MINIMALLY INVASIVE GYNECOLOGIC SURGERY

EVIDENCE-BASED LAPAROSCOPIC, HYSTEROSONIC AND ROBOTIC PROCEDURES

Edited by

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Chapter 5

Hysteroscopy – instrumentation, office and operating room set-up

Morris Wortman

INTRODUCTION

Instrumentation for diagnostic and operative hysteroscopy has made significant improvements in the past quarter century. Prior to late 1980s, the hysteroscope was generally considered a surgical tool in pursuit of an indication. With the advent of endometrial ablation techniques employing both laser (Goldrath 1981) and electrosurgery (DeCherney & Polan 1983, Vancailie et al. 1989), the hysteroscope had become an indispensable part of the minimally invasive surgical armamentarium for gynecologists. The modern hysteroscope is an essential component in numerous techniques including endometrial ablation (Vancailie et al. 1989) and resection (Magos et al. 1991), myomectomy and polypectomy (Gimpelson 2000), as well as tubal sterilization (Kerin et al. 2003) and adhesiolysis (March et al. 1978). Recent refinements – including smaller diameter hysteroscopes, resectoscopes, and morcellators – have even allowed the migration of some hospital-based procedures into an office setting (Wortman 2010, Wortman et al. 2013). This chapter will describe the range of instrumentation available for diagnostic hysteroscopy in an office-based setting as well as the equipment for operative hysteroscopy in a hospital or outpatient setting. The author will also suggest an approach to instrument organization or ‘set-up’ that he has developed over the past 30 years.

INSTRUMENTATION FOR OFFICE-BASED DIAGNOSTIC HYSTEROSCOPY

Although diagnostic hysteroscopy can be performed in an office or ambulatory surgical unit (ASU), we will focus on the instrumentation and set-up for office-based procedures. There are many instances when diagnostic hysteroscopy is more appropriately performed in a hospital or ambulatory surgery center – this is particularly true for the medically compromised patient or when a hysteroscopy serves as a part of a more complex surgical procedure that warrants the ASU environment. The information contained herein is easily transferable to the ASU setting.

The author will address the separate components of a diagnostic hysteroscopy system and how they can be assembled in a manner that allows for efficient use of personnel and equipment. Additionally, several newer and important products will be reviewed that effectively combine many individual components in order to simplify office-based hysteroscopy.

There are three types of hysteroscopic optical devices available.

Rod-lens hysteroscope

The first, the ‘rod-lens’ hysteroscope (RLH), shown in Figure 5.1, has been used for many decades and consists of a series of solid lenses, an angle of view prism, and an illumination fiber placed within a 30 cm tube. The RLH varies from 1.9 to 4.0 mm in outside diameter and its angle of view prism varies from 12 to 30. The RLH is sturdy, inexpensive, and reusable while providing optical clarity unmatched by any other category of hysteroscopic optical device.

The RLH’s angle of view prism allows the operator easy visualization of the anterior, posterior, and lateral walls by simply rotating the hysteroscope on its own axis, thereby minimizing the need for aggressive movements within the uterine cavity. The classic RLH is generally assembled with an inflow (internal) and outflow (external) sheath in order to facilitate the continuous flow of irrigation fluid.

Flexible fiberoptic hysteroscope

The second type of hysteroscopic optical device (the flexible fiberoptic hysteroscope (FFH), shown in Figure 5.2) has a working length varying from 24 to 29 cm, an outside diameter of 3.1–4.9 mm,
and a 0° viewing angle. Unlike the RLH, the outside diameter of the FFH represents the entire diameter of the scope, the working channel, and the sheath. Although both RLHs and FFHs can be introduced vaginoscopically (Major et al. 1995) – without the use of a speculum or tenaculum – the ability to angulate the FFH’s tip allows for easier introduction into and through the endocervical canal. The disadvantages of the FFH include its greater cost, diminished optical clarity, and the vigilant care required during sterilization cycles. The FFH is not equipped with a continuous flow sheath limiting its utility in the presence of blood and debris.

