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Clinical Obstetrics & Gynecology Continuing Education and Review

Optimizing Operative Hysteroscopy in the Office Setting: Updated Techniques and Technology

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Learning Objectives: After participating in this continuing professional development activity, the provider should be better able to:

1. *Identify patients for operative hysteroscopy.*
2. *Outline strategies to prepare patients and optimize operative hysteroscopy in the ambulatory setting.*
3. *Differentiate available systems used for operative hysteroscopy and those that may soon be approved for use.*
4. *Describe complications that can occur with operative hysteroscopy.*

Key Words: Hysteroscopy, Office-based hysteroscopy

Hysteroscopy is the gold standard for diagnosing and treating intrauterine pathology.[1] Compared with other diagnostic modalities such as transvaginal ultrasound or saline sonohysterography, hysteroscopy has increased sensitivity and specificity for the evaluation of endometrial pathology.[1] Advances in hysteroscopy over the past few decades have been targeted at more effective and precise evaluation and treatment of intracavitary pathology. Given these advances in the field, operative hysteroscopy in the outpatient setting has become safer and more feasible for both patients and providers. In this article, we focus on identifying appropriate patients for operative hysteroscopy and discuss strategies for preparation to optimize the procedure. We also review available operative hysteroscopic technology with a focus on use in the outpatient setting and describe potential complications of this surgical procedure.

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Brief History of Hysteroscopy

The field of hysteroscopy was born in 1869 when Pantaleoni repurposed a rigid cystoscope to diagnose and treat an endometrial polyp in a postmenopausal patient. Later, the introduction of cavity distention with carbon dioxide gas improved visualization of the operative field but was ineffective when blood was present in the field. Dextran, a viscous hypertonic solution, provided excellent visualization but carried increased risk of fluid overload and potential anaphylaxis.[2] Electrolyte-free media such as sorbitol, glycine, or mannitol provided excellent visualization and allowed for

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the use of monopolar energy, given nonconduction of electricity.[2] Given the risk of hypoosmolality or hyponatremia with these media, the upper limit of fluid deficit should be no more than 1000 mL. As alternatives to monopolar energy for resection have become widely available, use of these distending media has declined.

Isotonic solution, most commonly normal saline, has largely replaced other options for distention medium in today's hysteroscopy. Normal saline can be used with mechanical, bipolar energy or laser systems during operative hysteroscopy. It carries less risk of hyponatremia and risk of cerebral edema, and, as such, a fluid deficit of up to 2500 mL for this solution is acceptable for an otherwise healthy patient. To aid in visualization with isotonic solutions, many current hysteroscopes contain both inflow and outflow tracts, which can be used to optimize cavity distention and clearing of blood products.[2]

The first operative hysteroscopy was performed using grasping forceps and scissors introduced through operative ports.[3] As hysteroscopy continued to evolve, the introduction of electrosurgical devices brought about more precise resection of endometrial masses. The resectoscope first revolutionized hysteroscopic resection, allowing both cutting and coagulation of tissue with loop electrodes and wire snares. The resectoscope provided maneuvers for removing tissue burden and maintaining optimal visualization, given its ability to be removed and reintroduced through the hysteroscopic sheath without altering cervical dilation.[3] Although bipolar devices are less hazardous given less thermal spread when compared with monopolar counterparts, visualization can be compromised due to more gas bubbles.

Another significant innovation in operative hysteroscopy came with the development of mechanical hysteroscopic morcellator tissue removal (mHTR) systems. Tissue removal with prior techniques required removal of the hysteroscope. The mechanical morcellator was the first to make use of a vacuum source and offer simultaneous resection and tissue removal in a saline-based medium. It also offered the benefit of no thermal or lateral energy spread, given the lack of electrocoagulation. New developments have likewise been focused on availability of smaller diameters of both the morcellator systems and hysteroscopes for outpatient use.[4]

