in the United States).
- **Combined thermal and bipolar radiofrequency** (Minerva, Minerva Surgical, Redwood City, CA).
- **Microwave** (Microwave Endometrial Ablation; no longer available in the United States).

Postoperative hysteroscopy

- Postoperative hysteroscopy is potentially useful to identify **areas** of **remaining endometrium** or detect **uterine perforation.**
- Some surgeons **ablate endometrial remnants** using resectoscopic instruments.
- However, the **clinical benefit** of hysteroscopy for these indications is **uncertain.**
- There are no data regarding whether small amounts of residual endometrium following non-resectoscopic ablation impact treatment success; data **suggest that partial resectoscopic ablation is successful.**

The duration of energy delivery of the non-resectoscopic endometrial ablation procedures, from shortest to longest, are:

- **NovaSure** bipolar radiofrequency (90 to 120 seconds)
- **Minerva** thermal/radiofrequency (120 seconds)
- **Mara** vapor system (120 seconds)
- **MEA** (3 to 5 minutes)
- **ThermaChoice** hot liquid filled balloon (8 minutes)
- **HTA** circulating hot water (10 minutes)
- **Her Option** cryoablation (10 minutes)

essentially the same as for REA [45] .

Fig. 7

Second-Generation, Non-resectoscopic, Endometrial Ablation Methods FDA Approved in USA

TABLE 13.2 Second-Generation, Nonresectoscopic, Endometrial Ablation Methods FDA Approved in the United States

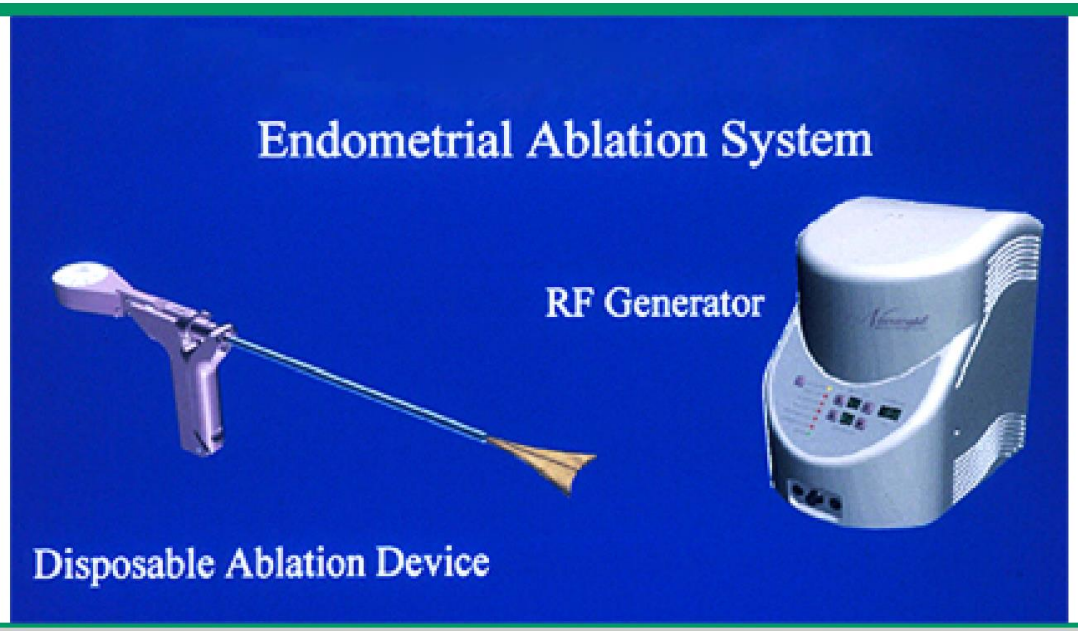
	BIPOLAR RADIOFREQUENCY (NOVASURE)	CRYOABLATION (HER OPTION)	HYDROTHERMAL ABLATION (HYDRO THERMABLATOR)	COMBINED THERMAL AND RADIOFREQUENCY (MINERVA)
Mechanism	Bipolar mesh probe delivers radiofrequency current to the surrounding endometrium until reaching specific tissue impedance	An ice ball forms around the tip of a probe cooled by liquid nitrogen or differential gas exchange. Temperature reaches −20°C, 3-5 mm from edge of ice ball, permanently destructive to tissue	Heated (90°C) saline is administered into the uterine cavity through a hysteroscopic sheath inducing thermal destruction of surrounding endometrium	Electrical current ionizes argon into a plasma, which heats surrounding silicone membrane. This heat, along with radiofrequency current, conducts to endometrial tissue
Device diameter (mm)	7.5	5.5	7.8	7.0
Uterine cavity length (cm)	≥6 to ≤10	≥4 to ≤10	≥6 to ≤10.5	≥4
Uterine cavity width (cm)	≥2.5	Not specified	Not specified	≥2.5
Duration of energy delivery	90-120 s	10 min	10 min	120 s
Endometrial pretreatment	None	GnRH agonist	D and C or GnRH agonist	None
Additional equipment	None	Ultrasound	Hysteroscope	None

