



Hysteroscopy will uncover numerous intracavitary lesions, such as submucous fibroids, polyps, endometrial hyperplasia, and cancer. Gynecologists need to possess the expertise and skill to resect focal lesions or perform directed biopsies.

Cutting the risk of hysteroscopic complications

Proper selection and treatment of patients and prompt intervention minimize complications and legal risks of this effective, underutilized procedure.

The state of the art can be simply put: Hysteroscopy is underutilized. Most studies consistently demonstrate the safety and efficacy of operative hysteroscopy, as well as high patient satisfaction.

It is a valuable tool in the evaluation and treatment of infertility, recurrent pregnancy loss, and abnormal and postmenopausal uterine bleeding, and is useful when saline infusion sonography findings are equivocal.

Further, if a global ablation device fails, the surgeon can convert to hysteroscopic

ablation rather than abandon the procedure altogether. This is not as unusual as it might appear: In US Food and Drug Administration trials, there was a staggering 10% to 22% malfunction of global ablation technology.¹

Safe, easily learned

Although gynecologists are beginning to embrace this modality, many physicians avoid it because of inadequate training or exaggerated fears of complications. In reality, hysteroscopy is one of the safest and most

easily acquired surgical skills in gynecology. For example, in a prospective evaluation of 13,600 diagnostic and operative hysteroscopic procedures performed at 63 hospitals in the Netherlands—which involved both established surgeons and residents—Jansen et al² found an astonishingly low complication rate of 0.28%, with no deaths.

Proper selection and treatment of patients and prompt intervention minimize complications as well as legal risks. Surgical misadventures and lawsuits occur with delayed intervention, failure to recognize pathology or risky conditions, and inadequate preventive maneuvers.

Overall, emphasis on safety is vital to success, and thorough awareness of potential complications is just as important.

Three types of complications

Complications fall into 3 categories (TABLE):

- Procedure-related
- Media-related
- Postoperative

PROCEDURE-RELATED COMPLICATIONS

Complication rates

In a retrospective investigation, Propst et al³ determined the rate of complications associated with specific hysteroscopic procedures. Demographic data and medical histories were collected for 925 women who had operative hysteroscopy in 1995 and 1996. The overall complication rate was 2.7%. Myomectomy and resection of uterine septa carried the greatest odds of complications; polypectomy and endometrial ablation had the lowest. Preoperative treatment with a gonadotropin-releasing hormone (GnRH) agonist increased the odds of complications by a factor of 4 to 7. Women under age 50 were more likely to experience complications than those over 50.

In the study by Jansen et al,² 38 complica-

tions occurred in the 13,600 procedures. The greatest risk of complications occurred with adhesiolysis (4.48%), followed by endometrial resection (0.81%), myomectomy (0.75%), and polypectomy (0.38%).

Cervical entry requires special attention

Almost half of the complications in the Jansen study were related to cervical entry, so caution and, perhaps, preoperative cervical ripening are advised. Many premenopausal subjects were given GnRH analogues, which may render the cervix more resistant to dilation. Complications associated with a stenotic cervix include a cervical tear, creation of a false cervical passage, and uterine perforation.

Cervical ripening may help prevent uterine perforation.

The most common complication, occurring in 14.2 cases per thousand, is uterine perforation.² The risk of this is highest in postpartum procedures, followed by procedures in postmenopausal, then perimenopausal, women. Patients with endometrial cancer also have a higher rate of perforation.

Risk factors for uterine perforation include:

- nulliparity
- menopause
- use of GnRH agonists
- prior cone biopsy
- markedly retroverted uterus
- undue force

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KEY POINTS

- Preoperative treatment with a gonadotropin-releasing hormone agonist increases the odds of operative complications by a factor of 4 to 7.
- Preoperative cervical ripening reduced the need for cervical dilation, minimized cervical complications, and reduced operative time.
- CO₂ should never be used for operative hysteroscopic procedures because of the high risk of CO₂ embolism.
- Ultrasound guidance may improve outcomes in selected hysteroscopic procedures.

