

Office Hysteroscopy: Distension Media and Pain Management

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Abstract

Background: Office hysteroscopy is a safe and effective diagnostic and operative procedure for intrauterine pathology and abnormal uterine bleeding. Although it avoids hospital admission and general or regional anesthesia, pain remains a principal cause of procedural failure and is influenced by cervical manipulation, uterine distension, instrumentation, anxiety, and patient-related factors.

Objective: To review the clinical principles and applications of office hysteroscopy, with emphasis on distension media, procedural techniques, safety considerations, pain mechanisms, and pharmacological and nonpharmacological strategies for improving patient comfort.

Conclusion: Pain control during office hysteroscopy requires attention to patient selection, technique, instrument diameter, distension media, anxiety, and appropriate analgesic or anesthetic measures. Vaginoscopy, mini-hysteroscopes, reduced waiting time, music, and selected local anesthetic techniques may improve tolerance; however, published evidence remains heterogeneous and further research is required to establish standardized pain-control protocols.

Keywords: Office hysteroscopy; Distension media; Pain management; Vaginoscopy; Analgesia

Introduction

Hysteroscopy is used to visually examine the uterine cavity for structural defects, lesions, and other pathology. Pantaleoni conducted the first hysteroscopy in 1869, and subsequent advancements in technology have significantly expanded the capabilities of this procedure. Advancements in hysteroscopic equipment, including scopes, optics, distention media, and analgesics, have enhanced the practicality of office hysteroscopy and improved comfort for patients. The benefits of office hysteroscopy include the ability to forgo general anesthesia, increased convenience for both the patient and physician, quicker recovery time, and increased cost-effectiveness compared to the operating room. Additionally, the office setup requires less draping and gowning for the procedure, leading to enhanced sustainability and decreased waste (Wright et al., 2024).

Despite these benefits, office hysteroscopy continues to be underutilized. According to a study by Shields et al. (2018), out of 305 hysteroscopies, only 25% were performed in the office. The discordance could stem from inadequate physician training, barriers to investing in capital equipment, and physician anxieties about patient discomfort.

Outpatient hysteroscopy in the office setting is a safe and effective procedure for diagnosis of intrauterine pathology and abnormal uterine bleeding, as well as for therapeutic operative treatment and transcervical sterilization (Buzzaccarini et al., 2022).

Office hysteroscopy is a diagnostic and operative technique with many advantages compared with operating room-based hysteroscopy: it does not require hospital admission, preoperative tests, and general or regional

anesthesia. Importantly, it has a decreased postsurgical recovery period and global cost of the procedure (Buzzaccarini et al., 2022).

Moreover it helps to minimize rate of complications, although it is generally a well-tolerated procedure. However pain, vagal syndrome and hypotension are common among patients undergoing hysteroscopy (Buzzaccarini et al., 2022).

Pain is still the main cause of office hysteroscopy failure. Factors related to pain experience during hysteroscopy are still not well-known. In addition, there is controversy about anesthesia and analgesia for outpatient hysteroscopy. 84% of failed hysteroscopies are due to excessive discomfort. 34.8% of patients who undergo anesthesia-free diagnostic hysteroscopy report severe pain. Moderate to severe pain [measured by Visual Analog Scale (VAS) score of 5 or more immediately after examination] was reported in 68.4% of patients (Marchand et al., 2022).

An adequate knowledge of anatomy is essential to understand the physiology of pain in hysteroscopy. Anatomical structures of the female pelvis are innervated by two pathways. The fundus of the uterus is innervated by sympathetic fibers from T10 to L2 via the inferior hypogastric plexus, which enters the uterus by the uterosacral ligaments and by the infundibulopelvic ligament, forming the ovarian plexuses. The upper vagina, cervix, and lower uterine segment are innervated by parasympathetic fibers from S2 to S4, which form the Frankenhauser or uterovaginal plexus, which enters the uterus following the cardinal ligaments. Myometrium and endometrium are innervated by a plexus at the myometrial–endometrial interface. Only the basal third of the endometrium is innervated. Myometrial innervation can vary with disease processes such as endometriosis or adenomyosis (Bettocchi & Selvaggi, 1997).

Considering hysteroscopic techniques, pain is mainly produced when speculum or tenaculum are placed, with cervical dilation, passage of the hysteroscope through the cervical canal, and distension of the uterus with fluid. Operative procedures that damage the endometrial walls, such as endometrial biopsy, polypectomy or myomectomy, ablation or tubal sterilization, are also painful. Due to this complex innervation, successful anesthesia requires simultaneous targeting of more than one site, including paracervical and intracervical anesthesia and topical agents in the cervical canal and endometrial cavity (Akizuki et al., 2005).

Historical Development of Hysteroscopy

Bozzini (1773–1809) is considered to be the father of endoscopy. In 1804, he developed a light conductor called the Lichtleiter, allowing him to visualize the internal cavities of the human body, creating a principle of illumination with a concave mirror. In 1843, the French physician Antonin Jean Desormeaux (1815–1894) developed the first cystoscope by introducing Bozzini's instrument into the bladder. This device was characterized by a hollowed instrument that allowed direct visualization thanks to a light produced by an alcohol and turpentine lamp that passed through one-half of the tube before being reflected by a concave mirror inserted into a viewing tube. His endoscope was a system of mirrors and lenses with an open flame as the light source, and by filling the bladder with fluid, it was possible to observe the cavity through a glass window (Vitale et al., 2024).

Today, with the development of bipolar energy, various instruments, safe and effective distending media, optics, and smaller scope sizes, hysteroscopy is the preferred technique for managing intrauterine pathology. The utilization of in-office hysteroscopy depends not only on appropriate patient selection but also on the availability of equipment and resources. The preferred entry technique is vaginoscopy due to the reduction of intraprocedural and postprocedural pain. The efficacy of the vaginoscopic approach is comparable to the traditional entry approach (Liu et al., 2022).

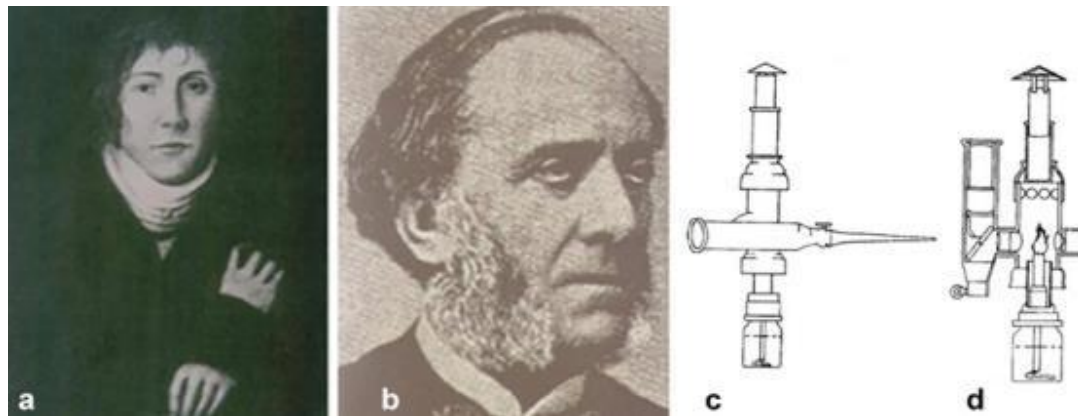


Figure (1): a Philipp Bozzini (1773–1809); b Antonin Jean Desormeaux (1815–1894); c Diagram of Desormeaux's endoscope d Sagittal view showing flame and reflecting lenses (Vitale et al., 2024).

Principles and Overview

Hysteroscopy involves inserting a rigid or flexible hysteroscope through the cervical canal into the uterus and then using distending media to allow for complete visualization of the endometrial cavity. The type of distending media is selected based on the type of energy that will be used. Electrolyte-rich distention media may not be used if monopolar energy is used due to the risk of conducting electricity outside the operative field. Because of the potential for fluid overload and resulting complications, a fluid deficit with an upper limit of 1000 mL is recommended when using the hypotonic solution as the distending media (Xia et al., 2022).

A fluid deficit upper limit of 2500 mL is recommended when using the isotonic solution as the distending media. This limit does not apply to older adults or patients who have comorbidities. A fluid deficit cutoff of 750 mL for hypotonic solutions and 1500 mL for isotonic solutions is recommended in this population. This is due to the potential for complications resulting from fluid overload. Normal saline has been found to provide better visualization and is associated with less postoperative pain than carbon dioxide. Normal saline also allows for the utilization of bipolar electrocautery since it is isotonic (Ogelle et al., 2022).