Bipolar radiofrequency (NovaSure)

- The device **(a three-dimensional bipolar mesh probe)** is inserted into the uterine cavity and the mesh is **expanded** until it is in contact with the endometrium.
- **Suction** is then applied to the endometrial cavity, thereby **drawing the endometrium closer** to the bipolar mesh probe.
- The suction also removes debris and vapor that can increase impedance and **reduce the depth of energy penetration.**
- The system **will shut down** when complete **desiccation has occurred** (calculated at a tissue impedance of **50 ohms** of resistance) or after a total treatment time of **two minutes**.
- The average treatment time is just **over one minute** and the average depth of ablation is **4 to 5** millimeters.

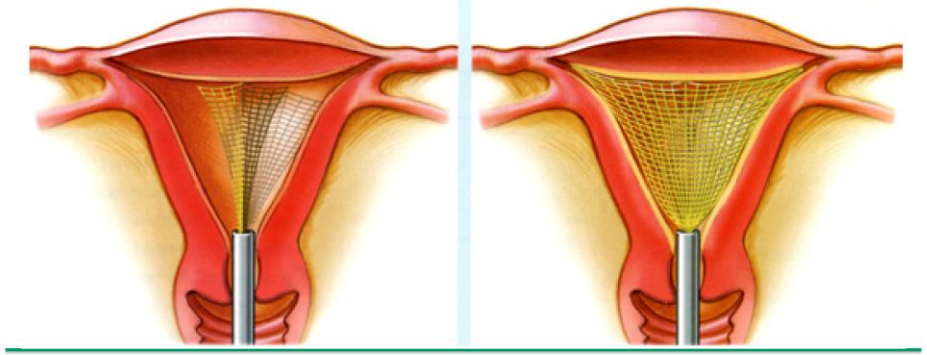
Novasure

Bipolar radiofrequency endometrial ablation



NovaSure endometrial ablation system.

