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WOMEN'S HEALTH CARE PHYSICIANS



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## Committee on Gynecologic Practice

*This Committee Opinion was developed by the American College of Obstetricians and Gynecologists' Committee on Gynecologic Practice and the American Association of Gynecologic Laparoscopists (AAGL) Practice Guidelines Committee in collaboration with the American College of Obstetricians and Gynecologists member Linda C. Yang, MD, MSc and AAGL member Angela Chaudhari, MD.*

## The Use of Hysteroscopy for the Diagnosis and Treatment of Intrauterine Pathology

**ABSTRACT:** This Committee Opinion provides guidance on the current uses of hysteroscopy in the office and the operating room for the diagnosis and treatment of intrauterine pathology and the potential associated complications. General considerations for the use of diagnostic and operative hysteroscopy include managing distending media, timing for optimal visualization, and cervical preparations. In premenopausal women with regular menstrual cycles, the optimal timing for diagnostic hysteroscopy is during the follicular phase of the menstrual cycle after menstruation. Pregnancy should be reasonably excluded before performing hysteroscopy. There is insufficient evidence to recommend routine cervical ripening before diagnostic or operative hysteroscopy, but it may be considered for those patients at higher risk of cervical stenosis or increased pain with the surgical procedure. In randomized trials, patients reported a preference for office-based hysteroscopy, and office-based procedures are associated with higher patient satisfaction and faster recovery when compared with hospital-based operative hysteroscopy. Other potential benefits of office hysteroscopy include patient and physician convenience, avoidance of general anesthesia, less patient anxiety related to familiarity with the office setting, cost effectiveness, and more efficient use of the operating room for more complex hysteroscopic cases. Appropriate patient selection for office-based hysteroscopic procedures for women with known uterine pathology relies on thorough knowledge and understanding of the target pathology, size of the lesion, depth of penetration of the lesion, patient willingness to undergo an office-based procedure, physician skills and expertise, assessment of patient comorbidities, and availability of proper equipment and patient support. Both the American College of Obstetricians and Gynecologists (ACOG) and the American Association of Gynecologic Laparoscopists (AAGL) agree that vaginoscopy may be considered when performing office hysteroscopy because studies have shown that it can significantly reduce procedural pain with similar efficacy. The office hysteroscopy analgesia regimens commonly described in the literature include a single agent or a combination of multiple agents, including a topical anesthetic, a nonsteroidal antiinflammatory drug, acetaminophen, a benzodiazepine, an opiate, and an intracervical or paracervical block, or both. Based on the currently available evidence, there is no clinically significant difference in safety or effectiveness of these regimens for pain management when compared to each other or placebo. Patient safety and comfort must be prioritized when performing office hysteroscopic procedures. Patients have the right to expect the same level of patient safety as is present in the hospital or ambulatory surgery setting.

### Recommendations and Conclusions

The American College of Obstetricians and Gynecologists and the American Association of Gynecologic Laparoscopists (AAGL) make the following conclusions and recommendations regarding the use of hysteroscopy

for the diagnosis and treatment of intrauterine pathology:

- In premenopausal women with regular menstrual cycles, the optimal timing for diagnostic hysteroscopy is during the follicular phase of the menstrual

- cycle after menstruation. Pregnancy should be reasonably excluded before performing hysteroscopy.
- Some women with unpredictable menses can be scheduled at any time for operative hysteroscopy, but ideally patients who are actively bleeding may not undergo the procedure because adequate visualization could be impaired.
  - There is insufficient evidence to recommend routine cervical ripening before diagnostic or operative hysteroscopy, but it may be considered for those patients at higher risk of cervical stenosis or increased pain with the surgical procedure.
  - Intravaginal misoprostol administration of 400 micrograms has been shown to decrease pain during and after office hysteroscopy when administered at least 4 hours before the procedure, likely because of the decreased need for dilation. Data support that with the addition of 25 micrograms vaginal estrogen 14 days before the procedure, along with 400–1000 micrograms vaginal misoprostol 12 hours before the procedure, ease of cervical dilation and reduction in pain was substantial in postmenopausal patients.
  - Potential advantages of hysteroscopic tissue removal systems are shorter operative time and higher likelihood of complete lesion removal (endometrial polyp, type 0 or I leiomyoma) compared with conventional resectoscopy. Potential disadvantages of these systems include the cost of the disposable devices along with their associated fluid management systems; the lack of electrosurgical element in some of these types of devices, resulting in the inability to cauterize bleeding vessels; and limited data on the capability to treat type II leiomyomas.
  - In randomized trials, patients reported a preference for office-based hysteroscopy, and office-based procedures are associated with higher patient satisfaction and faster recovery. Other potential benefits of office hysteroscopy include patient and physician convenience, avoidance of general anesthesia, less patient anxiety related to familiarity with the office setting, cost effectiveness, and more efficient use of the operating room for more complex hysteroscopic cases.
  - Office hysteroscopy for the treatment of endometrial polyps should be considered whenever possible.
  - Appropriate patient selection for office-based hysteroscopic procedures for women with known uterine pathology relies on thorough knowledge and understanding of the target pathology, size of the lesion, depth of penetration of the lesion, patient willingness to undergo an office-based procedure, physician skills and expertise, assessment of patient comorbidities, and availability of proper equipment and patient support.
  - Vaginoscopy may be considered when performing office hysteroscopy because studies have shown that it can significantly reduce procedural pain with similar efficacy.