The type of hysteroscope is selected based on operative needs. The 3 parts of the scope are the eyepiece, the barrel, and the objective lens. Scope viewing angles range from 0 to 70 degrees, with a decreased angle giving a more panoramic view. An operative hysteroscope is needed for surgical intervention. Options include a resectoscope, a hysteroscopic tissue retrieval system, or the addition of an operative sheath (Louis & Lulla, 2020).

With the invention of smaller hysteroscopes with reduced diameters and more technically advanced operating systems, in-office hysteroscopy has become a widely accepted method for diagnosing and treating intrauterine pathology. For women with abnormal uterine bleeding (AUB), hysteroscopy has been introduced as a viable or even superior alternative to hysterectomy in some cases. Hysteroscopy has also been validated as a diagnostic tool for infertility workups. Moreover, this procedure has been shown to be safe and effective for the removal of retained products of conception and foreign bodies (Wright et al., 2024).

A new concept gaining popularity is the “see-and-treat” strategy, in which the patient is diagnosed during office hysteroscopy with an intrauterine organic pathology, eg, endometrial polyps or thickened endometrium. This identified pathology can then be treated hysteroscopically during the same visit. The see-and-treat strategy has all the same indications, and more, compared to traditional hysteroscopy, including thickened endometrium, endometrial pathology, retained products of conception, and retained foreign bodies. Polypectomy is the most common hysteroscopic procedure worldwide and can be easily transitioned to be performed through the see-and-treat method (Figueiredo & Silva, 2021).

Clinical Indications and Contraindications

The most common indications for hysteroscopy are as follows: (Xia et al., 2022).

Suspicion of the intracavitary lesion.

Abnormal uterine bleeding.

Abnormal endometrial thickening.

Postmenopausal bleeding.

Infertility.

Mullerian congenital anomaly.

Removal of foreign bodies.

Whenever possible, in-office hysteroscopy is preferred. Compared to surgical inpatient hysteroscopy, in-office hysteroscopy offers many potential benefits, including patient and physician convenience, avoidance of general anesthesia, higher patient satisfaction, faster recovery, and cost-effectiveness. Factors that challenge outpatient hysteroscopy feasibility include large intrauterine pathology, patient anxiety, lack of appropriate treatment setting and personnel, and physician skill and expertise (Jeong et al., 2025).

Contraindications:

Hysteroscopy has few absolute contraindications, including active pelvic infection, prodromal or active genital herpes, and confirmed cervical or endometrial cancer. Moderate vaginal bleeding is a relative contraindication to hysteroscopy. However, adequate visualization for the procedure may be achieved with copious irrigation. Pregnancy is also a contraindication to hysteroscopy unless used in the setting of retained IUD or products of conception removal (Vitale et al., 2023).

Medical comorbidities could be potential contraindications to hysteroscopic surgery (eg, coronary heart disease and bleeding diathesis) (Phillips & Clark, 2020).

Hysteroscopic Equipment and Instruments

Hysteroscopes.

There are several types of hysteroscopes available for diagnostic and operative purposes that deserve further explanation. The two main types of hysteroscopes are flexible and rigid. Hysteroscopes are available at viewing angles ranging from 0 to 70 degrees. They all easily connect to fluid channels, a light source, and a video monitoring system.

A continuous flow of distending media is needed for optimal visualization of the endometrial cavity. Most hysteroscopes have an operative channel that permits the passage of surgical instruments such as small hysteroscopic graspers, scissors, or a tenaculum (Riemma et al., 2022).

There are other types of rigid diagnostic and operative hysteroscopes that range in diameter and degree of viewing angulation. In addition, the resectoscope and mini-resectoscope offer easy manipulation of electrocautery monopolar and bipolar loop devices that can be loaded into the scope, providing for an easier dissection through dense tissue (Stamenov et al., 2020).

Other Instruments:

Traditional hysteroscopic entry technique requires a tray with instruments for cervical dilation. These instruments and materials include a metal speculum, cervical tenaculum, sound, cervical dilators, ring forceps, and raytecs. Local anesthesia, if needed, might be selected based on operator preference. Preferred options include 1% or 2% lidocaine with or without epinephrine. A long 25 or 27 gauge needle is needed for the administration of anesthetic into the cervix. With vaginoscopy and the no-touch-technique, there is no need for any instruments apart from the hysteroscope (Vitale et al., 2020).

Distension Media

The evolution of minimally invasive surgery has profoundly transformed medical interventions, allowing for significantly shorter recovery times, minimized infection risks, and improved aesthetic outcomes. However, accessing and visually evaluating potential anatomical spaces-such as the human uterus, urinary bladder, major synovial joints, and specific segments of the gastrointestinal tract-requires the artificial distension of these cavities. Without exogenous distension media, the mucosal lining of organs like the uterus would remain collapsed, bleeding upon mechanical contact and precluding any direct optical visualization (Jeganathan et al.,).

Historically, endoscopic distension evolved from crude methodologies to modern, highly calibrated systems. Early interventions utilized simple distilled water; while cost-effective and optically clear, distilled water is profoundly hypotonic and led to catastrophic erythrocyte hemolysis, shock, and acute renal failure upon intravascular absorption. This drove the shift toward liquid non-electrolytic fluids (such as 1. 5% glycine and 3% sorbitol) designed for safe monopolar electrosurgery, and eventually to modern isotonic solutions utilized with advanced bipolar technology (Tsonis et al., 2023).

Categories of Distension Media

The ideal distension medium should provide clear vision, mix well with blood, have isotonic properties to avoid fluid imbalance, and be compatible with surgical instruments (Ogelle et al., 2022) As no single medium perfectly meets all these criteria, modern options are categorized by physical state and osmolality:

Gaseous Media: Carbon dioxide (CO₂) is the standard for outpatient diagnostic hysteroscopy. Because its refractive index is essentially identical to air, it provides a clear panoramic view of the endometrium. It is clean, avoids fluid spillage, and requires low-pressure insufflation (maximum flow of 100 mL/min). However, CO₂ interacts with blood to produce an opaque foam, making it unsuitable for operative procedures with active hemorrhage (Xia et al., 2022).

Liquid Non-Electrolytic Media: Formulations such as 1. 5% glycine, 3% sorbitol, and 5% mannitol are devoid of charged ions, making them mandatory for older monopolar electrosurgery (where electrolytic fluids would disperse the electrical current and cause collateral burns). Glycine and sorbitol are hypotonic; thus, massive systemic absorption dilutes serum sodium and precipitates hyponatremia and cerebral edema. Furthermore, the metabolism of glycine produces ammonia, which can independently lead to hyperammonemia and temporary central nervous system toxicity (Vilos et al.,).

Liquid Electrolytic Media: Isotonic normal saline (0. 9% NaCl) is the universally preferred medium for mechanical diagnostics and bipolar electrosurgery. Because it mirrors human plasma osmolality, it completely eliminates the risk of dilutional hyponatremia and hypotonic encephalopathy (Chohan & Davidow, 2024).

Viscous Colloid Media: Hyskon (32% dextran 70) is a thick, highly viscous liquid that remains entirely immiscible with blood, offering unparalleled visual clarity during highly hemorrhagic surgeries. However, it comes with severe risks: it exerts a massive osmotic pull (expanding intravascular volume drastically), causes unpredictable anaphylaxis (DIAR), and can permanently destroy endoscopic equipment if allowed to crystallize (Feng, 2022).

Intravasation, Extravasation, and Fluid-Related Complications

The central danger in fluid-based endoscopy is the forced intravasation (absorption into the bloodstream) or extravasation (leakage into tissues) of the distension medium. To maintain cavity distension, the fluid is pumped at pressures exceeding the patient's local venous pressure, forcefully driving the fluid into deep venous sinuses severed during tissue resection (Haude et al., 2020).

In hysteroscopy and transurethral resection of the prostate (TURP), this absorption causes Operative Hysteroscopy Intravascular Absorption Syndrome (OHIA) or TURP syndrome. When hypotonic fluids are absorbed, patients face rapid dilutional hyponatremia and hypo-osmolality, driving water into brain cells and causing lethal cerebral edema. Conversely, while isotonic normal saline avoids hyponatremia, the massive

volume expansion greatly increases cardiac preload, leading directly to right-sided heart failure and fulminant pulmonary edema if cardiac capacity is exceeded (Wang et al., 2020).

Fluid Management and Safety Protocols

Given these profound physiological risks, meticulous real-time intraoperative monitoring of the fluid deficit—the exact difference between fluid infused and fluid recovered—is strictly mandatory (Göçmen, 2024). National guidelines from bodies like the AAGL and ESGE have established rigid safety thresholds:

Hypotonic Solutions: A maximum fluid deficit of 1,000 mL is permitted for healthy adults, reduced to just 750 mL for elderly or comorbid patients (Umraniyar et al., 2016).