Bipolar radiofrequency endometrial ablation



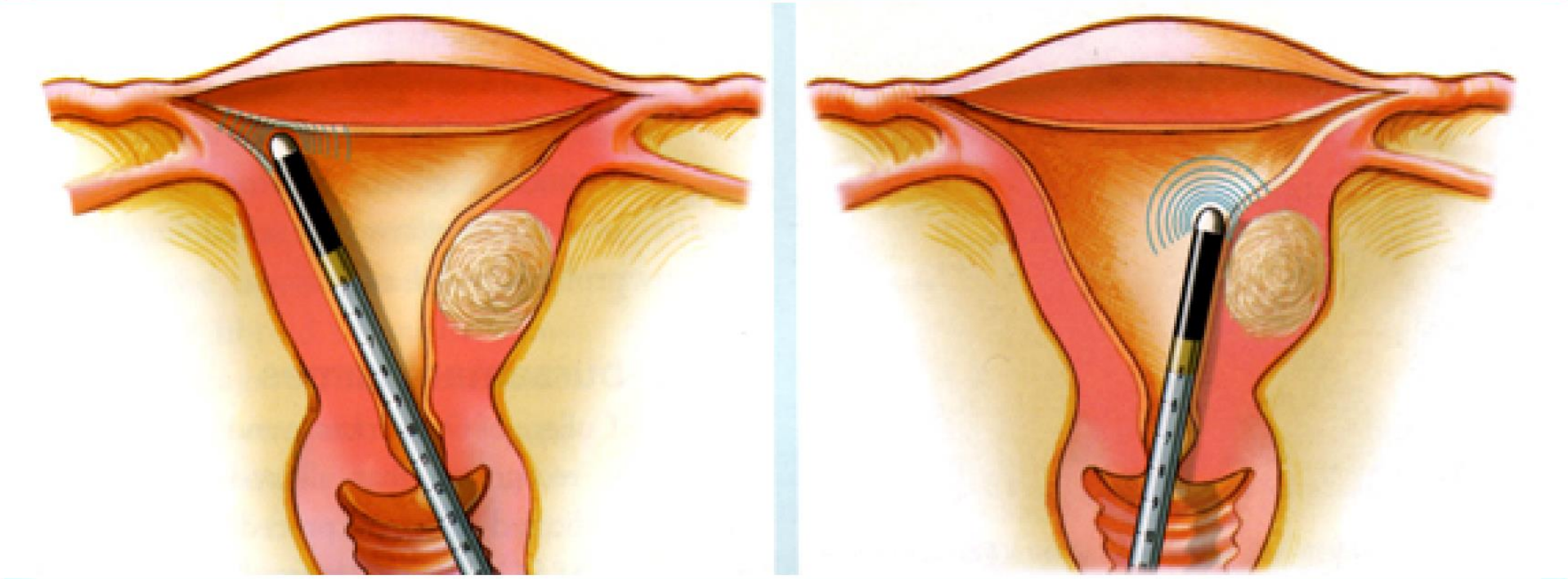
Reproduced with permission from: Purdon TF. NovaSure System Bipolar Radio Frequency Technology: Very short procedure time. OBG Management 2005. Copyright © 2005 Dowden Health Media.

Graphic 61150 Version 4.0

Microwave Endometrial Ablation (MEA)

- It is a 9.2 GHz, 30 watt, microwave system.
- When inserted into the uterine cavity, this energy will produce a tissue temperature of 75 to 85°C at a depth of 6 mm.
- In order to treat the entire uterine cavity, the surgeon moves the probe from cornu to cornu and across the lower uterine segment until the entire endometrium has reached the desired temperature.
- Total treatment time is three to five minutes. Unlike other non-resectoscopic ablation devices, the probe is reusable.
- The manufacturer of MEA advises hysteroscopic evaluation before and after ablation and preoperative measurement of the thicknessof the myometrium in contrast with other non-resectoscopic ablation devices.