Patient Selection for Operative Hysteroscopy

Indications

Hysteroscopy is a mainstay of diagnosing and treating structural causes of abnormal uterine bleeding such as intracavitary polyps and submucosal fibroids. This tool is also valuable for targeted biopsy of intracavitary lesions to rule out premalignant and malignant lesions. Additional common indications include removal of foreign bodies, diagnosis and treatment of intrauterine adhesions, and management of uterine septa. Other more complex uses include management of cesarean section scar pregnancy, tubal canalization, and surgical resection of retained products of focal placenta accreta.[4]

Contraindications

There are few contraindications to hysteroscopy. These include a viable pregnancy, active pelvic infection, and prodromal or active herpes infection. Medical comorbidities such as significant cardiac or renal disease should be taken into consideration

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Table 1. Indications and Contraindications for Operative Hysteroscopy

Indications	Contraindications
Abnormal uterine bleeding	Viable pregnancy
Removal of IUDs or foreign bodies	Active pelvic infection
Diagnosis of malignancy	Prodromal or active herpes infection
Infertility	
Retained products of conception	
Endometrial polypectomy	
Removal of submucosal leiomyomas	
Treatment of intrauterine adhesions	
Abnormal endometrial thickness	
Mullerian anomalies	
Cesarean scar pregnancies	
Postmenopausal bleeding	

IUD, intrauterine device.

due to the potential risks of fluid overload associated with the procedure.[4] Table 1 provides a comprehensive list of both indications for and contraindications to operative hysteroscopy.

Preoperative Considerations

The success of hysteroscopy lies largely in careful preoperative planning. Patient evaluation to identify any potential risks or contraindications is essential, as is a diagnostic workup, which may include transvaginal ultrasound, saline sonohysterogram, hysterosalpingography, or endometrial biopsies, depending on the clinical scenario.

Antibiotic Prophylaxis

Routine prophylaxis for diagnostic or operative hysteroscopy is not recommended.[4] A randomized controlled trial by Nappi et al[5] has confirmed this specifically for office operative hysteroscopy, with no difference between treatment and placebo with regard to the rate of postsurgical infection.

Cervical Preparation

Given that the most common complication of hysteroscopy is uterine perforation,[6] many studies have examined the role of mechanical dilators and cervical ripening agents before hysteroscopic procedures with conflicting results.

A systematic review from 2015 examined cervical preparation before hysteroscopy. Misoprostol administration before the procedure decreased the need for cervical dilation as well as decreased the rate of cervical laceration or false track formation, but it did not decrease the rate of uterine perforation. However, several side effects such as abdominal pain, vaginal bleeding, and diarrhea were increased with misoprostol pretreatment. Misoprostol was found to be superior to dinoprostone in increasing cervical dilation. Laminaria may be more effective at cervical dilation than misoprostol but require placement and retention for 1 to 2 days before the procedure.[7]

Vaginal delivery of misoprostol has been found to be more effective than oral delivery and may potentially have fewer side effects.[8,9] Side effects also appear to be dose dependent. A recent randomized controlled trial looked at dosage effects of vaginal misoprostol, at a dose of 200 μμg compared with 800 μg administered 12 hours before operative hysteroscopy, and adverse effects were more common in the 800-μg group.[10]

For postmenopausal patients, a 14-day pretreatment of vaginal estradiol combined with 1000 μg of vaginal misoprostol 12 hours before hysteroscopy provided a benefit when compared with placebo.[11] A systematic review by Cooper et al[12] further examined the perceived benefit of prostaglandins alone in postmenopausal patients and found that the marginal benefits were restricted to use of larger-diameter hysteroscope systems such as those more than 5 mm.

Endometrial Preparation

Endometrial thickness affects visualization of the endometrial cavity and intracavitary pathology.[13] For this reason, timing the procedure to occur during the follicular phase of the menstrual cycle can be very helpful. When this is not feasible, or in patients without a regular cycle, medical treatment is targeted at altering sex hormone levels, which influence endometrial thickness.[13]

Progestins have been studied for endometrial preparation and have been shown to induce endometrial atrophy and reduce operating time and bleeding during the procedure.[14] Another benefit noted was rapid resumption of menstruation, which can be beneficial to patients undergoing hysteroscopic myomectomy with the plan to conceive.[14] Combined oral contraceptives also have been found to increase intracavitary lesion visibility due to stabilization and uniform thinning of the endometrium.[15] Combined oral contraceptives taken regularly before the procedure can confer the added benefit of contraception when initiated at the start of the last menses.