**Chip-in-the-tip hysteroscope**

The third hysteroscopic optical device (known as a 'chip-in-the tip' (CIT) hysteroscope) is a recent innovation that mounts a complementary metal-oxide-semiconductor (CMOS) chip onto a semi-rigid cannula. The IDH-4 Invisio Digital Hysteroscope (Olympus, Center Valley, Pennsylvania), is a small diameter (4.0 mm) hysteroscope with a 5 Fr working channel and an inflow port. Additionally, a 5.5 mm outer sheath may be attached to allow continuous flow of distention medium. The digital hysteroscope contains two light-emitting diodes (LEDs) at the tip eliminating the need for an external light source and camera. The flexible tip attached to the rigid insertion portion of the hysteroscope can be deflected 30° to the right and left to optimize the visual field in a variety of clinical settings.

Another example of the CIT hysteroscope (specifically designed for office use) is the EndoSee (EndoSee Corp, Palo Alto, California) shown in Figure 5.3. The EndoSee consists of two parts - a reusable handle or 'mini-Tower' and a single-use semi-rigid steriley packaged cannula. The reusable handle contains an integrated video display and power supply along with video capture capability. The single-use cannulas are semi-rigid and contain a CMOS chip, two LEDs for illumination as well as inflow and outflow ports.
In general, the CIT hysteroscope produces an image that is less optically crisp compared to the RLH. Because the CIT hysteroscope has a fixed focal length, it provides adequate but not superb views. The advantage of the EndoSee hysteroscope is its low acquisition fee and the ability to use it in almost any examination room. Its disposable cannula obviates the need for specialized instrument preparation and sterilization. Finally, the EndoSee even boasts a self-contained image and video capture system.

### Hysteroscopic inflow or ‘inner’ sheath

All hysteroscopes contain a portal that allows for the delivery of distention fluid (usually saline) into the uterine cavity. Some hysteroscopes employ a dedicated inflow sheath (a hollow cylinder) through which the hysteroscope is passed allowing saline to flow between the hysteroscope and the walls of the inner sheath.

In newer hysteroscopes, such as the Campo Compact Hysteroscopy System (Karl Storz Endoscopy, Culver City, California), the inner sheath consists of two parallel channels - one contains the components of an RLH and a second one accommodates the inflow of irrigation fluid. The Campo hysteroscope is based on a 2 mm RLH with an integrated inflow channel - allowing for a combined outside diameter of only 2.9 mm.

Most inner sheaths come in two varieties - those with a dedicated inflow port and those that, in addition, contain an auxiliary working channel. The working channel allows for the introduction of 5 Fr instruments and devices that enable a variety of procedures including tubal occlusion, IUD retrieval, polypectomy, and adhesiolysis.

### Hysteroscopic outer sheath

One of the key requirements for high-quality panoramic hysteroscopy is the continuous flow of low-viscosity distention media, generally saline. Saline is carried into the uterine cavity under pressure but is allowed to egress (along with blood, mucus, and debris) through a dedicated outer sheath. The outer sheath generally contains numerous small perforations that facilitate egress (Figure 5.4).

For diagnostic hysteroscopy, the outer sheath is passively attached to a dedicated flexible tube that carries effluent to a fluid collection container. Active suction should never be used for diagnostic hysteroscopy as it detracts from the development of adequate intrauterine pressure. Finally, not all diagnostic hysteroscopes are equipped with outer sheaths. The FFH is not equipped with an outer sheath while others (in order to reduce the outside diameter) provide it only as an option.

### Light source

Both RLH and FFH require an external light source generally supplied by a 300 W xenon lamp and subsequently transmitted through a flexible fiberoptic cable to the hysteroscope. There are also small self-contained LED systems (Figure 5.5) that attach directly to the light post and obviate the need for a fiberoptic light cord and an expensive external light source. The CIT hysteroscope is equipped with an LED at the tip obviating the need for an external light source.

### ‘Combination’ systems – light source, video camera, and monitor

There are two different types of ‘combination’ systems available today. The first combines a light source, video camera, and monitor into a single unit. An example of this system (the Telepak Hysteroscopy System – Karl Storz Endoscopy, Culver City, California) can accommodate either an RLH or FFH (Figure 5.6). The second system is the EndoSee Hand Tower (EndoSee Corp Palo Alto, California) featuring a ‘mini-tower’ that combines a power source and video monitor with a disposable catheter that contains a light source and CIT hysteroscope (Figure 5.3).