Isotonic Solutions: The threshold is expanded to 2,500 mL for healthy adults but remains strictly lowered to 750–1,500 mL for patients with underlying cardiovascular or renal impairments (Umraniyar et al., 2016).

Historically, fluid deficits were calculated manually, a highly inaccurate practice prone to underestimating absorption. Today, modern safety standards dictate the use of automated fluid management systems (e. g., Hystero Lux, Fluent Pro). These digital platforms continuously weigh incoming fluid and suctioned waste, instantly calculating the precise net absorption and sounding escalating alarms if safe deficit thresholds are breached or if sudden pressure drops indicate an organ perforation (Metheny, 2012).

Preparation and Technique

Preparation for hysteroscopy includes preoperative evaluation and individualized testing for patient needs. Further testing for preoperative clearance should be undertaken if comorbid conditions exist that increase operative morbidity. Hysteroscopy may be performed at any time in postmenopausal women. For premenopausal women, a consideration that performing a hysteroscopy during the secretory phase of the menstrual cycle may lead to an overdiagnosis of endometrial polyps is essential since the endometrium may appear polypoid during this time. Using misoprostol for cervical dilation pre-procedure is not universally accepted and is not routinely performed (Lanier,).

Prophylactic antibiotics are not needed for hysteroscopy. A thorough history and physical should be conducted on every patient before a hysteroscopy is performed. In addition, a preoperative pregnancy test should be performed on all premenopausal women. Currently, no consensus on pain management for in-office hysteroscopy has been established. Different protocols, both pharmacologic and nonpharmacologic, have been proposed. Informed consent, including a discussion of risks, benefits, and alternatives, should always be obtained before any surgical procedure (Muzii et al., 2020).

Technique:

First, as with any gynecologic procedure, the appropriate positioning of the patient must be ensured. The patient is positioned in the dorsal lithotomy position, taking care to avoid unnecessary pressure that may cause nerve injury. The table must be flat; Trendelenburg positioning should be avoided. The bimanual examination should always be performed before the start of any gynecologic procedure. An indwelling Foley catheter is unnecessary; however, a straight catheter may drain the bladder before starting the procedure (Annan et al., 2024).

Next, the hysteroscope is set up, the camera is white-balanced and focused, and the inflow tract is primed. With the vaginoscopic entry technique, the need for the traditional instruments used for entry is avoided. The clinician begins vaginoscopy by introducing the hysteroscope into the vagina. The vagina is then distended, and the cervix and external os may be located by gently advancing the scope. The posterior fornix is usually easily identified. Once the external os is located, the hysteroscope is carefully inserted and passed through the internal os into the uterine cavity (Zelivianskaia & Robinson III, 2022).

Insertion and Uterine Cavity Assessment

Using standardized techniques, a speculum is first inserted. The cervix is visualized and grasped anteriorly with a single tooth tenaculum. The cervix is then dilated to the diameter of the hysteroscope being used, after which

the hysteroscope is inserted. At the same time, countertraction is applied with the tenaculum to straighten the uterus (Izcara Gual, 2024).

Once inside the uterus, the entire uterine cavity may be inspected. Any pathology can be quickly identified, and preoperative planning can be performed. The bilateral tubal ostia should be identified at the beginning of the case (Orlando & Bradley, 2022).

Uses and Efficacy of Office Hysteroscopy

Hysteroscopy has a broad range of applications for both diagnosis and treatment. Typical uses include diagnosis and management of abnormal uterine bleeding and postmenopausal bleeding, including polyps, submucosal fibroids, and thickened endometrium. office hysteroscopy can also be used to diagnose and remove intrauterine lesions or foreign bodies like intrauterine devices (IUDs), retained products of conception (POCs), or uterine septums. Most importantly, OH can be used to rule out abnormalities to prevent unnecessary trips to the operating room (FIGUEIREDO & Silva, 2021).

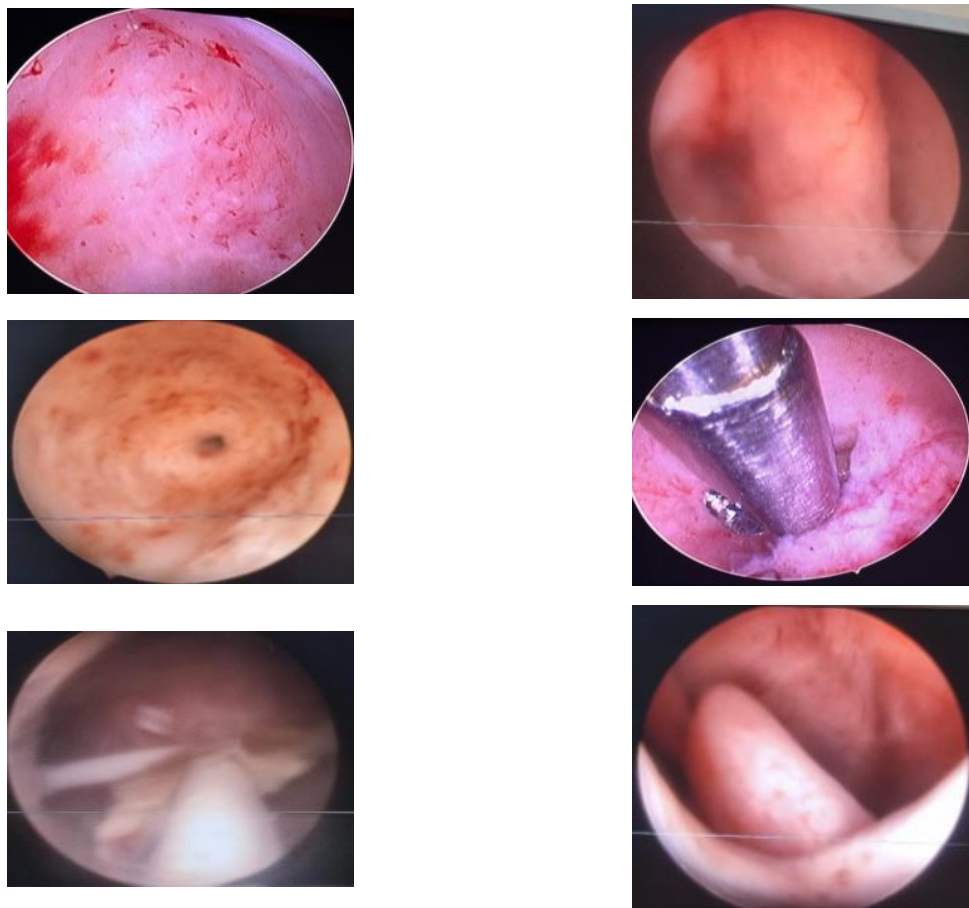


Figure (2): Hysteroscopic images of various intrauterine pathology taken in the office. A Uterine niche. B complete uterine septum. C tubal ostia and endometritis. D cutting a small intrauterine polyp. E A retained IUD with previously avulsed strings. F large intrauterine polyp.

Abnormal uterine bleeding constitutes 30% of all visits to the obstetrician-gynecologist. Traditionally, the diagnosis of intracavitary pathology has been based on a combination of tissue collection and ultrasound, even though these methods have low diagnostic capability for intracavitary pathology. Transvaginal ultrasound helps assess the myometrium, but its accuracy in detecting intracavitary pathology is lower than hysteroscopy. Hysterosalpingography, which is a procedure in which serial X-rays are taken while the dye is infused into the uterine cavity, has a sensitivity of only 50% and a positive predictive value (PPV) of 30% for the diagnosis of uterine polyps and submucosal fibroids in the asymptomatic infertile population. Sonohysterography (saline

infusion sonohysterography or SIS), a technique in which saline is infused into the uterine cavity under transvaginal ultrasound guidance, has a high sensitivity of 87–100% and PPV of > 90% for structural uterine pathologies. SIS has the added ability to assess the entire uterus including the myometrium. However, hysterosalpingography and sonohysterography only serve as diagnostic tests and do not offer the ability to treat pathology (Solone & Hillard, 2020).

Endometrial biopsy is considered highly accurate for assessing diffuse intrauterine pathologies such as endometrial hyperplasia or carcinoma. However, its diagnostic yield decreases when malignant lesions involve less than half of the endometrial surface, increasing the likelihood of missed diagnoses. In contrast, diagnostic hysteroscopy demonstrates a very high accuracy in identifying intrauterine pathology and provides reliable visualization of the endometrial cavity. Using this approach, a substantial proportion of both premenopausal and postmenopausal women presenting with abnormal uterine bleeding are found to have detectable intrauterine abnormalities (Buckley & Fox, 2024).