- The office hysteroscopy analgesia regimens commonly described in the literature include a single agent or a combination of multiple agents, including a topical anesthetic, a nonsteroidal antiinflammatory drug, acetaminophen, a benzodiazepine, an opiate, and an intracervical or paracervical block, or both. Based on the currently available evidence, there is no clinically significant difference in safety or effectiveness of these regimens for pain management when compared to each other or placebo.
- Antibiotic prophylaxis is not recommended for routine hysteroscopic procedures.
- Complications from fluid overload may be minimized with careful perioperative planning, use of a fluid management system, and evaluation of the intracavitary lesions to be removed.

This Committee Opinion provides guidance on the current uses of hysteroscopy in the office and the operating room for the diagnosis and treatment of intrauterine pathology and the potential associated complications.

## General Considerations for the Use of Hysteroscopy

General considerations for the use of diagnostic and operative hysteroscopy include managing distending media, timing for optimal visualization, and cervical preparations. Obstetrician–gynecologists should be familiar with these principles.

### Distending Media

The uterus requires distention for adequate visualization of the cavity during hysteroscopy. Historically, carbon dioxide gas and high-viscosity fluid media such as dextran were used. See Table 1 for information on the potential advantages, disadvantages, and complications of currently used hysteroscopic distending media, as well as guidance on maximum fluid deficit. For additional details, see *AAGL Practice Report: Practice Guidelines for the Management of Hysteroscopic Distending Media* (1).

### Optimization of Visualization

In premenopausal women with regular menstrual cycles, the optimal timing for diagnostic hysteroscopy is during the follicular phase of the menstrual cycle after menstruation. Pregnancy should be reasonably excluded before performing hysteroscopy. Hysteroscopy during the secretory phase of the cycle may make diagnosis more difficult because a thickened endometrium may mimic polyps. Some women with unpredictable menses can be scheduled at any time for operative hysteroscopy, but ideally patients who are actively bleeding may not undergo the procedure because adequate visualization could be impaired. Pretreatment with progestins or combined oral contraceptives may improve visualization by thinning the endometrium (2–4). Data support that

**Table 1.** Hysteroscopic Distending Media

Type	Maximum Fluid Deficit	Advantages	Disadvantages and Safety Precautions*	Complications
Low-Viscosity Fluid Media: Electrolyte-Poor Fluid (eg, glycine, 1.5%; sorbitol, 3%; and mannitol, 5%)	1,000 mL	Compatible with radiofrequency energy  Monopolar devices require electrolyte-poor fluids	Excessive absorption of these fluids can cause hyponatremia, hyperammonemia, and decreased serum osmolality with the potential for seizures, cerebral edema, and death.	Excessive absorption of these fluids can lead to hyponatremia, hyperammonemia, and decreased serum osmolality, with the potential for seizures, cerebral edema, and death.
Low-Viscosity Fluid Media: Electrolyte-Containing Fluid (eg, normal saline, sodium lactated solution)	Maximum fluid deficits with isotonic solutions are based only on expert opinion but consensus would be approximately 2,500 mL.	Readily available  Isotonic  Media of choice during diagnostic hysteroscopy and in operative cases where mechanical, laser, or bipolar energy is used	Although the risk of hyponatremia and decreased serum osmolality can be reduced by using these media, pulmonary edema and congestive heart failure can still occur. Careful attention should be paid to fluid input and output, with particular attention to the fluid deficit.	Fluid overload causing pulmonary edema and congestive heart failure

\*Careful attention should be paid to fluid input and output, with particular attention to the fluid deficit, particularly in elderly patients and patients with cardiopulmonary or renal compromise, in whom lower fluid thresholds should be considered.