Specific to hysteroscopic myomectomy, many preoperative treatments have been targeted at both achieving a thin endometrium and reducing size of myomas before resection. Pretreatment with gonadotropin-releasing hormone (GnRH) agonist has been studied in patients with submucous myomas before operative hysteroscopy. GnRH agonists induce a hypoestrogenic state leading to endometrial thinning and reduction in myoma vascularity and volume.[16] Prospective studies have shown conflicting results in the value of GnRH agonists to improve short- or long-term operative results (ie, size of myoma, absorption of distension media, operative length, and operative bleeding).[17] A meta-analysis looked specifically at 2 randomized controlled trials and found no significant operative benefit in terms of complete myoma resection, but did show shorter operative time and reduction in distension medium absorption in GnRH agonist groups.[18] When considering the available evidence, it is not sufficient to support routine use of GnRH agonists before hysteroscopic myomectomy, especially in light of the profound vasomotor symptoms that may arise from use of this medication.[13]

As outlined, many options exist for preoperative preparation of hysteroscopy. Although there are insufficient data to support one specific approach, providers can consider available strategies to meet the patient's needs and operative goals, weighing side effects, dosage, duration and cost-benefits before procedures.[13]

Intraoperative Considerations

There is a wide array of technology available to optimize performance of operative hysteroscopy. Regardless of the device used, there are intraoperative techniques to improve the safety and success of the procedure.

Vasopressin Use

The use of vasopressin was assessed in a recent randomized control trial, which found that injecting vasopressin during a hysteroscopic myomectomy reduced operative time and mean inflow volume, and also enhanced visual clarity.[19] Vasopressin or epinephrine can also be used to reduce the force needed for cervical dilation.[20] Given the rare but significant risks of severe toxicity with these agents, the American Association of Gynecologic Laparoscopists (AAGL) recommends "the concentration of vasopressin should not exceed 0.4 u/mL and preferably … it should be less than that." The American College of Obstetricians and Gynecologists (ACOG) recommends that vasoconstricting agents should be used with extreme caution in the outpatient setting.[2]

Patient Positioning and Fluid Management

Complications involving operative hysteroscopy are rare and have been discussed in detail to follow. Whether in the office or operating room setting, attention to patient positioning is crucial. Patients should be placed in dorsal lithotomy, with the patient's buttocks to the end of the table and sacrum supported with a drape to collect fluid beneath the patient. This is important to provide a more accurate account of fluid deficit during the procedure. Additional best practices include use of an automated fluid monitoring system and a team member assigned to report fluid deficits frequently to the operative team.[2]

Operative Hysteroscopy in the Ambulatory Setting

There has been a shift toward office-based hysteroscopy, with evidence to support patient preference, faster recovery, and higher patient satisfaction.[4] Cost advantages have also been cited, and other potential benefits include avoidance of general anesthesia, patient and provider convenience, and more efficient use of the operating room space for more complex procedures.[4] Patient selection for office-based hysteroscopic procedures relies on several factors. Provider understanding of the uterine pathology in question, including size and depth, available equipment, and patient support services are very important.[4] Patient anxiety and experiences with office-based procedures also should be taken into account. A thorough assessment of the patient's health status, including comorbidities that may exclude them from safely undergoing office-based procedures without the presence of qualified anesthesia personnel, should be considered.[4]

A major barrier to office hysteroscopy is pain, with the greatest pain related to use of the speculum, tenaculum, and cervical dilators.[21] Vaginoscopy is a technique by which these steps may be avoided. For vaginoscopic entry, the hysteroscope with inflow on is introduced into the vagina while manually occluding the labia minora. The hysteroscope is directed toward the cervical os and entered with a twisting motion while adjusting for the uterine position (whether anteflexed or retroflexed). Vaginoscopic entry has been shown to produce less pain for the patient and has a similar success rate compared with traditional hysteroscopic entry.[22] Both the AAGL and the ACOG recommend this approach to minimize procedural pain in the office when compared with traditional hysteroscopy.