Microwave endometrial ablation



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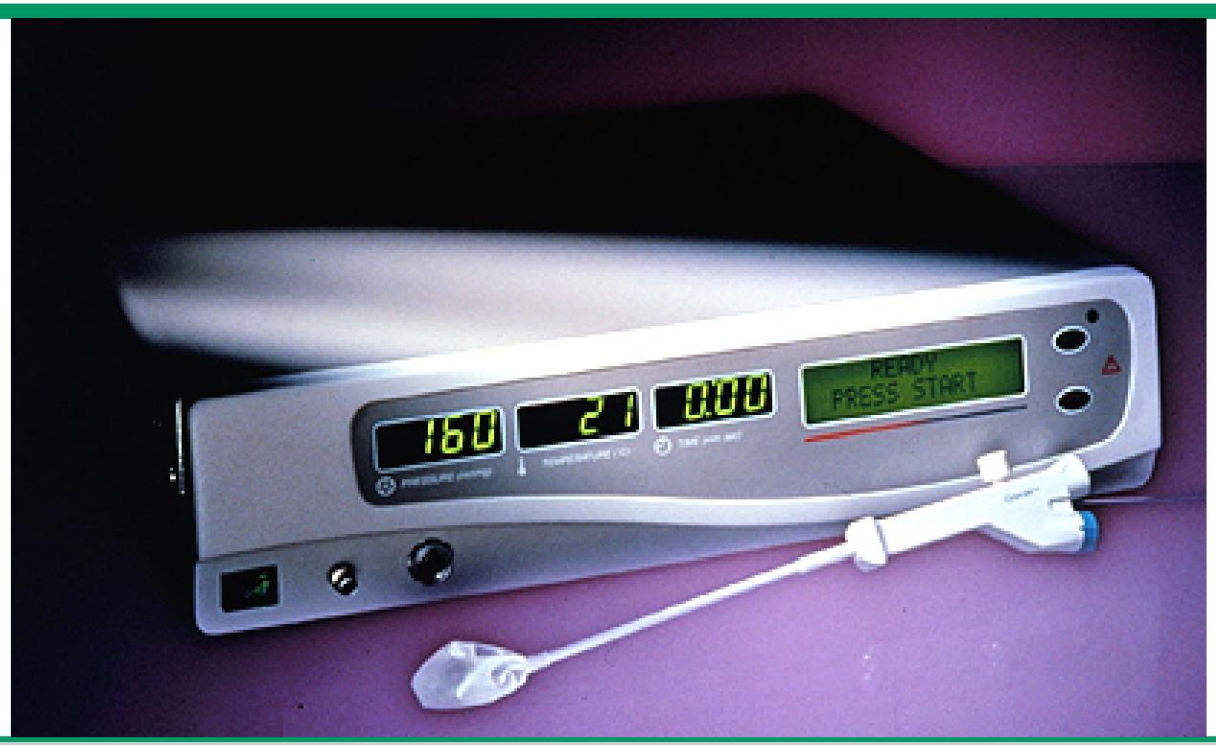
Hot liquid filled balloons

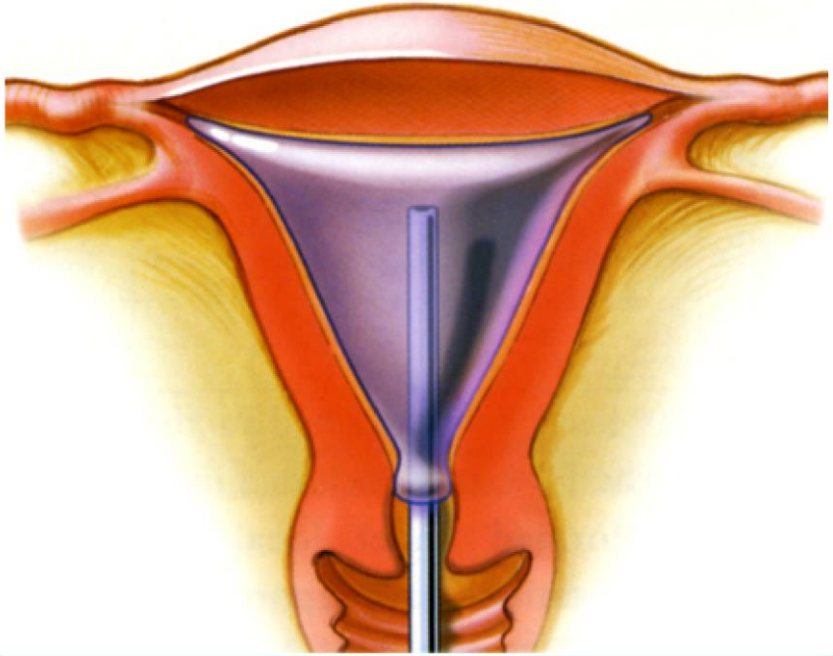
- ThermaChoice III, A prospective study of 148 patients followed for 12 months reported reduced bleeding in 31 percent and amenorrhea in 66 percent. No patient had undergone re-ablation or hysterectomy.
- Cavaterm plus – A prospective study of 220 patients followed for 19 months reported reduced bleeding or amenorrhea in 74 to 83 percent. No patient had undergone reablation, but 15 percent had undergone, or were planning, hysterectomy.
- Thermablate EAS – A prospective study of 47 patients followed for 12 months reported reduced bleeding or amenorrhea in 77 percent . There were no reports of re-ablation or hysterectomy.
- Hot liquid filled balloon techniques may cause more perioperative pain than other non-resectoscopic ablation techniques. The likely mechanism of this is the stimulation of pain fibers by both the heat and uterine distention pressure produced during the procedure.