### Image capturing system

It is extremely helpful to have the ability to capture both still images and video as part of hysteroscopic documentation. There are three types of systems available. The first is stand-alone system such as the MediCap (MediCapture Inc Plymouth Meeting, Pennsylvania) that can be used with nearly any commercial medical video system. The second type of image capturing system is one which is already incorporated into some of the costlier video systems and allows images and videos to be downloaded onto a storage device. Finally, both the EndoSee Hand Tower system and the Telepak Hysteroscopy System (Karl Storz...
Endoscopy) have incorporated a video and image capturing system into their design.

### Uterine distention system

Modern hysteroscopes rely exclusively on the use of normal saline for distention. Physiologic saline is well-tolerated, has excellent optical qualities, and offers few problems in the cleaning and maintenance of equipment. There are at least three methods of administering saline for uterine infusion. The first requires the use of a 50 mL syringe and intravenous (IV) tubing. The second is a gravity-fed system utilizing a 500 mL or 1 L bag of saline with IV tubing attached to the hystroscope’s inflow port. Finally, one can place a 1 L bag of saline into a C-Fusor Pressure Infusor (Smiths Medical, Dublin Ohio) and connect urologic tubing between the fluid containment bag and the hystroscope’s inflow port. The latter arrangement is especially useful when the operator is confronted with active uterine bleeding, a patulous cervix, or an enlarged cavity.

### Fluid collection system

A simple office fluid collection system is easily assembled employing a reusable plastic basin and disposable blue pads placed underneath the patient’s buttocks. Fluid is allowed to drain into the bucket, which can be kept on the floor in front of the patient or in a designated examination table drawer.

### Examination table

Simple office-based diagnostic hysteroscopy can be performed using an ordinary examination table. Special stirrups or electrically operated tables are not necessary for the safe and efficient performance of diagnostic hysteroscopy.

### Ancillary equipment

Other useful equipment include an assortment of cervical dilators, flexible plastic cervical or finders, tenacuiae, and a variety of vaginal speculums. Although many hysteroscopies can be performed without a speculum, vaginoscopy is not always possible. If paracervical block is to be used, the author recommends the use of Xylocaine 0.5% along with a 24 gauge spinal needle.

### Ultrasound

The author prefers to have an ultrasound equipped with both transvaginal and abdominal transducers available at the time of hysteroscopy. The reasons are twofold: first, difficult cervical dilations are not uncommon and the ability to perform sonographic guidance at the time of cervical dilatation has virtually eliminated uterine perforation in our practice. Second, ultrasound allows for simultaneous sonohysterography to be performed during selected hysteroscopic examinations. This is especially helpful when assessing submucous leiomyomas that have a large intramural component. Moreover, sonohysterography provides superior information regarding the size of a myoma and its attachment point along with the nature of its relationship to the endometrial cavity.

### Monitoring equipment

Our procedure room is equipped with a pulse oximeter as well as an automated blood pressure recording device.

### Emergency equipment

Table 5.1 contains a list of recommended equipment that should be kept either on an emergency cart or in the procedure room itself.

### SET-UP FOR OFFICE-BASED DIAGNOSTIC HYSTEROSCOPY

Diagnostic hysteroscopy can be performed in almost any standard examination room. Some practitioners prefer to perform them in a designated procedure room, while others prefer to utilize equipment that can be easily moved from room-to-room. The author’s diagnostic hysteroscopy setting is a high-volume office-based surgical practice (Wortman 2010) that provides nearly 400 diagnostic hysteroscopies per year. After years of performing diagnostic hysteroscopy in a fixed procedure room, we now use a portable system that allows us to perform our diagnostic procedures in any of our examination rooms. However, we still employ a designated procedure room for our more challenging diagnostic procedures and all of our surgical ones.