A systematic review of pain relief for outpatient hysteroscopy compared placebo versus local anesthesia (intracervical, paracervical, and topical), nonsteroidal anti-inflammatory drugs, and opioids. No differences in efficacy or safety were noted in comparing these different types of pain relief, and, as such, treatment should be individualized based on patient and provider preference.[23]

An additional systematic review by De Silva et al[24] sought to determine differences in pain levels for patients undergoing office hysteroscopy with various hysteroscopic devices. No trials within this systematic review looked at office myomectomies, but found polypectomies were associated with less pain and shorter procedure times with mechanical morcellators as compared with bipolar devices.[24]

Available Devices for Operative Hysteroscopy in the Outpatient Setting

There are 4 major categories of operative hysteroscopic systems that may be considered for use in the outpatient setting. A key feature is a small outer diameter sheath that requires little or no cervical dilation. Advantages and disadvantages are reviewed with some illustrative examples. This is not intended to be an exhaustive list of available systems. Systems mentioned have FDA approval.

Disposable Hysteroscopes With Operative Channels

Disposable hysteroscope systems are relatively new, with the first FDA approval in 2015 for the Endosee (Cooper Surgical) followed by the OperaScope (LiNA Medical) in 2018. These semi-flexible disposable hysteroscopes have a cannula diameter under 5 mm and rely on cannula angle to fully view the cavity on screens mounted on the end of the scope. Normal saline is used as the distension medium with an operative channel that can admit manually operated instruments. The Endosee Advance monitor is reusable whereas LiNA OperaScope is single use. Both have their light source included in the monitor. Several newer systems have recently been introduced, which include Aveta System (Meditrina), Hystero-V (UroViu), and NeoFlex (NeoScope).

Reusable Hysteroscopes With Operative Channels

Reusable hysteroscopes include both rigid and flexible options with operative channels through which manually operated or, in some cases, bipolar electrode instruments may be passed. Advantages of reusable scopes include enhanced optical quality and most include outflow ports for clearing of the field when bleeding is present. Disadvantages include the need for sterilization and increased initial costs when purchasing equipment, which includes the scope, light source, and monitor. Examples of reusable scopes include Bettocchi (Storz), Campo Trophyscope (Storz), Compact hysteroscope (Richard Wolf), Omni hysteroscope (Hologic), and the Luminelle DTx system (Luminelle).

Table 2. Available Hysteroscopic Tissue Removal Systems With Small Outer Diameter for Possible Office Use

Device (Manufacturer)	Sheath Diameter, mm	Indications	Limitations	Benefits
Bipolar system				
Symphion System (Minerva Surgical)	6.3	Resection of intrauterine tissue	Risk of thermal injury Gas bubbles, increased risk of emboli	Bipolar radiofrequency with automatic aspiration Spot coagulation for bleeding in field
Mechanical systems				
MyoSure System (Hologic)	5.5/6.0	Resect and remove tissue such as submucous myomas, endometrial polyps, and retained products of conception	Less effective with type 2 myomas	Manual device option for in-office polypectomy Reusable scope, disposable device
TruClear System (Medtronic)	5.7/6.0	Resect and remove tissue such as submucous myomas, endometrial polyps, and retained products of conception	Less effective with type 2 myomas	Long working channel, better access to cornua and fundus Reusable scope, disposable device
Aveta System (Meditrina)	4.6/5.7	Resect and remove tissue such as submucous myomas, endometrial polyps, and retained products of conception	Less effective with type 2 myomas	Both scope and device are single use

Bipolar Hysteroscopic Resection Systems

The development of bipolar hysteroscopic resectoscopes with decreased outer diameter of 5 to 6 mm has made this method more attractive for outpatient procedures given the decreased need for cervical dilation.[25] These so-called mini-resectoscopes allow for more advanced operative hysteroscopy while maintaining safety even with challenging pathology.[26] Like traditional resectoscopes, the chips created by resection must be removed from the uterus before completing the procedure. Unfortunately, at this time, there are no FDA-approved mini-resectoscope options on the market in the United States.