Office Hysteroscopy Equipment

Hysteroscopes are now available in various sizes, lens angles, and functionalities. When initiating an office hysteroscopy program, it is essential to consider the specific procedures that will be performed, which can include diagnostic evaluations, directed biopsy, polypectomy, IUD removal, removal of products of conception, or even myomectomy in certain instances. Office hysteroscopes have a smaller outside diameter but do not have attachments for anything other than inflow. On the other hand, operative hysteroscopes have a wider outer sheath and allow for the passage of tools such as scissors, graspers, tenaculums, tissue extractors, or biopsy forceps. Diagnostic and surgical hysteroscopes are now available in sizes as small as 2.8 and 3.8 mm, respectively (Vitale, Bruni, et al., 2020).

Additionally, the smallest bipolar resectoscope now has an outer diameter of 5 mm. Compared to other common gynecologic procedures in the office, these hysteroscopes provide additional comfort for both the physician and the patient. For example, a standard endometrial biopsy pipelle has a diameter of 3 mm, whereas an intrauterine device insertion sheath ranges from 4–5 mm (Wright et al., 2024).

Lenses are available in various angles. An ideal choice for a diagnostic hysteroscope is a 30° lens, which offers excellent visibility around sharp angles with minimal adjustment required, providing increased comfort for the patient. A 12° lens is preferable for an operative hysteroscope as it allows for a clearer view of the operating equipment positioned directly in front of the lens (Xia et al., 2022).

Finally, one must consider whether they want to use rigid or flexible hysteroscopes. Rigid hysteroscopes enable vaginoscopy (described further under “pain control”) and more durable operative procedures. These systems sometimes necessitate a substantial initial investment but are more economical than disposable alternatives when used with any frequency. Flexible hysteroscopes offer the ability to visually navigate sharp angles without contacting sensitive cervical walls. Nevertheless, flexible hysteroscopes commonly incorporate costly fiber-optic cables for which maintenance can be expensive, and these devices are frequently restricted to diagnostic functions alone. Flexible scopes often lack the capability to perform vaginoscopy, which is a recommended method for pain management (Prathiba et al., 2024).

Disposable hysteroscopes were created to provide an option to avoid the initial capital expenses and sterilization requirements associated with reusable hysteroscopes. However, the cost per use is often higher than the reimbursement, and the production of plastic medical waste is a major environmental concern. Most of these instruments possess a 3 to 5 mm outer sheath and have limited capacity to perform operative procedures outside of directed biopsy. These hysteroscopes may be ergonomically challenging to use and have flimsy sheaths that do not allow for vaginoscopy. Given the larger size, overall expense, and waste creation, the authors cannot recommend disposable hysteroscopes at this time for office hysteroscopy practices. The technology must advance to smaller outer diameters before they can be compared to reusable hysteroscopes (Liu et al., 2022).

Operative Tools and Procedure-Room Requirements

In setting up an office operative hysteroscopy program, assessing which tools will be required is essential. Most office treatments, such as polypectomy, lysis of adhesions, and metroplasty, can be performed using scissors. Additionally, a grasper can be used for procedures including guided biopsy, IUD removal, and removal of products of conception. Although a biopsy forceps is beneficial for targeted biopsies, a grasper can offer the same capability while also having the ability to remove retained IUDs (Park & Isaacson, 2022).

More recently, mechanical tissue extraction devices that fit down a 5-French operating channel have expanded the ability to remove large sections of tissue in the office, either by manual operation by hand or with the use of power. A tabletop suction apparatus or fluid management system accompanies some of these. A single-blinded non-inferiority trial that randomized 140 patients to an operative hysteroscopic procedure using a manual morcellation device that can be used in-office versus a standard electromechanical morcellation device (typically when the patient is under anesthesia) concluded that the manual morcellation device was non-inferior. While geometric mean resection times were, on average, 1 min longer with manual morcellation, the mean instrument setup time and total procedure time fell below pre-defined non-inferiority limits. Additionally, the physician may opt to utilize a generator with the 15-Fr bipolar resectoscope and 5-Fr bipolar twizzle for surgeries such as metroplasty or myomectomy if they desire to employ energy (van Wessel et al., 2023).

Procedure Room Setup and Supplies:

Office hysteroscopy can be performed in a small space, such as a repurposed examination room. No procedure rooms are required. A height-adjustable examination table is preferable. Aside from the hysteroscope, a visualization system is necessary, which includes a camera, light source, and monitor. Additionally, the system should have the capability to take images for the electronic health record. Essential components include tubing for both inflow and outflow, seals for the operative port, and a means of measuring the inflow and outflow (Orlando & Bradley, 2022).

Use a 1-L normal saline bag, either to gravity or contained within a pressure bag, for the inflow while allowing the outflow to hang freely, either into a basin or into a drape positioned under the buttocks. This manual system uses gravity and a difference in elevation between the bag and the level of the uterus to create intrauterine pressures ranging from 70–100 mg Hg. A Mayo stand or cart can be helpful for setting the equipment on and easily reaching it during the procedure. Furthermore, it is essential to have a speculum, tenaculum, dilators, and local anesthetic readily accessible in case they are required, though the authors prefer to avoid the use of these supplies if possible. A cleaning process is necessary for all reusable devices, including high-level disinfection or autoclaving in-office or through a centralized sterile processing facility (Wright et al., 2024).

Normal saline is the most commonly used uterine distention medium in office-based hysteroscopy because of its ready availability and flexibility in bag sizes. In most office settings, the use of automated fluid management systems is unnecessary, as these devices require considerable space and involve costly tubing, collection canisters, and waste disposal systems.

Fluid deficit can be manually estimated by assessing the remaining volume in the inflow bag and collecting effluent using a graduated drape placed under the patient or a receptacle positioned at the foot of the bed. When hysteroscopes without an outflow channel are used, the volume of infused fluid is typically minimal, making precise deficit calculation unnecessary (Raymond & Lentz, 2021).

The recommended maximum fluid deficit for normal saline is 2500mL. For procedures anticipated to approach or exceed this threshold, the use of a dedicated fluid management system is advised. In addition, when hypotonic distention media such as glycine are used in conjunction with monopolar energy systems, automated fluid monitoring becomes essential. Absorption of relatively small volumes of hypotonic solutions can lead to significant electrolyte disturbances, including rapid declines in serum sodium levels and the development of hyponatremia. Given these risks, the use of monopolar systems is generally discouraged, although they remain in use in many hospital-based settings (Vilos et al.,).

Patient Selection

Appropriate patient selection is essential to ensure comfort and procedural success when establishing an office hysteroscopy program. Patient-related factors associated with increased discomfort include nulliparity, the presence of cervical pathology, and longer procedure duration. For this reason, clinicians may find it helpful to begin with diagnostic hysteroscopy in multiparous patients without cervical abnormalities to build experience and confidence before advancing to operative procedures (Wygant et al., 2020).

Analgesia, Local Anesthesia, and Sedation

Analgesia:

Local anesthesia:

Routine cervical dilatation is associated with pain, vasovagal reactions, and uterine trauma, and should therefore be avoided. Cervical dilatation to facilitate the insertion of an outpatient hysteroscope is unnecessary in most procedures.

Cervical dilatation generally requires local cervical anesthesia. Standard protocols regarding the type, maximum dosage, and route of administration of anesthetic should be developed and implemented to help recognize and prevent rare but potentially serious adverse effects resulting from systemic vascular absorption. Instillation of a local anesthetic into the cervical canal may reduce the incidence of vasovagal reactions. However, it does not reduce the pain during diagnostic outpatient hysteroscopy. Topical application of a local anesthetic to the ectocervix should be considered when application of a cervical tenaculum is necessary. Application of a local anesthetic to or around the cervix (paracervical block with 8-11 mL of 1% lidocaine) may reduce the pain experienced during outpatient diagnostic hysteroscopy. In postmenopausal women, routine administration of intracervical or paracervical local anesthetic should be considered (De Silva et al., 2021).

Increasing the use of the vaginoscopic technique and decreasing the diameter of hysteroscopes may diminish the advantages of intracervical or paracervical anesthesia. Routine administration of intracervical or paracervical local anesthetic should be used when larger diameter hysteroscopes are being employed (outer diameter greater than 5 mm) and when the need for cervical dilatation is anticipated (e. g., cervical stenosis). The routine administration of intracervical or paracervical local anesthetic is not indicated to reduce the incidence of vasovagal reactions ("The Use of Hysteroscopy for the Diagnosis and Treatment of Intrauterine Pathology: ACOG Committee Opinion, Number 800, " 2020).

Sedation:

Sedation should not be routinely used in outpatient hysteroscopic procedures as it provides no advantage in terms of pain control or patient satisfaction over local anesthesia (Cornelissen et al., 2021).