### Designated procedure room

Our procedure room design is based on (Figure 5.7) several important principles:

- **Adequate ingress and egress** are imperative in the event of an emergency that requires patient transfer to a hospital. One must

<table>
<thead>
<tr>
<th>Table 5.1 Emergency equipment list for office hysteroscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oxygen administration equipment</strong></td>
</tr>
<tr>
<td><strong>Oxygen canister, nasal cannulas, bag-valve mask, oral airways</strong></td>
</tr>
<tr>
<td><strong>Defibrillator</strong></td>
</tr>
<tr>
<td><strong>Lactated Ringer’s or normal saline solution with intravenous tubing</strong></td>
</tr>
<tr>
<td><strong>Medications</strong></td>
</tr>
<tr>
<td>- Atropine 0.4 mg/mL</td>
</tr>
<tr>
<td>- Ephedrine ampoules (1 mg/mL) with syringes for SC or IM</td>
</tr>
<tr>
<td>- Diphenhydramine 50 mg/mL</td>
</tr>
<tr>
<td>- Intravenous catheters, lines, and crystalloids</td>
</tr>
<tr>
<td>- Albuterol sulfate 0.083%</td>
</tr>
<tr>
<td>- Romazicon (flumazenil) 0.1 mg/mL 10 mL vial</td>
</tr>
<tr>
<td>- Narcan (naloxone hydrochloride) 0.4 mg/mL</td>
</tr>
</tbody>
</table>

SC, subcutaneous; IM, intramuscular.
Table 5.2 Commercially available uterine distention media

<table>
<thead>
<tr>
<th>Medium</th>
<th>Osmolarity (mOsmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycine 1.5%</td>
<td>200</td>
</tr>
<tr>
<td>Sorbitol 3.3%</td>
<td>185</td>
</tr>
<tr>
<td>Mannitol 5%</td>
<td>275</td>
</tr>
<tr>
<td>Saline 0.9%</td>
<td>308</td>
</tr>
<tr>
<td>Normal serum</td>
<td>285–295</td>
</tr>
</tbody>
</table>

Table 5.3 Suggested instrumentation for ultrasound-guided hysteroscopic surgery

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Specifics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous flow resectoscopes (CFR)</td>
<td>28 Fr CFR with 27 Fr Loops (Monopolar)</td>
</tr>
<tr>
<td></td>
<td>26 Fr CFR with 24 Fr Loops (Monopolar)</td>
</tr>
<tr>
<td></td>
<td>22 Fr CFR with 19 Fr Loops (Monopolar)</td>
</tr>
<tr>
<td></td>
<td>26 Fr CFR with 24 Fr Loops (Bipolar)</td>
</tr>
<tr>
<td></td>
<td>Operating bridge for vasopressin injection needle</td>
</tr>
<tr>
<td>Vasopressin injection needle</td>
<td>40 cm x 21 gauge (Vita Needle Company, Needham, MA)</td>
</tr>
<tr>
<td></td>
<td>N-Trial Intraligamental Syringe (Integra Lifesciences, Rietheim-Weilheim, GE)</td>
</tr>
<tr>
<td>Cervical dilators</td>
<td>Hegar</td>
</tr>
<tr>
<td></td>
<td>Pratt</td>
</tr>
<tr>
<td></td>
<td>Denniston</td>
</tr>
<tr>
<td></td>
<td>Os-finders (Cooper Surgical, Trumbull, CT)</td>
</tr>
<tr>
<td>Forceps</td>
<td>Ovum forceps (7, 10 and 12 mm)</td>
</tr>
<tr>
<td></td>
<td>Sopher forceps (10, 12 and 14 mm)</td>
</tr>
<tr>
<td>Multiple single-toothed tenaculum</td>
<td></td>
</tr>
<tr>
<td>Electrosurgical equipment</td>
<td>Electrosurgical generator (bipolar and unipolar)</td>
</tr>
<tr>
<td></td>
<td>Grounding pads with return electrode monitoring</td>
</tr>
<tr>
<td></td>
<td>Various cutting loops (0, 165, 90 degree)</td>
</tr>
<tr>
<td>Fluid management system</td>
<td>–</td>
</tr>
<tr>
<td>Ultrasound scanner</td>
<td>–</td>
</tr>
<tr>
<td>Video-cart</td>
<td>–</td>
</tr>
</tbody>
</table>

Figure 5.7 Designated procedure room for hysteroscopy.

ascertain that emergency personnel can have adequate access to and from the procedure room.
- **Sufficient room** on all sides of the examination table is important so that staff can move freely about the patient.
- **Floor space should be maximized** by eliminating (wherever possible) free-standing instrumentation. In our procedure room, the video camera, image capturing device, and light source are all built into a cabinet. When the instrumentation is not in use, the cabinet doors are secured and the instrumentation is protected and kept dust-free. Distention fluid is generally hung from ceiling-mounted fixtures. The author also prefers to have wall-mounted monitors so that images can be viewed by the surgeon, the patient, and the staff. Clutter can be further reduced by providing wall mounts for oxygen canisters, a pulse oximeter, and automated blood pressure monitoring equipment.
- **Counter tops should be used in place of instrument tables or Mayo stands.** This represents yet another strategy to maximize floor space allowing staff to move about the patient and providing ingress and egress for emergency personnel.