Data from Munro MG, Storz K, Abbott JA, Falcone T, Jacobs VR, Muzii L, et al. AAGL practice report: practice guidelines for the management of hysteroscopic distending media: (replaces hysteroscopic fluid monitoring guidelines. *J Am Assoc Gynecol Laparosc.* 2000;7:167–8). AAGL Advancing Minimally Invasive Gynecology Worldwide. *J Minim Invasive Gynecol* 2013;20:137–48.

pretreatment with combination oral contraceptives may improve visualization at the time of polypectomy and increase surgical satisfaction compared with timed procedures, even with short courses of therapy (3). Although pretreatment with gonadotropin-releasing hormone (GnRH) agonists also thins the endometrium and may reduce blood loss and improve visualization with submucous myomectomy, they are not routinely recommended because of adverse effects; however, in patients with severe anemia, they are beneficial for surgical preparation and optimizing hemoglobin levels before surgery (5).

### Preoperative Ripening of the Cervix

There is insufficient evidence to recommend routine cervical ripening before diagnostic or operative hysteroscopy, but it may be considered for those patients at higher risk of cervical stenosis or increased pain with the surgical procedure. The potential benefits should be weighed against the increased risk of adverse effects of the medication (6). Options for cervical preparation methods include sublingual, oral, or vaginal prostaglandin, such as misoprostol; and vaginal osmotic dilators, such as laminaria. A 2015 systematic review concluded that use of misoprostol for preoperative ripening is more effective than placebo or no treatment and is associated with fewer intraoperative complications; however, it is

associated with a higher rate of adverse effects, including mild abdominal pain, increased body temperature, and vaginal bleeding (7). In women undergoing diagnostic hysteroscopy in the operating room or the office setting, misoprostol has been studied at various dosages, most frequently 200–400 micrograms orally or vaginally, and has demonstrated a decrease in procedural times, improved ease of cervical entry, and decreased pain scores (8, 9). Intravaginal misoprostol administration of 400 micrograms has been shown to decrease pain during and after office hysteroscopy when administered at least 4 hours before the procedure, likely because of the decreased need for dilation (10). Data support that with the addition of 25 micrograms vaginal estrogen 14 days before the procedure, along with 400–1000 micrograms vaginal misoprostol 12 hours before the procedure, ease of cervical dilation and reduction in pain was substantial in postmenopausal patients (11, 12). In women undergoing operative hysteroscopy, misoprostol administration at various dosages and by different routes has been shown to decrease the need for mechanical dilation over placebo (7, 13). A comparison of osmotic dilators versus misoprostol demonstrated a decreased need for mechanical dilation with a similar side effect profile for osmotic dilators; however, an additional office visit for osmotic dilator placement before hysteroscopy may make this a less desirable choice for patients and health

care providers (6, 14). Also, if the patient does not undergo surgery for any reason, the dilator will need to be removed.

Some clinicians may consider adding a vasoconstricting agent, such as vasopressin or epinephrine, to the local anesthetic to aid with cervical dilation. Potential benefits of vasoconstrictor use include reduction in procedural blood loss and fluid absorption, increase in the duration and potency of anesthesia, and decrease in systemic absorption and toxicity of the local anesthetic (15). An additional cited advantage of intracervical dilute vasopressin is reduction in the force required for mechanical cervical dilation, although there is variability in dosage in practice. For example, a randomized, double-blind study of 52 women used 20 mL of a dilute solution (4 units of 0.05 units/mL of vasopressin in 80 mL of normal saline) (16). Cautious administration of these agents is recommended, especially in the office setting, given the possibility of rare but serious cardiovascular events including bradycardia, hypotension or hypertension, and cardiac arrest (17, 18).

## Operative Hysteroscopy

Obstetrician–gynecologists use operative hysteroscopy to treat intrauterine pathology such as endometrial polyps, uterine leiomyomas, uterine septa, retained products of pregnancy, and adhesions. Additional uses of operative hysteroscopy include the removal of foreign bodies such as malpositioned intrauterine devices, tubal cannulation, treatment of isthmoceles, and directed biopsy.