Hot liquid balloon endometrial ablation



ThermaChoice system.

Hot liquid balloon endometrial ablation

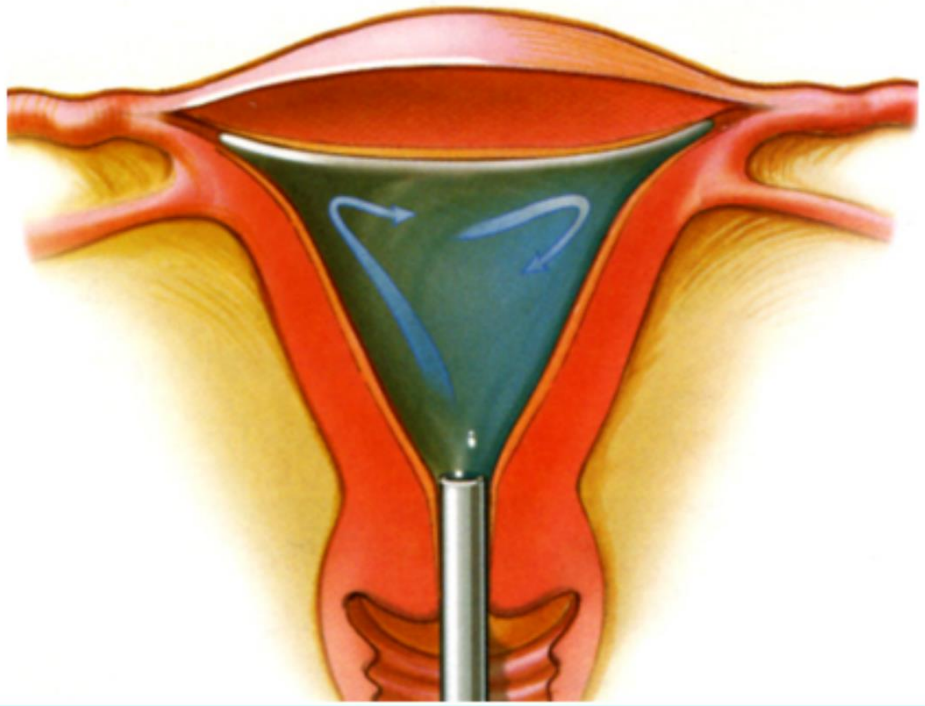


Uterine coverage with ThermaChoice uterine balloon endometrial ablation system.

Circulating Hot Water (Hydrothermal)

- Refers to a technique in which a **hysteroscope sheath** is inserted into the uterine cavity under **direct** hysteroscopic **visualization****. Heated isotonic saline is administered into the uterus through the sheath.
- To maintain a low uterine distension **pressure (<70 mmHg)**, the fluid is instilled using **gravity** rather than a **pump.**
- The treatment phase lasts for **10 minutes,** during which the fluid should be at a temperature of **90°C.** An intrauterine cool down phase is then performed for one minute with the fluid at 45°C.
- **Safety apparatus** within the equipment detects whether any **fluid has escaped** from the **closed** system, which **will shut down** if more than **10 cc** of fluid are lost, whether through the **cervix, fallopian tubes, or a uterine perforation.**
- Patients treated with HTA compared with rollerball were less likely to have postoperative **hematometra** (1 versus 6 percent), but they were significantly more likely to experience **abdominal pain** (53 versus 38 percent) and **postoperative nausea and vomiting** (22 versus 7 percent). Two patients in the HTA group had **lower extremity burns** due to contact with the device tubing.