A bipolar option for resection with a different appearance to the traditional resectoscope is the Symphion System; it is FDA approved and available in the United States (see Table 2). Symphion employs a hysteroscope with 6.3-mm outer diameter sheath through which a disposable bipolar radiofrequency device is placed. This device, similar in appearance to the mechanical hysteroscopic tissue removal (mHTR) devices, contains a side window with a built-in tissue aspiration mechanism. The cutting window is bladeless; bipolar radiofrequency energy creates the tissue resection. In addition, the fluid management for Symphion is a closed loop system; the saline recirculates through a molecular filter and returns to the inflow source. This system has the advantage of spot coagulation and tissue aspiration to maintain visualization.

Mechanical Hysteroscopic Tissue Removal Systems

mHTR systems were specifically designed to overcome the risks associated with electrosurgical or thermal energy when compared with traditional resectoscope procedures. In addition to the elimination of electrical energy or risk of thermal damage, the use of normal saline distention media and continuous aspiration of tissue allow for better visualization of the uterine cavity.[26] There are currently 3 available systems in the United States: TruClear, MyoSure, and the newer Aveta system. Each has more than one size of morcellator available, but for office consideration, all systems offer an option with a small outer diameter (see Table 2). There are no studies that directly compare these systems.

Resectoscope Versus Hysteroscopic Morcellator

There are several considerations when comparing a resectoscope to mHTR. In regard to polypectomy, mHTRs offer significantly faster removal than the loop resectoscope.[27] Additionally, the incidence of recurrence of polyps after 2 years was 0.8% with mHTRs and 4.5% with the resectoscope, a significant consideration.[28]

For removal of myomas, mHTRs are limited depending on the size and type of myoma. Arnold et al[29] report a removal rate of up to 90% for myomas less than 2 cm versus 48% for myomas greater than 4 cm. When compared with resectoscopes, a recent meta-analysis showed no difference in length of time of surgery for submucosal leiomyomas.[30] Vitale et al[30] also demonstrated that mHTR systems are less efficient for type 2 submucosal myomas when compared with type 0-1 myomas. Although mHTRs are becoming the preferred approach to treating intrauterine pathology, the resectoscope continues to be an important tool, particularly in the setting of type 2 submucosal myomas.[31]

The prevalence of complications is low for mHTR, reported at 0.02% for inhospital procedures and 1.6% when used in the office setting.[32] When compared with the resectoscope, the mHTR system is associated with fewer complications such as uterine perforation, bleeding, and fluid overload, which can be life threatening.[33]

A notable advantage of these mHTR systems is the ease of use with trainees. A randomized control trial compared

the use of mechanical morcellators versus resectoscopes and found a decrease in the mean operating time with the morcellator and subjective preference in technique convenience among resident trainees.[34]

Complications Associated With Operative Hysteroscopy

Perforation

Hysteroscopy has a 0.22% overall complication rate,[35] the most common of which is uterine perforation. Many steps within the hysteroscopy process involve the risk of perforation including uterine sounding, cervical dilation, and insertion of the hysteroscope or additional instruments. Risk factors for uterine perforation include blind instrumentation, creation of false passage(s), myometrial thinning, anatomic distortions, cervical stenosis, and uterine malposition.

Hemorrhage

Hemorrhage, another complication of hysteroscopy, may be secondary to uterine perforation, cervical laceration, or resection of intracavitary lesions. Mechanical morcellator systems are at a disadvantage compared with electrocautery-based devices when it comes to controlling intracavitary bleeding.[26] There are preoperative and intraoperative measures, which may decrease the risk of intracavitary bleeding, including the use of vasopressin (see above). Additional methods to control bleeding include intrauterine balloons, uterine artery embolization, and hysterectomy if all more conservative approaches fail.[4]