## Hysteroscopic Polypectomy and Myomectomy

Indications for polyp removal include abnormal uterine bleeding, infertility, and recurrent pregnancy loss. Management of endometrial polyps consists of expectant management or surgical management, depending on patient symptoms and risk factors for malignancy within the endometrial polyp (19). Surgical resection techniques that can be used involve blind polyp removal or curettage; direct visualization and removal using hysteroscopic scissors and grasping forceps, monopolar or bipolar resectoscopes; or hysteroscopic mechanical tissue removal devices. For polypectomy, direct hysteroscopic removal is preferred over blind procedures, which are associated with inaccurate detection and ineffective removal of intrauterine lesions (20, 21).

Hysteroscopic myomectomy is widely used for the treatment of abnormal uterine bleeding in the setting of submucosal uterine leiomyoma. Other specific indications for hysteroscopic removal of submucosal leiomyoma include recurrent pregnancy loss and infertility. The reported complication rate for hysteroscopic myomectomy ranges between 1% and 12%, with rates of 1–5% reported in most studies (22). The success of hysteroscopic myomectomy is dependent on the type of submucosal leiomyoma (eg, the degree of myometrial penetration).

The use of dilute vasopressin solution during hysteroscopic myomectomy has been shown to decrease intraoperative blood loss and distention fluid absorption significantly in two randomized trials (16, 23). The benefit of GnRH agonists as an adjunct before routine hysteroscopic myomectomy is unclear. More high-quality data are needed to support the use of preoperative GnRH agonists to reduce operative time, distending fluid absorption, and the need for repeat surgery.

Proper patient counseling regarding surgical outcomes and the ability to perform a single versus staged procedure is based upon leiomyoma characteristics. A two-step procedure may be required for patients with multiple, large, deep, or opposing leiomyomas to achieve complete surgical resection, minimize intrauterine adhesion formation, or both (24, 25). A small observational study noted 70.2%, 54.8%, and 44.2% of patients were surgery-free at 1, 2, and 3 years respectively after incomplete hysteroscopic myomectomy for type II leiomyomas. Mean age of this patient population was 42.5 years and the majority of these cases were terminated because of fluid absorption (26).

Hysteroscopic resection of endometrial polyps and submucosal leiomyomas can be performed using either monopolar or bipolar wire loop electrodes. Although the use of a monopolar resectoscope requires an electrolyte-free distending medium (eg, 1.5% glycine or 3% sorbitol), bipolar resectoscopes can be used with electrolyte-containing distending medium (eg, normal saline). Another less commonly used hysteroscopic surgical technique is electrosurgical vaporization, which uses a large surface-area vaporization electrode set at higher power density settings (eg, 120–220 watts) compared with the power density used for conventional wire loop electrodes. Vaporization devices allow for destruction of targeted lesions without the creation of tissue fragments, thereby eliminating the need for tissue removal; however, this also prohibits histologic evaluation of tissue, which may be necessary in some clinical scenarios. See Box 1 for additional types of intrauterine pathology that may be diagnosed and treated with hysteroscopy.

## Hysteroscopic Treatment of Intrauterine Pathology

Traditionally, targeted removal of intrauterine pathology using a monopolar or bipolar wire loop resectoscope required transcervical specimen removal of tissue fragments, often involving repetitive introduction of surgical instruments with potential for increased trauma to the cervix and uterus. Newer hysteroscopic tissue removal systems have emerged, allowing for the removal of lesions by simultaneous tissue resection and specimen extraction. Potential advantages of hysteroscopic tissue removal systems are shorter operative time and higher likelihood of complete lesion removal (endometrial polyp, type 0 or I leiomyoma) compared with conventional resectoscopy (27–29). Potential disadvantages of

### Box 1. Situations When Hysteroscopy May Be Used\*†

- Removal of foreign bodies (eg, intrauterine devices with nonvisualized strings or intrauterine devices that are malpositioned)
- Diagnosis and treatment of intrauterine adhesions
- Correction of septate uteri
- Detection of malignancy
- Management of cesarean scar pregnancy
- Management of retained products of pregnancy or focal accreta
- Detection and treatment of isthmocele
- Tubal cannulation

\*Excluding Endometrial Polyps and Leiomyoma

†Less common conditions managed by hysteroscope may require referral to a high-volume clinician or clinician with expertise in hysteroscopy.

these systems include the cost of the disposable devices along with their associated fluid management systems; the lack of electrosurgical element in some of these types of devices, resulting in the inability to cauterize bleeding vessels; and limited data on the capability to treat type II leiomyomas (30). Additionally, type II leiomyomas may be more difficult to remove with these devices, compared to the loop resectoscope that could dissect the myoma from surrounding myometrium. Blind removal is not indicated where instrumentation for guided removal is available (21).