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Modern operative hysteroscopes often require dilation of the cervix to a number 8-10 Hegar dilator. Navigation of the internal os is critical before operative instruments can be inserted and the surgical procedure performed. In the past, use of preoperative laminaria was recommended to soften the cervix, except in women with marked cervical stenosis and iodine allergy. Preoperative cervical softening still should be considered in high-risk patients.

Vaginal or oral misoprostol for cervical ripening prior to operative hysteroscopy was evaluated in a randomized trial.⁴ Researchers found a reduced need for cervical dilation, a minimum of cervical complications, and reduced operative time in study patients compared with controls.

When 400 μ g oral misoprostol is given 12 and 24 hours before surgery, it also softens the cervix and eases dilation.⁵ Although misoprostol has several bothersome side effects (such as lower abdominal pain and slight vaginal bleeding), few if any prevent its use.

Signs of perforation. Patients who sustain uterine perforation with subsequent intraperitoneal bleeding often complain of pain in the abdomen and shoulder, and experience hemodynamic instability. A quick sonographic survey of the abdomen will demonstrate free intraperitoneal fluid. (It is rare for much intraperitoneal fluid to accumulate by transtubal regurgitation during operative hysteroscopy, despite the quantity of fluid used.)

If perforation is suspected, laparoscopy or laparotomy is necessary to clarify the cause of pain, unstable vital signs, or free fluid visualized by ultrasound.⁶

Exercise extra care and precautions in women who have had a prior cesarean section, myomectomy, or uterine perforation. Complete visualization of uterine landmarks is necessary during operative hysteroscopy to exclude uterine dehiscence, sacculation, and perforation. Prior uterine surgery may cause myometrial weakness and lead to possible

perforation. Do not proceed if abnormal uterine morphology is detected. If uterine perforation occurs, injury to bladder and bowel is possible when electrical energy is applied to a uterine wall compromised by prior surgery. Strict visualization of uterine anatomy is critical in this population so that bowel or bladder burns can be avoided.

MEDIA-RELATED COMPLICATIONS

Notorious complications and several recent lawsuits have stemmed from fluid overload. A common element has been the physician's lack of awareness of how rapidly complications can arise, and what signs and symptoms are specific to the fluid used.

Monitor fluids vigilantly

Operative hysteroscopy must be performed in a fluid medium. The type of fluid depends on the surgeon's preference and the instrument utilized, but any fluid can be associated with complications. Fluid choices with monopolar instruments include glycine 1.5%, a mixture of sorbitol 3% and mannitol 0.54%, and mannitol 5%. These are frequently used with the continuous-flow resectoscope. Bipolar operative hysteroscopy can be performed using saline.

The solution to media-related complications is basic: vigilant monitoring of fluids. A cavalier attitude, poor fluid documentation, and failure to respond to complications can lead to trouble. If fluid overload occurs, comanagement and consultation with an intensive care specialist is advised.

Distention media

Among the options for distention media in operative and diagnostic hysteroscopy are high-viscosity dextran 70 and low-viscosity fluids such as hypotonic, electrolyte-free and isotonic, electrolyte-containing solutions. The popularity of dextran 70 is waning, however. While it is immiscible with blood, significant complications have been reported.