Fluid Overload

Fluid overload complications can be severe resulting in pulmonary edema and neurologic complications like cerebral edema and death.[4] Fluid deficit thresholds should be established before case onset. For patients who are otherwise healthy, the maximum fluid deficit is 2500 mL for isotonic solutions, 1000 mL for hypotonic solutions, and 500 mL for high-viscosity solutions.[2] This should be adjusted for elderly patients or those with comorbidities that may impact cardiac or renal function. Thresholds should also be reduced in the outpatient setting where there is limited acute care.[2]

Embolism

Air or gas embolism may cause cardiopulmonary compromise in patients under anesthesia. This can be due to introduction of room air during instrumentation of the uterus or cervix, placement of patients in Trendelenburg position, or, in the context of electrosurgery, gaseous byproducts from monopolar or bipolar instruments.[36] In anesthetized patients, changes in hemodynamic status such as hypotension or tachycardia should raise clinical suspicion for embolism. Decreases in end-tidal carbon dioxide pressure should also prompt evaluation. Risk factors for air or gas embolism include inadequate priming of the hysteroscope or purging of air before insertion, repetitive use of instruments in and out of the cervix, and excessive intrauterine pressure. Limiting these operative maneuvers aids in risk reduction. When suspicion is high, management includes terminating the procedure and initiating supportive measures such as Durant's maneuver, which is placing the patient in the left lateral decubitus position in Trendelenburg.[4]

Vasovagal Reaction

Vasovagal reactions are another potential complication, most commonly occurring with cervical manipulation during hysteroscopy. Manipulation can trigger the parasympathetic nervous system resulting in hypotension, bradycardia, pallor, diaphoresis, or loss of consciousness. Careful primary survey should be performed on the patient to ensure secure airway, breathing, and circulation. If bradycardia is persistent, the use of atropine may be warranted. Maneuvers such as Trendelenburg or leg raises while supporting the patient should be undertaken.[4]

Conclusion

Operative hysteroscopy is a valuable tool for diagnosing and treating intrauterine pathology. Proper patient selection and preparation will aid in the success of outpatient operative hysteroscopy. Understanding available operative hysteroscopic systems and complications that may arise is crucial to optimize patient care and outcomes.

Practice Pearls

- Hysteroscopy is the gold standard for diagnosing and treating intrauterine pathology.
- Advances in operative hysteroscopic technology including resectoscopes and morcellator tissue removal systems have proved to be valuable innovations.
- There are very few contraindications to hysteroscopy, but these include viable pregnancy, active pelvic infection, and prodromal or active herpes infections.
- Cervical preparation is not universally recommended but may be considered in patients with cervical stenosis.
- Endometrial preparation by timing of procedure or medical therapy should be considered to optimize visualization during the procedure.
- Vaginoscopy can be employed to reduce patient discomfort during office hysteroscopy.
- No analgesic methods have been shown to be superior to placebo for pain control during office hysteroscopy.
- Injection of dilute vasopressin may be considered to improve ease of cervical dilation, decreased bleeding in the operative field, and decreased fluid deficit; however, given rare but serious side effects, it should be used with caution in the outpatient setting.
- When considering operative systems for polyps and types 0 and 1 intracavitary myomas, the mHTR is more easily mastered by trainees, and is associated with shorter operative time and less perceived pain. The bipolar resectoscope may be more effective in resecting type 2 myomas.

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1. A 65-year-old patient presents with postmenopausal vaginal bleeding. A sonohysterogram reveals a 2.1-cm intrauterine mass with features that suggest a polyp. You recommend surgical evaluation with operative hysteroscopy. The *most* appropriate regimen for cervical preparation in this patient is
   - **A.** vaginal misoprostol 1000 µg administered 12 hours pre-procedure.
   - **B.** oral misoprostol 1000 µg administered 12 hours pre-procedure.
   - **C.** 2 weeks of vaginal estradiol followed by vaginal misoprostol 1000 µg administered 12 hours pre-procedure.
   - **D.** 2 weeks of vaginal estradiol followed by oral misoprostol 1000 µg administered 12 hours pre-procedure.