### Special Considerations for Office Hysteroscopy

Many diagnostic hysteroscopy and operative hysteroscopy procedures are being shifted from the operating room to an office-based setting. In randomized trials, patients reported a preference for office-based hysteroscopy and office-based procedures are associated with higher patient satisfaction and faster recovery when compared with hospital-based operative hysteroscopy (31, 32). Other potential benefits of office hysteroscopy include patient and physician convenience, avoidance of general anesthesia, less patient anxiety related to familiarity with the office setting, cost effectiveness, and more efficient use of the operating room for more complex hysteroscopic cases.

If the technology is available, office hysteroscopy for the treatment of endometrial polyps should be considered. Office hysteroscopic polypectomy has been shown to be safe, well tolerated, and more cost-effective compared with traditional inpatient hysteroscopic polypectomy (33). In a multicenter randomized trial, outpa-

tient polypectomy was found to be noninferior to inpatient polypectomy for the treatment of abnormal uterine bleeding, with similar treatment effects maintained at 12 months and 24 months (34). Both a multicenter, randomized, controlled, noninferiority study and a multicenter, prospective observational trial found that office hysteroscopic polypectomy may be associated with a higher risk of failed or incomplete polyp removal (34, 35). Conversely, inpatient hysteroscopic polypectomy may be associated with greater risk of complications (34, 35).

### Patient Counseling and Selection

The use of office hysteroscopy has been well established for the diagnostic evaluation of abnormal uterine bleeding (36). Appropriate patient selection for office-based hysteroscopic procedures for women with known uterine pathology relies on thorough knowledge and understanding of the target pathology, size of the lesion, depth of penetration of the lesion, patient willingness to undergo an office-based procedure, physician skills and expertise, assessment of patient comorbidities, and availability of proper equipment and patient support. For example, patients with medical conditions, such as sleep apnea or cardiopulmonary disease, may not be appropriate candidates for office-based intravenous sedation without the presence of an anesthesia care team. Consideration for performing hysteroscopy in an alternative setting, such as the operating room or ambulatory surgery center, should be made for patients who have anxiety or have previously failed or not tolerated the office-based procedure.

### Vaginoscopic Approach to Hysteroscopy

Vaginoscopy is a surgical technique involving the insertion of a hysteroscope to visualize the vagina, cervix, uterine cavity, or all of these structures, without the use of a vaginal speculum or cervical tenaculum. Small-diameter rigid or flexible hysteroscopes can be used as vaginoscopic instrumentation. A vaginoscopic technique involves gentle introduction of the hysteroscope into the vagina and use of distending medium, such as normal saline, to expand the vaginal canal. The vaginoscopic approach has been shown to reduce procedural pain substantially compared with traditional hysteroscopy. Furthermore, no significant difference was found in the number of failed procedures when comparing vaginoscopic technique with traditional hysteroscopy (37–40). Both ACOG and AAGL agree that vaginoscopy may be considered when performing office hysteroscopy because studies have shown that it can significantly reduce procedural pain with similar efficacy (41).

Minimizing fluid leakage from the vagina can be accomplished by manual compression of the labial tissue to narrow the vaginal introitus. The hysteroscope is directed toward the posterior vaginal fornix and the

external cervical os is identified. Guidance of the hysteroscope into the endocervical canal and subsequently into the uterine cavity is facilitated by knowledge of the uterine position and correction of antelexion or retroflexion, if necessary. Techniques to bring the uterus into axial position include applying direct pressure above the pubic symphysis or full bladder distention to reduce uterine antelexion, and placing anterior pressure digitally through the rectum to decrease uterine retroflexion (42).

## Pain Management

The office hysteroscopy analgesia regimens commonly described in the literature include a single agent or a combination of multiple agents, including a topical anesthetic, a nonsteroidal antiinflammatory drug, acetaminophen, a benzodiazepine, an opiate, and an intra-cervical or paracervical block, or both. On the basis of the currently available evidence, there is no clinically significant difference in safety or effectiveness of these regimens for pain management when compared with each other or placebo (43). Paracervical blocks have been shown to decrease pain at the time of tenaculum placement and passage of the hysteroscope through the external and internal os (44). Other evidence has shown that office hysteroscopy may be tolerated without the use of any analgesia, although preexisting pain conditions such as dysmenorrhea or chronic pelvic pain may warrant its use (45). No single regimen or group of medications has been shown to be clinically superior to placebo.