Cervical preparation and cervical dilatation:

There is conflicting or insufficient evidence regarding routine cervical preparation or ripening prior to diagnostic or operative hysteroscopy. However, each has shown promising effects. For patients expected to have cervical stenosis or severe pain, cervical preparation should be considered, and the potential benefits of a drug must be weighed against the increased risk of side effects (Peene et al., 2023).

One option that has been widely evaluated regarding dosage, route of administration, and effects is prostaglandins, such as misoprostol. For hysteroscopy in the operating room or the office setting, misoprostol has been investigated at various dosages, most frequently 200-400 µg, alone or with vaginal estrogen, and at different administration routes, including sublingual, oral, or vaginal. Compared to a placebo, misoprostol administration has demonstrated improved ease of cervical dilatation or a decreased need for dilatation, resulting in easy cervical entry, decreased pain, and decreased procedure times (Salah et al., 2024).

Another option is the use of osmotic dilators such as laminaria, which have been compared to misoprostol. Osmotic dilators also have improved difficulties regarding mechanical cervical dilation with similar side effects,

but depending on the case, additional hospital visits for osmotic dilator insertion prior to hysteroscopy may be the reason for discarding these options (Nair et al., 2023).

Distension Media and Pain

Selecting an appropriate distension medium for hysteroscopy involves considering visibility, avoiding damage related to the cautery, cost, and safety. The ideal medium should be non-toxic, non-allergenic, non-hemolytic, and quickly removed from the body. To assess the entire uterine cavity, it is essential to use a distension medium that expands it adequately. However, it is important to apply minimal pressure to avoid excessive distension of the uterus, which can cause pain (De Silva et al., 2024).

Distension media and pain:

Visualization:

Association with operative time:

In outpatient hysteroscopy, where the procedure must be completed quickly without anesthesia, the use of saline, which provides clear visualization, and was associated with shorter procedure times (D'Urso et al., 2023).

Selection of expansion media in surgical outpatient hysteroscopy:

Adverse Effects and Prevention

To prevent fluid overload, isotonic electrolyte solutions can be used and preoperative intravenous fluids limited. In cases in which large fibroids need to be resected, the procedure should be performed after adequate anesthesia, and the solution levels should be continuously monitored during the procedure.

Conventional Speculum-Assisted Technique

The conventional technique involves the use of a vaginal speculum to expose the cervix, followed by cleansing of the cervix and vagina with an antiseptic solution. A cervical tenaculum may be applied to stabilize the cervix and align the cervical canal with the uterine cavity.

Gradual cervical dilatation may be required, especially in nulliparous or postmenopausal women. The hysteroscope is then introduced through the cervical canal into the uterine cavity.

Although this method provides good control and visualization, it may be associated with patient discomfort due to the use of the speculum and tenaculum (Moini & Ferdowsi, 2024; ACOG, 2020).

Vaginoscopic No-Touch Technique

Vaginoscopy:

Vaginoscopy is a technique in which a hysteroscope is inserted to observe the vagina, cervix, and uterine cavity without using a vaginal speculum or cervical tenaculum. Small-diameter (less than or equal to 3.5 mm) rigid or flexible hysteroscopes are suitable instruments for vaginoscopic procedures. By tilting the table backward, expansion of the vaginal canal through the use of normal saline enables simultaneous visualization of the cervix and vagina; then, the scope proceeds through the cervical canal and enters the uterine cavity. Fluid leakage from the vagina can be reduced by manually compressing the labial tissue to narrow the vaginal introitus. As this technique is feasible without cervical preparation, it can be useful for examining children or nulliparous patients without concerns of hymen injury (De Silva et al., 2020).

Vaginoscopy should be the standard technique for outpatient diagnostic hysteroscopy and may be the preferred method, especially in cases where inserting a vaginal speculum is expected to be challenging. Its feasibility was reported to range from 83% to 98%, and no significant difference was found in the number of failed procedures when compared with traditional hysteroscopy (Jeong et al.,).

Complications of Office Hysteroscopy

Vasovagal syncope:

As vasovagal syncope is the most common complication during office hysteroscopy, physicians should prepare for its management. The vasovagal reflex commonly occurs when the cervix is dilated or when the hysteroscope is passed through it. The first step, when a patient complains of prodromal symptoms (e. g., warmth, nausea) and when vital signs show a decrease in blood pressure and/or bradycardia, is to pause the procedure and assess the airway, breathing, and circulation. In this situation, the patient is placed in the Trendelenburg position to increase central blood volume and cardiac output (Rodriguez et al., 2022).

Cervical trauma:

Uterine perforation:

Fluid overload:

The fluid deficit is carefully calculated intraoperatively to quantify the amount of fluid that the patient is absorbing into the circulation. Of particular concern is the risk of hyponatremia and resulting cerebral edema, especially when electrolyte-free hypotonic solutions are used. Cerebral edema may manifest with symptoms of nausea and vomiting, dizziness, shortness of breath, or headache. The mechanism of fluid absorption involves the amount of intrauterine pressure created by hysteroscopic fluid management systems and the venous absorption of distending media (Vilos et al.,).

Embolism:

Carbon dioxide embolism is a rare but serious complication that can occur when carbon dioxide is used as the uterine distension medium during hysteroscopy. If it develops, the consequences may be catastrophic due to the risk of acute cardiac failure and possible death. Reported rates of air embolism with carbon dioxide vary widely, indicating an unpredictable risk profile (Manchanda et al., 2022).

Delayed complications:

The incidence of infections was reported to be 2/1, 000 in more than 4, 000 diagnostic hysteroscopies. Acute pelvic inflammatory disease following hysteroscopic surgery is rare. Diagnosis is based on classic signs and symptoms, and treatment should be administered using appropriate antibiotics. Vaginal discharge is a common self-limiting symptom after any ablative procedure and can be prolonged for 2 or 3 weeks. Patients should alert their healthcare providers if the vaginal discharge becomes offensive or if they develop pyrexia, heavy bleeding, or severe lower abdominal pain.

Intrauterine adhesions are common, especially after myomectomy, when two fibroids are situated on opposing uterine walls. An intrauterine device insertion and 2 months of estrogen plus progesterone administration, such as combined oral contraceptives, can help prevent adhesion formation (Jeong et al.,).

Surgical Approach and Patient Satisfaction

Office hysteroscopy can be employed in several of the following scenarios: (1) to evaluate for structural uterine causes underlying patient symptoms or conditions (e. g., miscarriage or recurrent pregnancy loss) and (2) to further evaluate and treat an abnormal finding on TVUS or saline-infused sonography. In both cases, the office hysteroscopy procedure can be used as a “see and treat” modality, whereby diagnosis and treatment occur simultaneously. In cases where the intrauterine pathology is not amenable for treatment in-office (e. g., type 3 uterine fibroids or large type 1 and 2 submucosal fibroids), the procedure serves as a diagnostic tool with the added benefit of providing vital information for pre-operative planning to optimize the time spent in the operating room (Orlando & Bradley, 2022).

In cases where patient discomfort is suspected or there is low suspicion of needing operative intervention, it is recommended to initiate the procedure with a 30° 2. 8-mm diagnostic hysteroscope. The small size of the scope minimizes patient discomfort by allowing for hydrodilatation and passage through the internal cervical os with a device smaller than an endometrial biopsy pipelle. After advancing the scope through the cervical os into the

uterine cavity, the presence, location, and degree of uterine pathology can be assessed. If an operative intervention is required, the scope can be removed, and a continuous-flow operating sheath or additional hysteroscope can easily be added, which allows for the passage of semi-flexible 5-Fr instruments. If necessary, discomfort is minimized via serial hydrodilatation of the cervix by upsizing it to the larger operative scope (Wright et al., 2024).

In cases where there is a high suspicion of uterine pathology requiring operative intervention or in which cervical stenosis is not suspected (e. g., multiparous patients), the authors recommend starting with a rigid operative hysteroscope, which will allow for a quick introduction of operative instruments (Figueiredo & Silva, 2021).

While provider comfort, technique, and skill level vary, type 1 and 2 submucosal fibroids are admittedly more challenging to treat in the office. These may require staged procedures to achieve complete resection. The time interval between procedures allows the uterus to contract and push the fibroid further into the cavity, making it more like a type 1 or type 0 fibroid, which avoids touching more sensitive myometrium (Echeng et al., 2024).

Patient Satisfaction:

Office hysteroscopy has been shown to be both effective and highly acceptable to patients. Women undergoing hysteroscopic polypectomy in the office setting report a strong preference for this approach compared with operating room-based procedures. In addition, office hysteroscopy is associated with reduced postoperative analgesic requirements, shorter time away from home, and faster recovery, contributing to overall high patient satisfaction (Wright et al., 2024).