TABLE

Complications associated with hysteroscopy

TYPES OF COMPLICATIONS	SPECIFIC COMPLICATIONS	AVOIDANCE STRATEGY
Procedure-related	Bowel and bladder injury Cervical laceration or trauma Hemorrhage Inability to dilate the cervix Uterine perforation	Visualize and inspect endometrial cavity. Yellow tissue is likely associated with bowel injury. Indentations and sacculation may be associated with myometrial weakness and possible bowel or bladder injury. Observe uterine morphology in patients with prior cesarean, myomectomy, or known uterine perforation.
Media-related	Anaphylaxis Cardiovascular collapse Cerebral edema Congestive heart failure Fluid overload Gas and air embolism Hypertension Hyponatremic hypervolemia Pulmonary edema	Alert anesthesia to type of fluid being used, discuss known fluid concerns, and ask anesthesia to promptly report a change in vital signs, including CO ₂ , difficulty ventilating patient, or arrhythmias. Strict monitoring of fluid intake, output by automated system.
Postoperative	Adhesions Endometritis Delayed diagnosis of endometrial cancer Dysmenorrhea (new or worsening) Failure to treat significant symptoms Hematometra Myometrial thinning Postablation tubal sterilization syndrome Pregnancy complications <ul style="list-style-type: none"> • Intrauterine growth retardation • Placentation problems, eg, placenta accreta • Postpartum hemorrhage • Preterm labor • Premature delivery • Uterine rupture • Uterine dehiscence or sacculation Synechiae Tubal sterilization syndrome Unrecognized bowel, bladder or major blood vessel injury	Consider sounding cervix at 2- to 4-week post-operative visit to decrease risk of cervical synechiae and hematometra. Consider sterilization and endometrial ablation in patients who need contraception, or advise strict use of contraception by patient or partner to decrease risk of pregnancy. Pregnancy testing in patients with pregnancy symptoms. Consider magnetic resonance imaging to exclude adenomyosis if persistent postoperative pain. Consider preoperative cervical cultures for women with suspected sexually transmitted disease or high risk factors. Do not operate in women with prodromal or herpes infection.

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Signs of anaphylactic reactions to dextran 70 include acute hypotension, hypoxia, pulmonary edema, fluid overload, fulminant coagulopathies, and anemia. The surgeon must operate quickly, minimize endometrial trauma, use continuous pulse oximetry, and obtain a preoperative coagulation panel.

Dextran 70 also can ruin operative hysteroscopes if they are not cleaned promptly and thoroughly after use.

Hypotonic, electrolyte-free solutions. With hypotonic, electrolyte-free solutions such as glycine 1.5%, early recognition of possible complications, including hyponatremic hypervolemia, is vital. For example, when glycine and sorbitol are metabolized, free water accumulates and the body attempts to achieve homeostasis through compensatory mechanisms such as osmosis, which moves free water into extracellular and intracellular spaces. This can lead to increased free water in the brain, resulting in cerebral edema, rising intracranial pressure, and cellular necrosis.

The cerebral cation pump normally pumps osmotically active cations into the extracellular space, thereby minimizing cerebral edema. However, this pump is inhibited by estrogen, so the compensatory mechanism is diminished.

Classic clinical features of hyponatremic hypervolemia include apprehension, confusion, fatigue, headache, mental agitation, nausea, visual disturbances (including blindness), vomiting, and weakness. These complications are more readily apparent when regional anesthesia is used rather than general anesthesia.

If hyponatremic hypervolemia goes unrecognized, bradycardia and hypertension can ensue, followed rapidly by cerebral and pulmonary edema and cardiovascular collapse. In addition, glycine 1.5% is metabolized to glycolic acid and ammonia. Free ammonia is associated with central nervous system disorders. Recognition and prompt treatment by an intensivist may prevent permanent neurologic sequelae, death, and lawsuits.⁷

Isotonic, electrolyte-containing solutions. Mannitol 5% is electrolyte poor but isotonic, creating less risk for hypo-osmolality. However, dilutional hyponatremia (ie, low sodium levels) can still occur.

Advantages of bipolar instruments. To minimize complications from hypotonic, electrolyte-free solutions, manufacturers developed operative hysteroscopes that can function in a bipolar environment. Bipolar instruments can operate in isotonic, physiologic, electrolyte-containing media. Hyponatremia and hypo-osmolality cannot occur with normal saline or Ringer's lactate, but fluid overload can. (Fluid overload with saline can cause pulmonary edema and congestive heart failure.)

How much fluid will be absorbed? The answer depends on factors including surface area of the surgical field, duration of surgery, opened venous channels, type of irrigation fluid used, and pressure of the delivery system. Modern gynecologic suites employ fluid irrigation systems that continuously measure input and output, with alarms that signal a predetermined fluid deficit. The alarm indicates the need to halt the procedure and quickly evaluate the patient. Careful attention to the recommendations of Loffer et al⁸ would lead to fewer complications from fluid mismanagement.