## Office Preparation

Patient safety and comfort must be prioritized when performing office hysteroscopic procedures. Patients have the right to expect the same level of patient safety as is present in the hospital or ambulatory surgery setting (46). See ACOG's *Report of the Presidential Task Force on Patient Safety in the Office Setting* for more information on effective communication, staff competency, medication error avoidance, accurate patient tracking mechanisms, anesthesia safety, and general procedural safety (46). The use of procedure checklists, logs, and mock drills can promote consistent behavior and documentation to allow for quality review.

Office hysteroscopy should be performed in an appropriately sized, equipped, and staffed treatment room. Basic set-up requirements for in-office hysteroscopy include hysteroscopic instrumentation, camera and monitor, delivery system for distending media, and facilities to clean, disinfect, and sterilize equipment. There is insufficient evidence to recommend preferential use of a specific type of hysteroscope, and the choice of hysteroscopy should be left to the discretion of the operator (41).

Cleaning of reusable hysteroscopic devices is necessary before disinfection or sterilization. Protocols for disinfection and sterilization of equipment may vary depending on the type of equipment used and should

adhere to manufacturer's guidelines and comply with institutional, state, and federal regulations.

## Prevention and Management of Complications

The two largest multicenter studies of 13,600 diagnostic and operative hysteroscopies and 21,676 operative hysteroscopies found overall complication rates of 0.28% and 0.22% respectively (47, 48). Significantly more complications occurred during operative hysteroscopy than during diagnostic hysteroscopy (0.95% versus 0.13%;  $P < .01$ ). See Table 2 for potential complications, incidence, and risk factors.

### Perforation

The most common perioperative complication of hysteroscopic surgery is uterine perforation (48, 49). Known risk factors for uterine perforation are listed in Table 2. Management of uterine perforation is dependent on the location, cause, and severity of the uterine perforation. Each step of hysteroscopy, including mechanical cervical dilation, uterine sounding, hysteroscope insertion, or the use of electrosurgery or tissue removal device, may result in compromise of the uterine myometrium. Although data on the incidence of false passage creation during hysteroscopy are lacking, this complication may occur in cases of difficult uterine entry, which may increase the risk of uterine perforation. In a systematic review, the use of preoperative misoprostol reduced rates of false passage formation but did not reduce rates of uterine perforation during operative hysteroscopy (7). Major bleeding, suspicion of visceral injury, or perforation by an electrosurgical electrode may warrant immediate surgical intervention.

### Infection

Antibiotic prophylaxis is not recommended for routine hysteroscopic procedures. Hysteroscopy is contraindicated during an active pelvic infection (50) and in women with prodromal or active herpes infection. Infectious complications related to hysteroscopic procedures are uncommon with rates of postprocedure infection (eg, endometritis or endomyometritis, urinary tract infections) ranging from 0.01% to 1.42% (48, 51). In a prospective observational study of 1,952 operative hysteroscopies, the risk of endometritis was found to be higher after adhesiolysis compared with leiomyoma (Relative Risk [RR], 5.89; CI, 1.68–20.69,  $P = .0066$ ) or polyp resection (RR, 6.36; CI, 1.3–31.24,  $P = .0154$ ) (52). In randomized trials, the administration of antibiotic prophylaxis has not been shown to reduce postoperative infection after diagnostic hysteroscopy (53–55) or operative hysteroscopy (55).

### Electrosurgical Injury

Serious injury by electrosurgical electrodes can occur during operative hysteroscopic procedures, typically in

**Table 2.** Potential Complications, Incidence, and Risk Factors of Hysteroscopy

Potential Complication	Incidence	Risk Factors
Perforation	0.12% to 1.61%*†‡	Blind insertion of instruments, cervical stenosis, anatomic distortion (eg, leiomyomas and congenital anomalies, intrauterine adhesions, myometrial thinning, and uterine malposition [extreme anteversion or retroversion])
Air and gas embolism (clinically significant)	0.03% to 0.09% <sup>§  </sup>	Repetitive instrumentation through cervix, inadequate purging of air from tubing and instruments, excessive intrauterine pressure
Fluid overload	0.20% <sup>‡</sup>	Excessive absorption of any distending fluid, resection of large or deep lesions and high intrauterine pressure; increased risk of hyponatremia with use of electrolyte-free distending media, and cerebral edema with hypotonic distending media.
Hemorrhage	0.03% to 0.61%*†¶	Cervical laceration, uterine perforation, adhesiolysis, resection of cavitory lesions
Vasovagal reaction	0.21% to 1.85% <sup>#</sup>	Triggering of parasympathetic nervous system during manipulation of the cervix and instrumentation of the cervical canal or uterine cavity