Circulating hot water endometrial ablation



The closed-loop system ablates the lining of the endometrium under hysteroscopic visualization by recirculating heated saline within the uterus.

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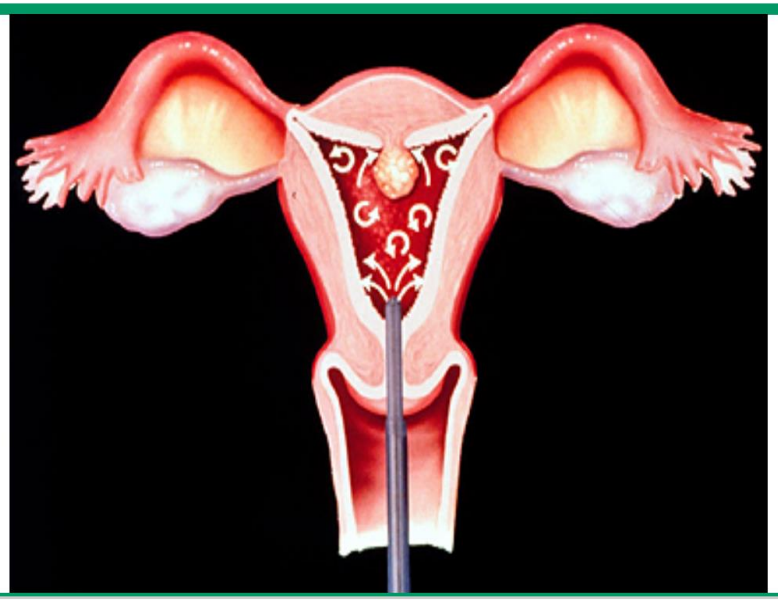
Circulating hot water system

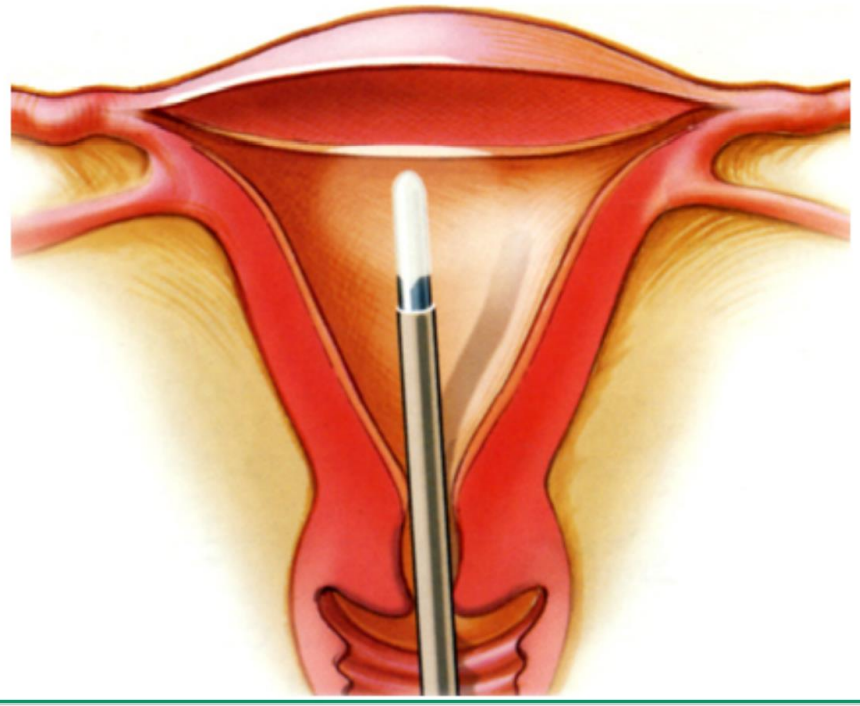


Hot water circulated throughout an abnormal cavity is able to make contact with all surfaces, potentially providing better endometrial ablation than with a nonconforming system, such as a balloon.