Appropriate use of CO₂

High risk of embolism with CO₂ in operative procedures. Although diagnostic hysteroscopic procedures often are performed with carbon dioxide (CO₂), operative procedures never should be. The reason: the high risk of CO₂ embolism that occurs with open venous channels and vascular endometrium. The choice between CO₂ and fluid medium for diagnostic hysteroscopy often is determined by physician preference and the presence of uterine bleeding. Many gynecologists prefer CO₂ for its optical clarity and patient comfort during insufflation.⁹

Purge tubing of room air before each procedure. Embolic complications with CO₂

Cancer concerns: When is hysterectomy the best option?

One of the greatest concerns about endometrial ablation is that diagnosis of endometrial cancer will be delayed because the endometrial cavity has been obliterated. Vilos¹⁹ recently reviewed the salient characteristics and findings in women treated by endometrial ablation who subsequently developed endometrial cancer. A review of the individual cases revealed that most of these patients had numerous risk factors for endometrial cancer.

Review risk factors, chronic conditions

Many patients with abnormal bleeding also have risk factors for endometrial cancer, as well as medical conditions that increase the likelihood of morbidity with surgery, such as obesity, hypertension, diabetes, and advanced age. In these cases, hysterectomy may be a better option than endometrial ablation. It would be far better to have such high-risk patients cleared for hysterectomy than to chance their becoming an endometrial-ablation "statistic." If endometrial ablation is performed in these cases, we prevent the egress of blood, foster development of synechiae, render endometrial biopsy difficult or impossible and, potentially, "bury" endometrial cells deeper within the myometrium—all of which contribute to a delayed and "upstaged" diagnosis of endometrial cancer.

Patients at risk of endometrial cancer should undergo a scrupulous and unambiguous work-up and evaluation. Indeterminate endometrial echo and office evaluation that generates biopsy samples designated as "insufficient for diagnosis," "no endometrial tissue seen," or "atrophy"

should raise suspicion. These patients require full visualization of the endometrium.

Heightened risk during perimenopause

Newer ablation techniques that utilize global therapy make it paramount that perimenopausal women undergo scrupulous evaluation. Until much more information is available, endometrial ablation should be avoided in patients with endometrial hyperplasia, particularly with atypia. While some gynecologists may be persuaded to consider endometrial ablation as a minimally invasive procedure compared to hysterectomy, the risk of delayed diagnosis of endometrial cancer is of paramount concern. The treatment of choice for these patients remains medical therapy with oral progesterone and, possibly, long-term use of a levonorgestrel-releasing intrauterine system. If this fails, hysterectomy is advisable. As Cooper²⁰ aptly states, "Conservative, nonextirpative procedures offer no life raft" compared with hysterectomy, which covers many missed diagnoses.

No risk of spreading cancer cells

Some gynecologists have worried about the risk of disseminating endometrial cancer cells during hysteroscopy. However, Kudela and Pilka²¹ studied the true risk in women undergoing blind dilation and curettage and hysteroscopy performed with a fluid medium. Cul-de-sac aspiration prior to instrumentation and at the conclusion of the procedure demonstrated no increased risk of positive cytology. They are continuing a Phase II trial comparing outcomes of both groups over 5 years.

have been recorded with use of the neodymium: yttrium aluminum garnet (Nd:YAG) laser and during operative procedures. Less well known are the adverse sequelae that can occur with room air prior to beginning the

procedure. It is critical to purge the entire tubal system with CO₂ prior to instrumentation, since up to 40 cm³ of room air may be insufflated into a patient when 200 cm of connective tubing with a 0.5-cm lumen is used.¹⁰ CONTINUED

Wait for several minutes before starting the procedure so that the whole system is purged.