2. A 35-year-old patient presents for office operative hysteroscopy to remove a retained intrauterine device. She has active vaginal bleeding and a recent abnormal Pap test result, for which she is scheduled to have colposcopy. She has a history of chlamydia, recently treated, and has prodromal symptoms of genital herpes, but no visible lesions. Which one of the following is a contraindication to performing her hysteroscopy today?
   - **A.** active bleeding
   - **B.** abnormal Pap result
   - **C.** recent history of chlamydia
   - **D.** prodromal symptoms of genital herpes

3. A 50-year-old patient plans to undergo operative hysteroscopy to resect a submucosal myoma. With regard to the use of a GnRH agonist before the procedure, which one of the following statements is *true*?
   - **A.** GnRH agonists result in a hyperestrogenic state to cause endometrial thinning.
   - **B.** GnRH agonists can increase the absorption of fluid during the procedure.
   - **C.** GnRH agonists may cause significant vasomotor symptoms.
   - **D.** GnRH agonists are routinely recommended to increase the likelihood of complete myoma resection.

4. Pain is a well-known barrier to performance of operative hysteroscopy in the office setting. Evidence-based strategies to reduce pain while performing office operative hysteroscopy include
   - **A.** vaginoscopy.
   - **B.** nonsteroidal anti-inflammatory drugs.
   - **C.** opioid analgesics.
   - **D.** topical application of lidocaine.

5. A student comes to your office to observe hysteroscopic procedures. Your office used to have a Bettocchi hysteroscope that was reusable with a small operative channel, but now has the Endosee hysteroscope, which has a disposable component. You review the advantages and disadvantages of the devices with the student. Compared with the disposable devices, which one of the following is an advantage of the reusable hysteroscope?
   - **A.** requires sterilization after each procedure
   - **B.** the purchase cost is less than a disposable device
   - **C.** the disposable device requires use of an electrolyte-poor distention media
   - **D.** the reusable device provides better optics

6. A 75-year-old patient is undergoing hysteroscopic resection of an endometrial mass. The anesthesia provider alerts you that the patient has had an acute change in status, and you are concerned about an air embolism. Which one of the following objective findings raises your concern for air embolism?
   - **A.** hypertension
   - **B.** bradycardia
   - **C.** decrease in end-tidal carbon dioxide pressure
   - **D.** asymmetric lower extremity edema

7. A 36-year-old G0 woman presents for preoperative planning to undergo operative hysteroscopy for a submucosal fibroid. She is not taking any hormonal medications, and her cervix appears somewhat stenotic on examination. Which one of the following would you recommend in preparation for the procedure?
   - **A.** vaginal misoprostol administered 12 hours before the procedure
   - **B.** laminaria placed 12 hours before the procedure
   - **C.** planning of the procedure immediately before next menses
   - **D.** administration of vaginal estrogen 1 week before the procedure

8. A 79-year-old patient with multiple medical comorbid conditions presents for consultation regarding ongoing postmenopausal bleeding. Imaging demonstrates a 2-cm endometrial mass of unclear etiology. The patient has a history of a non-ST-elevation myocardial infarction (NSTEMI) within the last 18 months, type 2 diabetes mellitus, and related chronic kidney disease. She also has significant anxiety. You counsel her on undergoing hysteroscopy in the office versus the operating room. What one of the following statements about office hysteroscopy is *true*?
   - **A.** General anesthesia is not needed.
   - **B.** Procedure-related pain is decreased.
   - **C.** The cost of the procedure is higher in the office.
   - **D.** Patient satisfaction tends to be lower compared with hysteroscopy in the operating room.

9. The *most* common complication of a hysteroscopic procedure is
   - **A.** hemorrhage.
   - **B.** uterine perforation.
   - **C.** fluid overload.
   - **D.** air embolism.

10. A 47-year-old patient presents with an endometrial mass that requires hysteroscopic resection. Options include use of a bipolar resectoscope or a mechanical hysteroscopic tissue removal device (mHTR). The bipolar resectoscope is
    - **A.** associated with lower risk of uterine perforation.
    - **B.** preferred by trainees.
    - **C.** associated with less operative time and lower risk of fluid overload.
    - **D.** more efficient for removal of type 2 submucosal fibroids.