Training Considerations

The lack of training in residency and physician discomfort with performing office hysteroscopy may be mitigated by simulation. Various models have been created to simulate hysteroscopy, but more research is needed to determine their usefulness in clinical practice (Gambadauro et al., 2018). Many models exist, using various animal and vegetable components, synthetic uteri, and virtual reality. The American College of Obstetricians and Gynecologists (ACOG) has developed a training program for residents in hysteroscopy using a synthetic uterine model and a vegetable model. This program aims to enhance trainee skills and knowledge in various aspects, such as hysteroscope assembly, maneuvering the hysteroscope, and using operative tools. Virtual models, such as the HystSim (VirtaMed, Zurich, Switzerland), have advanced in realism and now offer various treatments. However, these models still need to undergo additional validation before they can be included in standardized courses, and they may be cost-prohibitive to obtain outside of simulation centers (Vitale, Caruso, et al., 2020).

OBGYN specialist providers skilled in performing hysteroscopic procedures in an operative suite under anesthesia can train to transition to an office setting by using vaginoscopy under anesthesia to increase proficiency in entry into the uterine cavity. Once in the uterine cavity, The operator can complete the procedure quickly and with minimal movement. Additionally, physicians can use the same equipment in the OR as they do in the office to become familiar and comfortable with the usage. Physicians can start by selecting patients who are at low risk for discomfort and are motivated to have a procedure in the office. Early successes will translate into increasing comfort with more advanced procedures (Wright et al., 2024).

Strategies for Reducing Pain

- 1- No touch technique: performing a no-touch approach (direct entry with vaginoscopy and hydrodistension of the cervix for dilation, while avoiding the use of speculum and tenaculum) and the use of small caliber instruments. Moreover, normal saline has been shown to be more comfortable and safer than carbon dioxide and glycine as distension medium. Although it is thought that warming the distension fluid to physiological temperature (37. 5°C) to reduce pain perception, it has not been proven (Riemma et al., 2020).
- 2- A smaller outer diameter of the hysteroscope decreases pain perceived by the patients. Technological improvements have enabled minimization of the caliber of hysteroscopes (mini-hysteroscopes ≤ 3.5 mm) and

instruments. Reduction in outer diameter by 1 mm or 2 mm as well as reduction in total hysteroscope size reduces the section of area of the instrument by 50–75%. The passage of the minihysteroscope through the cervical canal is consequently smoother, causing less pain. Flexible hysteroscopes have also been developed, making it easier to follow the canal pathway. However, this no-touch technique is not always feasible, and even when it is possible, it is still sometimes painful. For this reason, identification of risk factors for a painful procedure has to be done (Deo et al., 2021).

- 3- Procedure-related risk factors for pain during hysteroscopy: are resection of polyps larger than 2.2 cm, and long procedures (>15 minutes). 30% more risk of pain when procedures exceed 3 minutes. Protective factors against unacceptable pain are a higher degree of hysteroscopist experience (reducing the risk by half), . Patients with high risk factors of suffering a painful procedure may be candidates for anesthesia (Abis et al., 2020).
 - 4- Controlling anxiety: has a role in pain perception. Methods for controlling anxiety have been proposed to reduce pain perception. Reducing waiting time has a statistically significant positive correlation, even if weak, with pain perception during hysteroscopy ($r=0.45$; $p < 0.01$). However, anxiety per se, measured by values of anxiety state (State-Trait Anxiety Inventory scales), was not significantly correlated with pain (Samy et al., 2020).
- A randomized trial using music to reduce anxiety during hysteroscopy has proven that it decreases anxiety and pain perceived during the procedure [VAS score 4.83 (no music group) vs. 2.95 (music group); $p < 0.001$]. It also reduces systolic blood pressure and heart rate and, distracts the patient from anxiety-provoking thoughts and makes them focus in more pleasant stimuli (Ghamry et al., 2020).
- 5- Anesthetic and analgesic methods reported in literature for outpatient hysteroscopy: include oral and intravenous analgesia; nonopioid analgesics such as nonsteroidal anti-inflammatory drugs (NSAIDs) or paracetamol; opioid analgesics; intrauterine, paracervical, transcervical, or uterosacral local anesthetics; and spray, gel, and cream topical anesthetics (Vitale, Bruni, et al., 2020).

NSAIDs are systemic analgesics that decrease uterine activity and pain by inhibiting cyclooxygenase and reducing circulating prostaglandins. They include naproxen, diclofenac, ibuprofen, and ketorolac (Riemma et al., 2020).

However, studies throw controversial results regarding the use of NSAIDs in hysteroscopic procedures. No beneficial effects from oral diclofenac given 1–2 hours before the procedure during and after conventional hysteroscopy. It was also unable to demonstrate a benefit in pain reduction with the use of 100-mg rectal diclofenac 60 minutes before outpatient hysteroscopy in a randomized controlled trial in nulliparous infertile women. Ketoprofen has also failed to decrease intraoperative pain, but seemed effective for postoperative pain after hysteroscopy. Ketoprofen VAS scores during and immediately after hysteroscopy were higher than misoprostol VAS scores in a randomized controlled trial (Vitale, Bruni, et al., 2020).

Acetaminophen also inhibits cyclooxygenase, acting in the central nervous system instead of the periphery. It is a good option in cases of allergy or intolerance to NSAIDs. Mefenamic acid, a prostaglandin synthesis inhibitor, also reduces circulating prostaglandins. Controversially, a randomized placebo controlled trial concluded that mefenamic acid (500 mg) given 1 hour before outpatient hysteroscopy is not superior to placebo in reducing discomfort during the procedure but significantly reduced postoperative pain (30 minutes and 60 minutes after the procedure) (Schutyser et al., 2021).

A Cochrane Review meta-analysis, Pain relief for outpatient hysteroscopy, did not demonstrate any significant reduction with NSAIDs or opioid analgesics during or after the procedure (Schutyser et al., 2021).

Opioids have also been used for pain treatment in hysteroscopy. They produce analgesic effects through interaction with endogenous opioid mu receptors. They provide analgesic effects and cause euphoria.

The most frequently used opioid for gynecologic procedures is fentanyl, which causes moderate sedation with a rapid onset and brief duration. It can be reversed by naloxone. Sublingual buprenorphine is not only unhelpful in

relieving pain associated with hysteroscopy but is also associated with significant adverse reactions. It reported 38. 8% of adverse reactions, including 5% drowsiness, 2. 5% nausea or vomiting, and 31. 3% of both. The high incidence of these adverse effects limits the use of opioids in the outpatient setting (Bennett et al., 2019).

Local anesthesia: according to the aforementioned Cochrane Review, only local anesthetics provide a significant reduction in the mean pain scores during and 30 minutes after the procedure. They include paracervical, intracervical, transcervical, or uterosacral block and topical application in spray, cream, or gel form. Intracervical and paracervical injections of local anesthetic significantly reduced pain in women undergoing outpatient hysteroscopy, whereas transcervical and topical application did not. Paracervical injection was significantly superior to the other anesthetic methods. They also concluded that local anesthetics did not have a significant effect on the incidence of vasovagal episodes (Schutyser et al., 2021).

Munro and Brooks' review of local anesthesia for office hysteroscopy also supports that a consistent positive anesthetic effect is only demonstrated with paracervical anesthesia. Five of the six randomized clinical trials that their review included demonstrated reduced pain in patients who received paracervical anesthesia compared with placebo. Paracervical anesthesia is also effective in hysteroscopic tubal sterilization, but only for passage of the hysteroscope through the cervical canal and for cervical manipulation, not for tubal insertion of the devices (Schutyser et al., 2021).

Although the Cochrane Review of paracervical local anesthesia for uterine intervention does not recommend the use of paracervical injection because it does not reduce intraoperative pain, this does not apply to office hysteroscopy, as the review includes procedures that require cervical dilation. Exclusively local anesthesia is not recommended by the Cochrane Review if cervical dilation is needed. Combined cervical block protocols have been studied for resection of polyps and myomas by hysteroscopy (Vitale et al., 2021).

A randomized trial found a statistically significant difference in pain score between a group receiving paracervical and intracervical block and a group only receiving intracervical block (1. 3 vs. 2. 1, respectively). This is supported by another clinical trial, which demonstrated a significant decrease of pain with combined paracervical/intracervical anesthesia during and after 30 minutes of the procedure (Vitale et al., 2021).

The effect of anesthetics and analgesics for pain control in outpatient hysteroscopy provide controversial results. The lack of uniformity in the published papers makes it difficult to draw conclusions. Although ambitious, this review's aim is probably too wide, attempting to assess the subject of analgesia for hysteroscopy, which presents many alternatives and no clear conclusions (Vitale et al., 2021).