Advantages of CO₂ in diagnostic hysteroscopy. Although any number of gaseous solutions could be used during diagnostic hysteroscopy, CO₂ is the most ideal due to its solubility in blood, the rapidity with which it is dissolved, and the large quantities (1 L/min or more) that would be necessary to cause a fatality. (A hysteroinsufflator utilizing 100 mL/min or less is used for diagnostic hysteroscopes.) When Bradner et al¹¹ reviewed the incidence of severe nonfatal embolism in 3,932 diagnostic hysteroscopic procedures using CO₂, the risk of subclinical embolic events was 0.51%; 0.03% of patients experienced severe events. When special precautions were taken to deaerate the supply tubing and instruments, no events occurred in the next 1,000 cases. Thus, it is possible that ambient air trapped in tubing—rather than CO₂—could be the culprit in gas emboli.

6 most common symptoms of venous or air emboli. Anesthesiologists and gynecologists must be vigilant to prevent venous or air emboli. Munro et al¹² succinctly outline the 6 most common symptoms:

- pulmonary hypertension
- hypercarbia
- hypoxia
- arrhythmias
- tachypnea
- systemic hypotension

Morbidity and mortality can be prevented when these symptoms are quickly recognized and promptly treated.¹³

Beware of a drop in end-tidal CO₂. The most common sign of impending cardiovascular collapse is a sudden decrease in end-tidal CO₂, when the right cardiac outflow tract is obstructed by CO₂, which leads to arterial oxygen (O₂) desaturation. If such a decrease is suspected, stop the procedure immediately and administer 100% O₂. (Also stop nitrous oxide, if used.) Turn the patient to the left lateral decubitus position and use a central venous catheter

to aspirate gas, if necessary. Cardiac massage and a precordial thump may dislodge CO₂; unfortunately, high false-positive rates of precordial Doppler make its use impractical.

How to minimize risks

- Avoid coaxial gas cooling tips associated with Nd:YAG crystal lasers
- Avoid a steep Trendelenburg position
- Keep cervix covered with sponge or dilator when operative hysteroscope is removed to minimize air embolism
- Deaerate the equipment prior to surgery
- Use a low-pressure hysteroscopic CO₂ insufflator
- Carefully monitor the patient
- Be highly suspicious when vital signs are unstable

POSTOPERATIVE COMPLICATIONS

Some complications of hysteroscopy may not become clinically evident for months or even years. The most common complications of hysteroscopic endometrial ablation include pregnancy, postablation tubal sterilization syndrome, new or worsening dysmenorrhea, hematometra, endometrial cancer, and failure to completely treat symptoms.

Patients scheduled for hysteroscopy must be informed of potential delayed risks of the procedure. In addition, all reproductive-aged women should be advised that pregnancy is possible after endometrial ablation or operative removal of an intracavitary mass; thus, contraception is crucial. The endometrial tissue is resilient and may regenerate after ablation.

Hematometra: Avoid cervical canal

Hematometra is an infrequent late complication of operative hysteroscopy. If menstruating women or those taking hormone replacement therapy experience cyclic or chronic lower pelvic pain after surgery, scarring or narrowing of the endometrial cavity may be the cause. Approximately 1% to 2% of women who undergo operative hysteroscopy

experience this phenomenon. Most cases can be treated with cervical dilation alone.

Since the cervical canal contains no endometrial glands, there is no need to treat this area in women undergoing endometrial ablation. In fact, avoiding this area during treatment is a critical component of successful surgery.

Tubal sterilization syndrome possible after endometrial ablation

Consider this syndrome when a patient undergoing endometrial ablation complains of crampy, cyclic, unilateral or bilateral pelvic pain, possibly accompanied by vaginal spotting. Sometimes a unilateral mass can be palpated, but more commonly tenderness is elicited on pelvic examination.

Ultrasound may demonstrate fluid near the cornual region. Laparoscopy confirms the diagnosis by visualizing a swollen, edematous proximal fallopian tube. Salpingectomy may confirm hematosalpinx, chronic or acute inflammation, or hemosiderin deposits.

Treatment includes bilateral cornual resection and reablation of proximal endometrium, or hysterectomy.¹⁴

Pregnancy complications

Endometrial ablation is not to be regarded as a method of contraception. Patients needing birth control should consider concurrent tubal ligation or other reliable methods after this procedure.