\*Aydeniz B, Gruber IV, Schauf B, Kurek R, Meyer A, Wallwiener D. A multicenter survey of complications associated with 21,676 operative hysteroscopies. *Eur J Obstet Gynecol Reprod Biol* 2002;104:160–4.

†Jansen FW, Vredevoogd CB, van Ulzen K, Hermans J, Trimbos JB, Trimbos-Kemper TC. Complications of hysteroscopy: a prospective, multicenter study. *Obstet Gynecol* 2000;96:266–70.

‡Agostini A, Cravello L, Bretelle F, Shojai R, Roger V, Blanc B. Risk of uterine perforation during hysteroscopic surgery. *J Am Assoc Gynecol Laparosc* 2002;9:264–7.

§Brandner P, Neis KJ, Ehmer C. The etiology, frequency, and prevention of gas embolism during CO<sub>2</sub> hysteroscopy. *J Am Assoc Gynecol Laparosc* 1999;6:421–8.

||Vilos GA, Hutson JR, Singh IS, Giannakopoulos F, Rafea BA, Vilos AG. Venous gas embolism during hysteroscopic endometrial ablation: report of 5 cases and review of the literature [published online May 14, 2019]. *J Minim Invasive Gynecol*. DOI: 10.1016/j.jmig.2019.05.003.

¶Agostini A, Cravello L, Desbriere R, Maisonneuve AS, Roger V, Blanc B. Hemorrhage risk during operative hysteroscopy. *Acta Obstet Gynecol Scand* 2002;81:878–81.

#Agostini A, Bretelle F, Ronda I, Roger V, Cravello L, Blanc B. Risk of vasovagal syndrome during outpatient hysteroscopy. *J Am Assoc Gynecol Laparosc* 2004;11:245–7.

the setting of uterine perforation. Exploratory surgery may be indicated if clinically significant bleeding arises or if there is suspicion of thermal damage to visceral structures. Lower genital tract structures (eg, vagina or perineum) also may be at risk for thermal injury. Potential risk factors include cervical overdilation, instrument insulation defect, or electrode activation when the external sheath is not sufficiently advanced in the cervical canal (56).

### Fluid Overload

See Box 2 for guidelines for fluid monitoring. Excessive absorption of distending fluid can result in severe complications, including pulmonary edema, neurologic complications, and death. Use of electrolyte-free, hypotonic distending media is associated with a greater risk of hypotonic hyponatremia and cerebral edema. Complications from fluid overload may be minimized with careful perioperative planning, use of a fluid management system, and evaluation of the intracavitary lesions to be removed. Fluid deficit is affected by size and number of the lesions removed, the depth of myometrial resection, the number of myometrial sinuses opened, and the intrauterine pressure. Preventive measures include limiting excess fluid absorption, recognizing and treating fluid overload promptly, and selecting a distending medium

that minimizes risk. Vasopressin injection in the cervical stroma may reduce the volume of fluid intravasation (16). The best way to limit excess fluid intravasation is to monitor the fluid deficit closely and frequently throughout the procedure. Management of fluid overload includes termination of procedure; assessment of hemodynamic, neurologic, respiratory and cardiovascular status; measurement of serum electrolytes and osmolality; and consideration of diuretic administration. Newer fluid management systems have made fluid monitoring more accurate; however, some of these systems may be expensive and not readily available in all settings.