Cryoablation

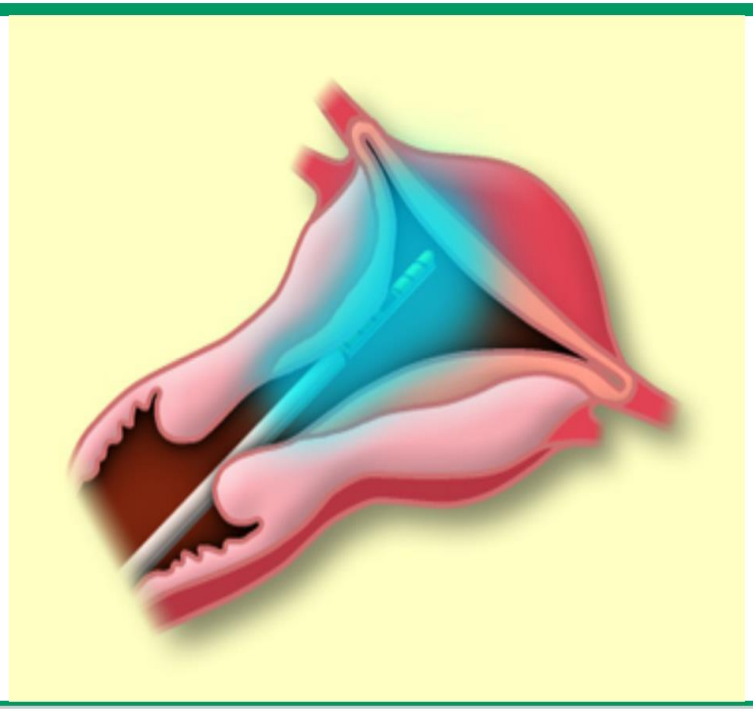
- Cryoablation is a technique in which a **cryoprobe** is inserted into the uterine cavity
- The probe is cooled either **by liquid nitrogen** or by differential gas exchange.
- An elliptical ice ball approximately 3.5 by 5 centimeters forms around the probe when it is cooled to less than -90°C.
- At the edge of the ice ball, the tissue temperature is 0°C, which is nondestructive.
- A temperature of **-20°C** is lethal to tissue; this temperature is reached approximately **3 to 5 mm from** the edge of the ice ball.
- Therefore, the endometrial tissue exposed to this low temperature, including the **basalis layer** of the endometrium is permanently destroyed.
- The number of ice balls that must be created to destroy the entire uterine cavity is dependent upon the **size of the cavity**.
- Intraoperative ultrasonography is used to monitor probe placement and depth of tissue freezing. In general, two to three ice balls are sufficient.
- Each freeze cycle **takes two to six minutes**.

Endometrial cryoablation



The cryoprobe is first placed at the fundus, angled toward 1 cornu. Probe placement is visualized on ultrasound. When the freeze is initiated, the progress of the iceball is monitored by ultrasound.

Endometrial cryoablation



Probe placement on the left side of uterus with ice ball formation.