The frequency of pregnancy after endometrial ablation ranges from 0.2% to 1.6%, though this data may represent underreporting. Pregnancy outcomes have been dismal in women conceiving after endometrial ablation. Complications include preterm labor, premature delivery, intrauterine growth retardation, prenatal death, postpartum hemorrhage, and placentation problems such as placenta accreta, increta, or percreta, as well as placental abruption.¹⁵

Uterine dehiscence and sacculation and extremely thin myometrium have been

reported after uterine adhesiolysis, uterine perforation during operative hysteroscopy, and with myoma resections. A high index of suspicion is vital when a gravida presents with pelvic pain, decreased fetal movement, vaginal bleeding, or abnormal uterine masses detected ultrasonographically.

Signs of uterine rupture. Pregnancy-related complications of operative hysteroscopy can be dramatic and fatal if not recognized quickly, as in the case of uterine rupture. Kerimis et al¹⁶ describe uterine rupture in a term pregnancy after hysteroscopic resection of a uterine septum. Severe fetal distress, maternal shoulder pain, and abdominal pain led to an emergency cesarean section. Intraoperative findings included a 7-cm tear from left cornua to right cornua. The original metroplasty, performed with cutting diathermy and laparoscopy, was not accompanied by complications or perforation.

Patients who experience intraoperative complications during metroplasty or deep resection of intramural fibroids should be informed of the risk of uterine rupture so they may consider elective cesarean. Regardless of the mode of delivery, prompt attention is vital if fetal distress is suspected.

Postablation warning signs

Patients undergoing endometrial ablation generally have a quick postoperative return to activity, minimal need for postoperative pain medication, and limited complaints. Beware of patients who make frequent postoperative phone calls and have escalating requirements for pain medication. While bowel and bladder injuries are infrequent—as is postoperative endometritis—these must be vigilantly considered and evaluated when patients complain of persistent pain, fever, and general malaise. Office evaluation is necessary, including thorough abdominal and pelvic examinations. Laboratory testing should include electrolytes, complete blood count, sedimentation rate, ultrasound, and a flat plate of the abdomen (kidneys,

■ Cutting the risk of hysteroscopic complications

ureter, and bladder; upright) may be required. Sometimes a computed tomography scan of the pelvis/abdomen may be needed if perforation with bowel or bladder injury is suspected.

Hysteroscopic fibroid removal may be necessary after UAE

Uterine artery embolization (UAE) is gaining popularity for the treatment of symptomatic uterine fibroids. Transcatheter embolization of the uterine artery leads to occlusion of the fibroid, ischemic shrinkage of the fibroid, and shrinkage of residual myometrial tissue. Fibroids may migrate weeks to months after the procedure as the myometrium contracts and the treated fibroid degenerates, leading to delayed discharge, passage of necrotic fibroids, cramps, and heavy bleeding if the fibroid migrates to a submucosal location. Hysteroscopic removal is an obvious option.

Recently, De Iaco et al¹⁷ reported the development of a uterine fistula and discontinuity of the myometrium after hysteroscopic resection of an embolized migrated fibroid. They speculated this was due to the development of an avascular myometrium after UAE. The patient was asymptomatic, but routine diagnostic hysteroscopy revealed a 2-cm discontinuity of the uterine wall at the site of the previous resectoscopic myomectomy. The myometrium was white and less than the full thickness.

Ultrasound guidance improves outcomes

Coccia et al¹⁸ described the benefits of intraoperative ultrasound guidance during operative hysteroscopy in fibroid treatment and uterine septum removal. Prospective evaluation of 81 patients involved an experienced ultrasonographer who mapped the limits of treatment. Patients were compared to 45 historical controls who had been similarly treated with laparoscopic monitoring. Satisfactory outcomes included relief of menorrhagia, complete resection of fibroids (including full resection of intramural fibroids), and thorough metroplasty of uterine septum.

Ultrasound guidance made it possible to extend the resection beyond the limit conventionally defined by hysteroscopy; none of the patients in the ultrasound group required reintervention. Among controls, a second operation was necessary in 4 cases. Investigators concluded that a wider resection (10 to 15 mm distance from the external surface of the uterus) of fibroids was achieved using ultrasound guidance. ■

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