## PERSONNEL

Nearly all of the author's procedures are performed with moderate sedation that requires at least two assistants during diagnostic hysteroscopy. Procedures performed with minimal sedation can often be performed with only a single designated assistant.

## INSTRUMENTATION FOR OPERATIVE HYSTÉROSCOPY

Experienced physicians have learned that optimum surgical outcomes are achieved when a skilled and practiced operating room (OR) team is melded with well-maintained equipment in an atmosphere that fosters unimpeded communication between team members.

The author will review both the instrumentation and OR set-up for operative hysteroscopy primarily focusing on the gynecologic resectoscope. The use of more recent additions to the surgical armamentarium such as hysteroscopic morcellators will also be addressed.

Hysteroscopic surgery involves the use of a complex array of equipment (Table 5.3). Prior to any procedure, the author recommends the use of standardized checklists to ascertain that all equipment function properly prior to induction of anesthesia. Additionally, it is of paramount importance that every piece of equipment from hysteroscopes to fluid management systems (FMS) has a useable and functioning duplicate permitting redundancy should any instrument fail during a procedure.

### The gynecologic or continuous flow resectoscope

The continuous flow resectoscope (CFR) was first introduced by Karl Storz Endoscopy in 1989. The modern resectoscope (Figure 5.8) has changed little in the past 25 years featuring an RLH, inner and outer external sheaths as well as a working element to which one of several types of electrodes can be attached. Typically, the CFR is attached to
four different components, which include a video camera, a FMS, a light source, and an electrosurgical generator. When first introduced, the CFR operated only as a monopolar instrument utilizing low-viscosity anionic fluids (LVAFs). Today's resectoscope is also available as a bipolar system that permits the use of normal saline for uterine distention.

When Karl Storz Endoscopy first introduced the unipolar resectoscope, it had an overall length of 30 cm along with an outside diameter of 28 Fr permitting a 24 Fr electrosurgical cutting loop or a similar size loop equipped with a 3 mm ball-end electrode. Unipolar CFRs are also available in 30 cm lengths with diameters of 22 and 28 Fr with matching electrodes. The author also employs a much shorter 13 Fr pediatric resectoscope equipped with a unipolar electrosurgical loop. Finally, at least one manufacturer produces a 35 cm long 26 Fr resectoscope that is very useful when working in an enlarged uterine cavity or one that is well suspended.

In addition to a variety of unipolar resectoscopes, the author also utilizes a 26 Fr bipolar resectoscope. The main advantage of a bipolar electrosurgery is that it is compatible with normal saline for distention. However, bipolar electrodes are both expensive and fragile compared to their unipolar counterparts. Although they offer excellent performance, when used in a cutting mode they work quite well, their ability to coagulate tissue is quite limited (Ko et al. 2010). Figure 5.9 shows the array of resectoscopes that we frequently utilize.

■ Continuous flow bridge

Oftentimes it is helpful to have the ability to inject vasopressin directly into a myoma or its base. It is our practice to utilize a continuous flow bridge that is inserted in place of the resectoscope working element alongside the lens, within the array of inner and outer sheaths. This allows the passage of a 40 cm x 22 gauge needle allowing direct injection of vasopressin into the myoma or its attachment point (Wortman 2013).

■ Hysteroscopic morcellators

There are presently three commercially available hysteroscopic morcellation systems offered today: the MyoSure (Hologic Inc, Bedford, Massachusetts) and the Trucut System (Smith and Nephew Inc, Andover Massachusetts) are both approved in the United States, while
the third, the Intrauterine Bigatti Shaver (IBS) (Karl Storz Endoscopy Tuttingen, Germany) is approved for use in Europe.