Future research should be directed to identifying the best analgesic method for office hysteroscopy, to avoid heterogeneity and the use of ineffective methods that can even cause morbidity, and to unification of doses and techniques that could generate international guidelines for this procedure that has no standards for pain control (Schutyser et al., 2021).

Nonpharmacological methods could also be useful in reducing hysteroscopy-related pain, such as a no-touch approach with vaginoscopy and minihysteroscopes, reducing waiting time before hysteroscopy, and the use of music during the procedure to reduce anxiety. Risk and protective factors of suffering pain during outpatient hysteroscopy are important for identifying patients who are susceptible to receiving anesthesia. Risk factors include menopause, nulliparity, dysmenorrhea, and a longer time of procedure. Experience of the hysteroscopist is a significant protective factor against pain perception during hysteroscopy (Schutyser et al., 2021).

References

1. Abis, P., Bigozzi, M. A., Dotto, J., Petriglia, C., Neri, M., Cornacchia, S., Lo Cane, F., Angioni, S., & Loddo, A. (2020). Pain Management During Office Hysteroscopy: A Survey of Hysteroscopists. *Surgical Technology International*, 37, 161-166.
2. Akizuki, H., Uno, A., Arai, K., Morioka, S., Ohyama, S., Nishiike, S., Tamura, K., & Takeda, N. (2005). Effects of immersion in virtual reality on postural control. *Neuroscience letters*, 379(1), 23-26.
3. American College of Obstetricians and Gynecologists (ACOG). (2020). Practice Bulletin: Hysteroscopy.

4. Annan, J. J. K., Dah, A. K., Dickson, F. D., Ken-Amoah, S., Tawiah, A., Tettey, H., & Yeboah, A. (2024). Minimal Access Gynaecological Surgery (MAGS).
5. Bennett, A., Lepage, C., Thavorn, K., Fergusson, D., Murnaghan, O., Coyle, D., & Singh, S. S. (2019). Effectiveness of outpatient versus operating room hysteroscopy for the diagnosis and treatment of uterine conditions: a systematic review and meta-analysis. *Journal of Obstetrics and Gynaecology Canada*, 41(7), 930-941.
6. Bettocchi, S., & Selvaggi, L. (1997). A vaginoscopic approach to reduce the pain of office hysteroscopy. *The Journal of the American Association of Gynecologic Laparoscopists*, 4(2), 255-258.
7. Buckley, H., & Fox, H. (2024). Biopsy pathology of the endometrium. CRC Press.
8. Buzzaccarini, G., Alonso Pacheco, L., Vitagliano, A., Haimovich, S., Chiantera, V., Török, P., Vitale, S. G., Laganà, A. S., & Carugno, J. (2022). Pain management during office hysteroscopy: an evidence-based approach. *Medicina*, 58(8), 1132.
9. Chohan, A. S., & Davidow, E. B. (2024). Clinical pharmacology and administration of fluid, electrolyte, and blood component solutions. *Veterinary Anesthesia and Analgesia: The Sixth Edition of Lumb and Jones*, 580-612.
10. Cornelissen, L. G., Kortekaas, J. C., Schoot, B. C., & van Vliet, H. A. (2021). Four year evaluation of therapeutic hysteroscopy under procedural sedation in an outpatient clinic. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 261, 65-71.
11. D'Urso, V., Gulino, F. A., Incognito, G. G., Cimino, M., Dilisi, V., Di Stefano, A., Gulisano, M., Cannone, F., Capriglione, S., & Palumbo, M. (2023). Hysteroscopic findings and operative treatment: all at once? *Journal of Clinical Medicine*, 12(13), 4232.
12. De Silva, P. M., Carnegy, A., Smith, P. P., & Clark, T. J. (2020). Vaginoscopy for office hysteroscopy: A systematic review & meta-analysis. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 252, 278-285.
13. De Silva, P. M., et al. (2020). Vaginoscopy in modern gynecological practice. *Journal of Minimally Invasive Gynecology*.
14. De Silva, P. M., Smith, P. P., Cooper, N. A. M., & Clark, T. J. (2024). Outpatient Hysteroscopy: (Green-top Guideline no. 59). *BJOG*, 131(13), e86-e110. <https://doi.org/10.1111/1471-0528.17907>.
15. De Silva, P. M., Smith, P. P., Cooper, N. A., Clark, T. J., Obstetricians, R. C. o., & Gynaecologists. (2024). Outpatient Hysteroscopy: (Green-top Guideline no. 59). In (Vol. 131, pp. e86-e110): Wiley Online Library.
16. De Silva, P. M., Stevenson, H., Smith, P. P., & Clark, T. J. (2021). A systematic review of the effect of type, pressure, and temperature of the distension medium on pain during office hysteroscopy. *Journal of Minimally Invasive Gynecology*, 28(6), 1148-1159. e1142.
17. De Silva, P., Wilson, L., Carnegy, A., Smith, P., & Clark, T. (2021). Cervical dilatation and preparation prior to outpatient hysteroscopy: a systematic review and meta-analysis. *BJOG: An International Journal of Obstetrics & Gynaecology*, 128(7), 1112-1123.
18. Deo, N., Khan, K. S., Mak, J., Allotey, J., Gonzalez Carreras, F. J., Fusari, G., & Benn, J. (2021). Virtual reality for acute pain in outpatient hysteroscopy: a randomised controlled trial. *BJOG: An International Journal of Obstetrics & Gynaecology*, 128(1), 87-95.
19. Echeng, N., Burrell, D., & Zaluski, K. (2024). Optimizing operative hysteroscopy in the office setting: updated techniques and technology. *Topics in Obstetrics & Gynecology*, 44(2), 1-7.
20. Feng, L. (2022). Distention Medium in Hysteroscopy. In *Practical Manual of Hysteroscopy* (pp. 51-63). Springer.
21. Figueiredo, C. P., & Silva, D. R. (2021). Study of the Variety of Pathologies Diagnosed by Hysteroscopy understood between the Years from 2019 to 2020: Case Study.
22. Gambadauro, P., Milenkovic, M., & Hadlaczky, G. (2018). Simulation for Training and Assessment in Hysteroscopy: A Systematic Review. *J Minim Invasive Gynecol*, 25(6), 963-973. <https://doi.org/10.1016/j.jmig.2018.03.024>.
23. Ghamry, N. K., Samy, A., Abdelhakim, A. M., Elgebaly, A., Ibrahim, S., Ahmed, A. A., Abdelbaky, W. H., Abdallah, K. M., Badawy, M. A., & Mohammed, A. H. (2020). Evaluation and ranking of different