### Air and Gas Embolism

Air or gas embolism may result from the introduction of CO<sub>2</sub> as a hysteroscopic distending medium, room air during instrumentation of the cervix or uterus, gaseous byproducts created during monopolar or bipolar electro-surgery, or initial placement of patient in Trendelenburg position (57). The chemical properties of gases affect the risk of embolism. The solubility of CO<sub>2</sub> in blood is higher than oxygen; therefore, the risk of an air embolism derived from room air (containing oxygen and nitrogen) is greater than the risk of a carbon dioxide gas embolism (58). Severe complications of air or gas embolism include cardiac or pulmonary failure or death. The most

## Box 2. Guidelines for Fluid Monitoring and the Limits of Fluid Excess

1. Intravenous hydration of patients undergoing hysteroscopy should be closely monitored preoperatively and intraoperatively. Hysteroscopic fluid absorption should be closely monitored intraoperatively.
2. Lower fluid deficit thresholds should be considered for elderly patients, patients with comorbid conditions, patients with cardiovascular or renal compromise, and when procedures take place in an outpatient setting with limited acute care and laboratory services.
3. In healthy patients, the maximum fluid deficit is 1,000 mL for hypotonic solutions, 2,500 mL for isotonic solutions, and 500 mL for high-viscosity solutions. However, if fluid deficit reaches 750 mL of a hypotonic solution, 2,000 mL of an electrolyte solution, or 300 mL of a high-viscosity solution, consideration should be given to stopping further infusion and concluding the procedure. Ideally include the anesthesia personnel in this discussion, if applicable.
4. In an outpatient setting with limited acute care and laboratory services, consideration should be given to discontinuing procedures at a lower fluid deficit threshold.
5. An automated fluid monitoring system facilitates early recognition of excessive deficit in real-time totals.
6. An individual should be designated to measure intake and outflow frequently and report the deficit to the operative team.
7. If maximum fluid deficit occurs, especially with hypotonic solutions, evaluation of the patient's hemodynamic, neurologic, respiratory, and cardiovascular status is necessary along with assessment of signs and symptoms of fluid overload. Measurement of serum electrolytes and osmolality should be performed, administration of diuretics considered, and further diagnostic and therapeutic intervention begun as indicated. The use of intravenous furosemide may aid in diuresis, with clinical improvement occurring in 15–20 minutes. Further treatment of fluid overload or hyponatremia may require administration of corrective fluids, consultation with medical specialists, and transfer to a critical care setting.

Data from Munro MG, Storz K, Abbott JA, Falcone T, Jacobs VR, Muzii L, et al. AAGL practice report: practice guidelines for the management of hysteroscopic distending media: (replaces hysteroscopic fluid monitoring guidelines. *J Am Assoc Gynecol Laparosc.* 2000;7:167–168.) AAGL Advancing Minimally Invasive Gynecology Worldwide. *J Minim Invasive Gynecol* 2013;20:137–48.

common symptoms of air or gas embolism are described as dyspnea and chest pain, although in the anesthetized patient a decrease in end-tidal carbon dioxide pressure or alteration in hemodynamic status (hypotension, tachycardia) should raise clinical suspicion of an embolism

event. A churning or splashing auscultatory sound (a “mill-wheel” murmur) is a classic physical examination finding, although it may not be detected in all cases. Although the reported incidences of emboli have been variable in the literature, the rate of clinically significant gas embolism is low (59, 60).

Risk reduction strategies for the prevention of air or gas embolism include purging air from hysteroscopic tubing and instruments; minimizing repetitive insertion of instruments through the cervix, which may introduce air into the uterus in a “piston-like” manner; removing intrauterine gas bubbles; and limiting intrauterine pressure. Acute management of air and gas embolism consists of both supportive care and active measures, including prompt termination of procedure, deflation of the uterine cavity, and the elimination of sources of fluid and gas. Durant's maneuver, described as placement of the patient in the left lateral decubitus and Trendelenburg position, can be performed to promote migration of air or gas toward the right ventricle to reduce obstruction at the right ventricular outflow tract (58).

### Hemorrhage

For the management of hemorrhage, various intraoperative hemostasis measures can be employed, depending on the severity, nature, and location of bleeding; however, insufficient data exist regarding the effectiveness of these techniques. Examples include electrocautery applied to the source of bleeding, use of an intrauterine balloon (Foley catheter), uterine artery embolization, injection of vasopressin or epinephrine, tranexamic acid, and hysterectomy.

### Vasovagal Reaction

Upon recognition of vasovagal signs (hypotension, bradycardia) or symptoms (nausea, vomiting, diaphoresis, pallor, or loss of consciousness), the procedure should be stopped and patient assessment and supportive care should be undertaken (vital signs including pulse and blood pressure and “ABCs”—airway, breathing, and circulation). The majority of vasovagal reactions resolve with supportive measures such as raising the patient's legs or placement in the Trendelenburg position. If symptoms or bradycardia persist, atropine may be administered as a single dosage of 0.5 mg intravenously every 3 to 5 minutes, not to exceed a total of 3 mg (61).

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