Morceaion systems have three advantages: they utilize normal saline for distention, eliminate floating chips, and cut without electrosurgical energy. Each of the systems feature a cutting blade powered by an electromechanical drive system that enables a combination of reciprocating cutting and rotation to efficiently remove tissue—fibroids or polyps. Additionally, all morcellation systems utilize suction to draw the specimen in contact with the side-facing cutting window of the morceator. These systems work well with grade 0, 1, and some grade 2 leiomyomas (Emanuel & Wamsteker 2005) with few reports of their efficacy and utility for fibroids >3 cm. One of the disadvantages of these mechanical cutting blades is that their function with very dense leiomyomas may be suboptimal.

The Truclear system is available in two sizes: a 5.6 mm outer diameter and 9.0 mm inner diameter equipped with a 2.9 and 4.0 mm cutting blade, respectively. The MyoSure system is available in a 6.3 and 7.3 mm outside diameter hysteroscope featuring 3 and 4 mm outer diameter cutting devices, respectively. The smaller diameter systems may be used in an office setting.

### Light source, video camera, and image capturing system

The free-standing light source, video camera, and image capturing systems that are used for diagnostic procedures also meet the requirements for operative hysteroscopy. They are summarized earlier in this chapter.

### Fluid management system

There are many commercially available FMS, and they are commonly composed of two parts:

1. **An infusion pump** that delivers low-viscosity fluids at an increased pressure (a maximum of 140–200 mmHg). There are two types of infusion pumps: inflatable bladder and peristaltic pumps. The Dolphin II (Olympus Corp, Center Valley, Pennsylvania) relies on a rigid enclosure that houses an inflatable bladder. A single 3 L bag is placed into the compartment whereupon the bladder is filled with air compressing a 3 L bag of low-viscosity fluid to a pressure up to 140 mmHg. The other type of infusion pump is a peristaltic roller rotation pump available on several systems including the Aquilex (Hologic Inc, Bedford, Massachusetts), the Hamou Endomat (Karl Storz Endoscopy, Culver City California), and Fluid Safe Management System (Stryker Medical, Portage, Michigan).

2. **A fluid collection system** consists of disposable containers generally attached to a scale that weighs the effluent. Some collection systems also include a self-contained suction pump, while others rely on the OR wall suction. The fluid collection system includes tubing that is able to collect all the effluent coming from the outflow port of the hysteroscope as well as that contained in the fluid collection bag.

Most FMS are capable of handling several 3 L bags or bottles and allow switching from one to the next in a rapid sequence. The FMS is often equipped with digital readout of the net fluid absorption along with alarms that alert the OR team when a specified fluid deficit has been reached. It is worthwhile noting that FMS vary considerably in the amount of fluid they deliver—from 500 mL/min to 800 mL/min. High flow rates are especially important when employing hysteroscopic morcellators, though the author finds them advantageous, especially in cases where significant debris and blood loss can be anticipated.

### Fluid collection drapes

There are many excellent commercially available collection drapes available on the market. The author has enjoyed a great deal of success with the Uro Catcher Drape (Allen Medical Systems, Acton, Massachusetts).

### Distention media

There are numerous choices commercially available for distention fluid (Table 5.2). The author’s preference is to use glycine 1.5% for cases involving unipolar electrosurgery and normal saline for cases requiring bipolar electrosurgery. Although some authors (Indman 2000) advocated the use of mannitol 5% because of its iso-osmolarity with serum, it is expensive and available only in 1 L bottles.

### Operating room table and stirrups

There are many choices available for OR tables. They all work well and have many more functions than are necessary for operative hysteroscopy. It is worth mentioning that patients undergoing operative hysteroscopy should never be placed in Trendelenburg position as it increases the risk of air emboli during operative hysteroscopy (Wortman 2006). We have found that Allen stirrups (Allen Medical Systems, Acton, Massachusetts) offer a wide variety of positioning options, which is important for providing patient comfort and access for both operative hysteroscopy and simultaneous sonographic guidance.

### Electrosurgical generator

The author’s preference is to utilize a single generator that can function with both a unipolar and bipolar resectoscope. We employ the Autocon II 400 (Karl Storz Endoscopy, Culver City, California) that can deliver up to 300 W of unmodulated (cutting) current and 120 W of modulated (coagulation) current in a unipolar mode along with a variety of cutting and coagulation bioeffects in a bipolar mode.