- interventions for pain relief during outpatient hysteroscopy: A systematic review and network meta-analysis. *Journal of Obstetrics and Gynaecology Research*, 46(6), 807-827.
24. Göçmen, D. (2024). Perioperative fluid management. In *New Insights in Perioperative Care*. intechopen.
25. Haude, O., Overdijk, L. E., van Kesteren, P. J., Geerts, B. F., & Rademaker, B. M. (2020). Comparing volumetric and biochemical assessment of intravasation caused by hysteroscopic surgery. *Acta Anaesthesiologica Scandinavica*, 64(2), 232-237.
26. Izcara Gual, A. (2024). Revolutionizing Pelvic Exams: A sustainable, patient-centred redesign of the Vaginal Speculum.
27. Liu, X., Lin, B., Quan, Y., Liu, X., Lin, B., Liu, X., Quan, Y., & Liu, X. (2022). Equipment and Instruments for Hysteroscopy. In *Practical Manual of Hysteroscopy* (pp. 7-27). Springer.
28. Louis, F., & Lulla, C. P. (2020). Hysteroscopy is superior to 3D ultrasound in gynecological diagnosis. *The Journal of Obstetrics and Gynecology of India*, 70(6), 447-461.
29. Manchanda, R., Valenti, G., Rathore, A., Carugno, J., Török, P., Riemma, G., De Angelis, M. C., Vilos, G. A., Pacheco, L. A., & Vitale, S. G. (2022). Distension media delivery systems in hysteroscopy: past, present and future. *Minimally Invasive Therapy & Allied Technologies*, 31(1), 1-12.
30. Marchand, G. J., Kurdi, W., Sainz, K., Maarouf, H., Ware, K., Masoud, A. T., King, A., Ruther, S., Brazil, G., & Cieminski, K. (2022). Efficacy of hyoscine in pain management during hysteroscopy: a systematic review and meta-analysis. *Journal of the Turkish German Gynecological Association*, 23(1), 51.
31. Metheny, N. (2012). *Fluid and electrolyte balance*. Jones & Bartlett Publishers.
32. Moini, A., & Ferdowsi, F. (2024). *Hysteroscopy: Principles and practice*.
33. Moini, J., & Ferdowsi, K. (2024). *Electrolyte and Acid-Base Imbalance*. In *Handbook of Nutritional Disorders* (pp. 355-368). CRC Press.
34. Muzii, L., Di Donato, V., Di Tucci, C., Di Pinto, A., Casciulli, G., Monti, M., Patacchiola, F., & Panici, P. B. (2020). Efficacy of antibiotic prophylaxis for hysteroscopy: a meta-analysis of randomized trials. *Journal of Minimally Invasive Gynecology*, 27(1), 29-37.
35. Nair, A. K., Subbaiah, M., & Maurya, D. K. (2023). Comparison of efficacy of vaginal Misoprostol versus a synthetic osmotic dilator (Dilapan-S) for cervical Preparation before operative hysteroscopy: A randomized controlled study. *Gynecology and minimally invasive therapy*, 12(4), 225-229.
36. Nair, V. G., Mahajan, R., Aziz, A., & Tiwari, S. (2020). Effectiveness of warm saline for pain relief in office hysteroscopy: a prospective randomized control trial. *Int J Clin Obstet Gynaecol*, * 4*(4), 85-88.
37. Ogelle, O. M., Onwusulu, D. N., & Ezeama, C. O. (2022). Distension Media in Hysteroscopy. In *Gynaecological Endoscopic Surgery: Basic Concepts* (pp. 297-306). Springer.
38. Orlando, M. S., & Bradley, L. D. (2022). Implementation of office hysteroscopy for the evaluation and treatment of intrauterine pathology. *Obstetrics & Gynecology*, 140(3), 499-513.
39. Park, M. G., & Isaacson, K. B. (2022). Hysteroscopic management of intrauterine disorders: polypectomy, myomectomy, endometrial ablation, adhesiolysis, and removal of uterine septum. In *Clinical reproductive medicine and surgery: a practical guide* (pp. 429-458). Springer.
40. Peene, L., Cohen, S. P., Brouwer, B., James, R., Wolff, A., Van Boxem, K., & Van Zundert, J. (2023). 2. Cervical radicular pain. *Pain Practice*, 23(7), 800-817.
41. Phillips, K., & Clark, T. J. (2020). Complications of Hysteroscopic Surgery. *Diagnostic and Operative Hysteroscopy*, 109.
42. Raymond, L., & Lentz, G. M. (2021). Endoscopy in Minimally Invasive Gynecologic. *Comprehensive Gynecology*, 188.
43. Riemma, G., Schiattarella, A., Colacurci, N., Vitale, S. G., Cianci, S., Cianci, A., & De Franciscis, P. (2020). Pharmacological and non-pharmacological pain relief for office hysteroscopy: an up-to-date review. *Climacteric*, 23(4), 376-383.
44. Riemma, G., Vitale, S. G., Manchanda, R., Rathore, A., Török, P., De Angelis, C., Urman, B., Sareri, M. I., La Verde, M., & Carugno, J. (2022). The role of hysteroscopy in reproductive surgery: Today and tomorrow. *Journal of gynecology obstetrics and human reproduction*, 51(4), 102350.
45. Rodriguez, S., Haimovich, S., Vitale, S. G., Alonso, L., & Carugno, J. (2022). Vasovagal syncope during office hysteroscopy—a frequently overlooked unpleasant complication. *Medicina*, 58(11), 1626.

46. Salah, N., Maged, A. M., Mahmoud, S. I., Bassiouny, N., Mohsen, R. A., AbdelAziz, S., & Ragab, W. S. (2024). The use of misoprostol before hysteroscopy in Nulliparous women: a systematic review and meta-analysis of randomized controlled trials. *BMC pregnancy and childbirth*, 24(1), 796.
47. Schutyser, V., Buyl, R., De Vos, M., Tournaye, H., & Blockeel, C. (2021). Clinical efficacy of virtual reality for acute pain and anxiety management during outpatient hysteroscopy and endometrial biopsy in subfertile patients. *Human Reproduction*.
48. Shields, J., Dilday, E., Chang, S., & Kho, K. (2018). Moving hysteroscopy from the office to the operating room: A comparison of clinical outcomes and resource utilization. *Proceedings of the High Value Practice Academic Alliance National Conference*, Baltimore, MD, USA.
49. Solone, M., & Hillard, P. J. A. (2020). *Adult gynecology: reproductive years*.
50. The Use of Hysteroscopy for the Diagnosis and Treatment of Intrauterine Pathology: ACOG Committee Opinion, Number 800. (2020). *Obstet Gynecol*, 135(3), e138-e148. <https://doi.org/10.1097/aog.0000000000003712>.
51. Tsonis, O., Gkrozou, F., Lavasidis, L., & Paschopoulos, M. (2023). The history of hysteroscopy as an endoscopic method. *GinPolMedProject*, 18, 1-6.
52. Umranikar, S., Clark, T. J., Saridogan, E., Miligkos, D., Arambage, K., Torbe, E., Campo, R., Di Spiezio Sardo, A., Tanos, V., & Grimbizis, G. (2016). BSGE/ESGE guideline on management of fluid distension media in operative hysteroscopy. *Gynecol Surg*, 13(4), 289-303. <https://doi.org/10.1007/s10397-016-0983-z>.
53. van Wessel, S., Hamerlynck, T., van Vliet, H., Schoot, B., & Weyers, S. (2023). Manual morcellation (Resectr™ 9Fr) vs electromechanical morcellation (TruClear™) for hysteroscopic polypectomy: A randomized controlled non-inferiority trial. *Acta Obstet Gynecol Scand*, 102(2), 209-217. <https://doi.org/10.1111/aogs.14493>.
54. Vitale, S. G., Bruni, S., Chiofalo, B., Riemma, G., & Lasmar, R. B. (2020). Updates in office hysteroscopy: a practical decalogue to perform a correct procedure. *Updates in Surgery*, 72(4), 967-976.
55. Vitale, S. G., Caruso, S., Vitagliano, A., Vilos, G., Di Gregorio, L. M., Zizolfi, B., Tesarik, J., & Cianci, A. (2020). The value of virtual reality simulators in hysteroscopy and training capacity: a systematic review. *Minimally Invasive Therapy & Allied Technologies*, 29(4), 185-193.
56. Vitale, S. G., Della Corte, L., Ciebiera, M., Carugno, J., Riemma, G., Lasmar, R. B., Lasmar, B. P., Kahramanoglu, I., Urman, B., & Mikuš, M. (2023). Hysteroscopic endometrial ablation: from indications to instrumentation and techniques—a call to action. *Diagnostics*, 13(3), 339.
57. Vitale, S. G., Giannini, A., Carugno, J., van Herendael, B., Riemma, G., Pacheco, L. A., Drizi, A., Mereu, L., Bettocchi, S., Angioni, S., & Haimovich, S. (2024). Hysteroscopy: where did we start, and where are we now? The compelling story of what many considered the "Cinderella" of gynecological endoscopy. *Arch Gynecol Obstet*, 310(4), 1877-1888. <https://doi.org/10.1007/s00404-024-07677-x>.
58. Wang, M. -T., Chang, C. -C., Hsieh, M. -H., Chang, C. -W., Chiang, Y. -H. F., & Tsai, H. -C. (2020). Operative hysteroscopy intravascular absorption syndrome is more than just the gynecological transurethral resection of the prostate syndrome: a case series and literature review. *Taiwanese Journal of Obstetrics and Gynecology*, 59(5), 748-753.
59. Wright, K. N., Hamilton, K., & Kosturakis, A. (2024). An Overview of Office Hysteroscopy. *Current Obstetrics and Gynecology Reports*, 13(2), 88-96.
60. Wygant, J. N., Laughlin-Tommaso, S. K., Green, I. C., Price, K. R., Burnett, T. L., Hopkins, M. R., Famuyide, A. O., & Breitkopf, D. M. (2020). Improving patient access through office hysteroscopy clinic redesign. *Journal of the American Association of Nurse Practitioners*, 32(4), 316-322.
61. Xia, E., Valle, R. F., Huang, X., Yu, D., Liu, Y., Lin, B., Xia, E., Valle, R. F., Xia, E., & Huang, X. (2022). Complications of hysteroscopic surgery. In *Practical manual of hysteroscopy* (pp. 365-420). Springer.
62. Xia, E., Yu, D., Xia, E., Yu, D., & Xia, E. (2022). Diagnostic Hysteroscopy. In *Practical Manual of Hysteroscopy* (pp. 73-181). Springer.
63. Zelivianskaia, A., & Robinson III, J. K. (2022). *Office Hysteroscopy*.