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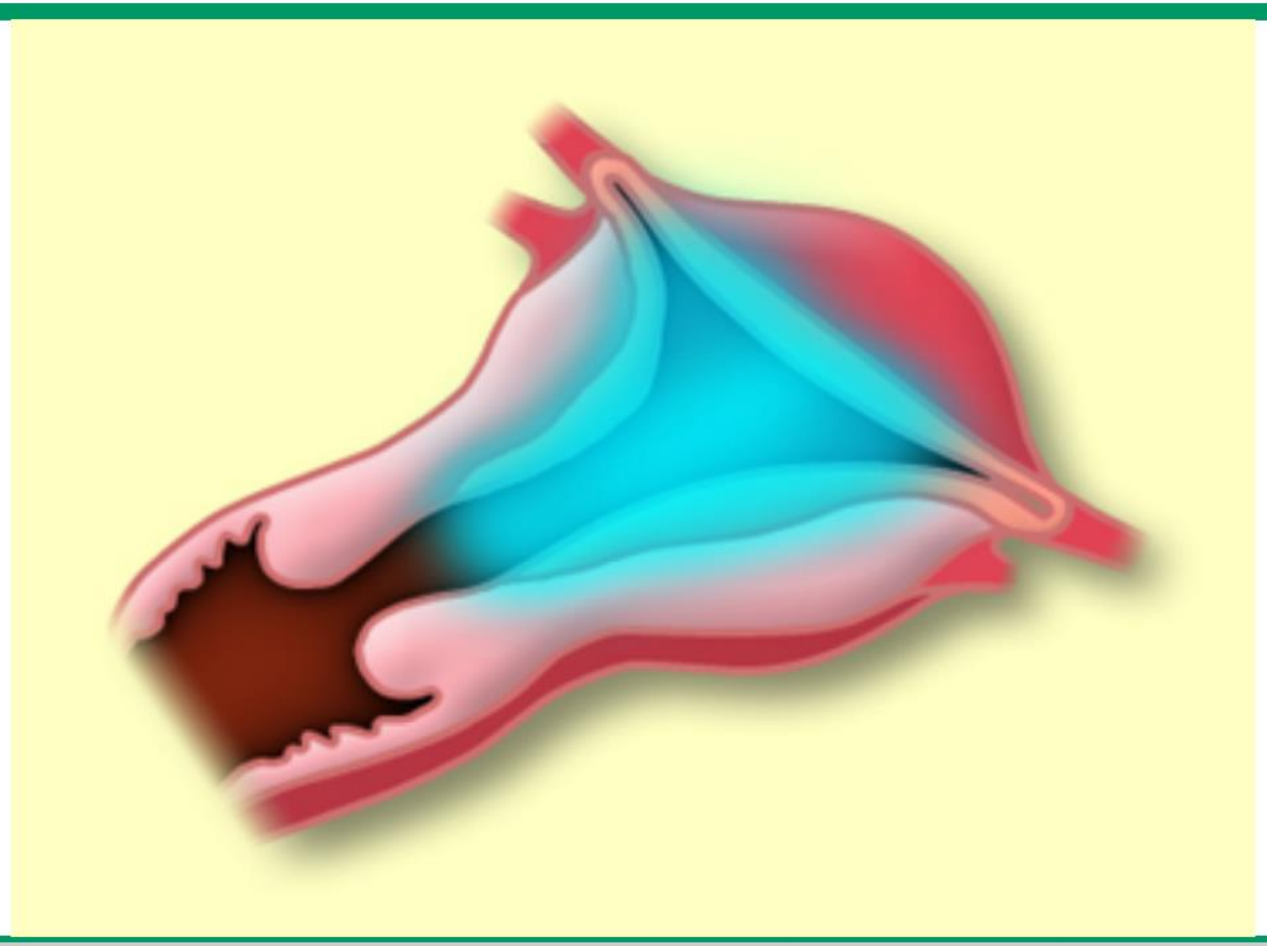
Endometrial cryoablation



Ice ball formation after two freezes (without probe).

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Combined Thermal and Radiofrequency Ablation

- A combined thermal and radiofrequency ablation endometrial ablation device **(Minerva)** was approved by the FDA in **2015** .
- **The mechanism** of ablation utilized by the device is mainly **heat applied** to the endometrium **via a silicone membrane** with circulating **ionized argon** gas (the **argon gas is heated by radiofrequency current).**
- **In addition,** heat is applied to the endometrium by **intracavitary fluid** produced and retained during the procedure that is heated by the silicone membrane and by direct effects of radiofrequency current on the endometrium.

Summary

- All of the endometrial ablation devices have similar efficacy and complication rates and each device has advantages and disadvantages.
- Cryoablation appears to result in the least patient discomfort.
- Bipolar radiofrequency, thermal/bipolar radiofrequency, and vapor ablation have the shortest energy delivery time.
- Circulating hot water is the only non-resectoscopic method performed using direct visualization.
- Surgeons should determine which device is most appropriate in their practice.
- In patients with submucosal fibroids or endometrial polyps, we suggest use of microwave ablation or cryoablation over other methods since the success of the other devices was not evaluated in the FDA studies. (Other methods are less studied in the presence of intra–cavitary lesions)


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