### Instrument table

The instrument table should contain certain standardized items including:

- One or more resectoscopes as needed for a particular case. It is our practice to have a unipolar and bipolar resectoscope available with appropriate electrodes
- Vasopressin solution containing 5 units in 40 mL saline; 4” needle extender, 20 mL syringe, and four 21 gauge × ½ needles
- N-Trilag Intraligamental Syringe (Integra Miltex, Rietheim-Weilheim, Germany)
- Hegar dilators (3–12 mm)
- Four single-toothed tenaculum.

It is worth mentioning that the instrument table contents are reviewed and modified for every patient based on her individualized needs. These modifications are added at the preoperative visit and become part of that patient’s preoperative checklist. We have a range of resectoscope options noted above. Sonographically guided myomectomies often call for a variety of additional instrumentation including a Sopher or Blier forceps as well as a myoma injection needle (Vita Needle Company, Needham, Massachusetts) for vasopressin administration. These are reserved only for cases in which their use is anticipated (Table 5.3).
Ultrasound machine

The ability to perform simultaneous sonographic guidance is an invaluable aid for operative hysteroscopy. The author has found sonography as an important adjuvant for hysteroscopic myomectomy, adhesiolysis, reoperative hysteroscopy surgery, and endometrial resection (Wortman 2012, Wortman 2013, Wortman et al. 2014). We utilize a Siemens Acuson digital ultrasound machine (Siemens USA, Washington DC) equipped with a variable frequency (2–6 MHz) abdominal transducer and find it an indispensable part of our OR set-up.

Operating room set-up for operative hysteroscopy

Physicians frequently underestimate the thought, planning, and coordination that are an essential part of successful operative hysteroscopy. Although much of the set-up for operative hysteroscopy is fixed; there are also many occasions that call for individualization of the ‘set-up’. Among the items that should be considered for each case are the following:

**Ultrasound machine and technician:** simple and straightforward cases such as hysteroscopic polypectomy or the resection of a small grade 0 leiomyoma do not require sonographic guidance. However, the excision of a uterine septum or the removal of grade 2 leiomyomas or fibroids >5 cm in diameter can be performed with greater confidence and safety utilizing sonographic guidance.

**Hysteroscope or resectoscope diameter:** There are many different instruments available today for hysteroscopic resection or ablation.

**Unipolar resectoscopes:** They vary from 13 to 28 Fr. Smaller diameter loops are well suited for the resection of polyps in the small postmenopausal uterus or for performing reoperative hysteroscopic surgery. Larger loops improve surgical efficiency whenever the anticipated tissue volume is high – an endometrial resection performed on a large surface area uterus or one with numerous or larger leiomyomas.

**Bipolar resectoscopes:** They are preferred when one is concerned about excessive fluid absorption of an LVAF. These resectoscopes are generally limited to 22 and 26 Fr. Morcellators are the tool of choice for many physicians and come in several sizes as well.

**Myoma forceps:** They are particularly valuable for debulking large myomas. The advantages of these debulking forceps (12 mm ovum forceps, Blier and Sopher forceps) is that they are inexpensive, reusable, and efficient. Importantly, they can be used without exposing the patient to distention fluid. They are best used under sonographic guidance (Wortman 2013).

CONCLUSION

The last few decades have seen constant technological advances in both diagnostic and operative hysteroscopy. Diagnostic hysteroscopes have become smaller and better suited to an office-based setting. Recently some hysteroscope manufacturers are even incorporating CMOS chips and producing self-contained mini-Towers that make them affordable for almost any practice. There are also several high-quality combination systems that allow the video system, monitor, light source, and image capturing system to be incorporated into a small portable device that can be utilized in any standard examination room. Operative hysteroscopy has seen many advances including the concomitant use of sonographic guidance as well as the development of a wide array of monopolar and bipolar resectoscopes. In addition, we are beginning to see a variety of electromagnetic morcellation devices that are gaining significant acceptance in the gynecologic community. An understanding of these devices and how to integrate them into an office- or hospital-based operating room is essential to providing excellent results and safe outcomes.

REFERENCES


