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REVIEW

# Role of Hysteroscopy in Modern Gynecology

Sangchai Preutthipan MD.

*Department of Obstetrics and Gynecology Faculty of Medicine Ramathibodi Hospital, Mahidol University Bangkok, Thailand 10400*

Over past decades, the developments in fiberoptics, light sources, high-resolution lenses, and endoscopic surgical instrumentation have led hysteroscopy to become an important diagnostic and therapeutic tool in patients with intrauterine disease. Hysteroscopy permits panoramic visualization of the uterine cavity and direct biopsy of lesions, thus increasing precision and accuracy in diagnosing intrauterine conditions. Intrauterine adhesions, submucous leiomyoma, and endometrial polyps could be visualized and in many cases treatment could be done, under direct vision, on the same setting. Hysteroscopy helps in defining some types of congenital anomalies of the uterus so that treatment could be planned and postoperative results assessed. This endoscopic technique aided in the accurate localization of misplaced IUDs and enabled their recovery under visual guidance. The combination of hysteroscopy and endometrial biopsy is an accurate method for the early detection of endometrial neoplasia, its precursors, and benign lesions that cause abnormal uterine bleeding (AUB).

As an operative technique, hysteroscopy increases the precision of surgery and minimizes trauma to the endometrial lining, and on many occasions, may preclude major surgical intervention. Hysteroscopic operation is considered a type of minimally invasive surgery. The procedure offers the advantages to the patients of a shorter hospital stay and recovery time.

## Instrumentation

Good instruments and proper training enable one to make an accurate diagnosis and to operate successfully to correct an intrauterine abnormality. There are a limited number of instruments for diagnostic and operative hysteroscopy. Therefore, surgeons should quickly become acquainted with all the instruments before starting doing hysteroscopy.

## The telescope

The hysteroscope is manufactured in both a rigid and flexible design. The rigid hysteroscope is used more often and is very similar to the laparoscope. The conventional telescope is 4 mm in outer diameter and 25cm in length. Under 4 mm the telescope will lose its light capacity. The distal viewing end of the telescope can be set straight (0 degree) or at an angle varying between 15-30 degrees. The 0-degree telescope is directly aimed at the object in view. However, an angled telescope (30-degree) allows the operator to look at the cornual region with minimal lateral deflection of the telescope.

The telescope can be used for panoramic and contact vision. The principles of panoramic hysteroscopy involve distention of the uterine cavity with either a liquid or gaseous medium before insertion of the telescope. No uterine distention is required for contact hysteroscopy, which is performed with the objective lens of the telescope in contact with the structure under observation. The panoramic view

is 1/1, but, when approaching the tissue as in pre-contact, most scopes enlarge up to 20X. The view offered at 20X is comparable to that seen with a standard colposcope and is of particular value in observing the vascular and glandular structures of the cervix, endocervix, and endometrium. In contact mode the magnification is 60X to 80X depending on the scope. The contact mode permits study of the grandular and papillary structures with a depth of field of almost 80um. In the microcolpohysteroscope, by switching a lever on the eyepiece, the magnification is 150X so that an in vivo nucleocytoplasmic examination becomes possible. At this magnification the superficial cellular layers can be visualized to a depth of 30um.

## Hysteroscopic sheaths

### *Diagnostic sheath*

The diagnostic sheath is a simple metal tube that covers the telescope. A channel is provided for insufflation of media through a side port. The media is discharged at the distal tip of the telescope. Most sheaths available for diagnostic work are not continuous flow, and thus the media leaves the uterus between the sheath and the cervix, through the cervical canal. The outer diameter of the diagnostic sheath is 5.5 mm.

### *Operative sheath*

Operative sheaths are wider sheaths that allow for the passage of instrumentation inside the sheath alongside the telescope. Most are equipped with two inflow/outflow stopcocks. Scissors, graspers, and biopsy forceps can be used through these sheaths. The outer diameter of the operative sheath is 7 mm.

### *Continuous-flow operative sheaths*

The continuous-flow sheaths have on the inner sheath that brings the distention medium to distend the uterine cavity and the outer sheath to evacuate the medium from the uterine cavity. The continuous rinsing of the cavity enables a clear view to be obtained during all stages of the operation.

### *Ancillary instruments*

Operative sheaths are wider sheaths that allow for the passage of the instrumentation inside the sheath alongside the telescope. Semirigid scissors, graspers, and biopsy forceps can be used through these operative channels for minor surgery. The shafts of these instruments are flexible, and the working elements of these instruments are small and fragile, requiring delicate use and care. Other devices such as small suction tubes (pediatric feeding tubes), tubal catheters for tuboplasty, and electrodes or laser fibers can be placed through these channels.

### *The resectoscope*

The resectoscope consists of a working element constructed in a way to fit the hand of the surgeon. The thumb is inserted in the posterior handle and three fingers of the hand fit the anterior handle. The spring handle of the supporting element maintains the working elements inside the insulated inner sheath when the resectoscope is not in use. The working elements may be equipped with a cylinder or ball electrode, cutting loop, or knife. The cutting loops are generally 8-9 mm wide angulated toward or away from the optic starting from a 90 o angle with the sheaths. The angle is corrected 15 o more toward the optic. This position allows a good supervision during the operation. The loop with no angle sometimes is used to resect the fundal area, but some expertise is needed for for it to be driven along the fundus. The ball electrodes come in many forms including the smaller and the larger barrels. These electrodes do hamper the vision through their volume, and with them a 0 degree scope gives the best vision. The ball electrodes are mainly used for endometrial ablation. Electric knives are usually used to operate on septa or intrauterine adhesions.

There are two types of working mechanisms, the active and the passive. The element of the active protrudes from the sheath at rest and requires that the surgeon draw it in by pulling the trigger. Conversely, in the passive the surgeon must advance the element by pulling the trigger. Return to the sheath is automatic

when the pressure on the trigger is relaxed.

***Illumination system***

Illumination system is provided from an external light source and is transmitted through fibre-optic which is attached to a light post on the proximal end of the hysteroscope. Light sources are available which range from the simple to the complex. The simplest, which is entirely satisfactory for all routine hysteroscopy, has a power of 150 watts. More procedures are being performed by observing camera transmitted image on a television monitor. A xenon or halogen light source of at least 250 watts is essential if a video camera is to be used.

***Distention media***

Distention media are necessary for panoramic and operative hysteroscopy. The ability to see the uterine cavity and perform operative procedures under direct vision are the major advantages of hysteroscopy. Uterine distention requires the production and maintenance of intrauterine pressure sufficient to separate its walls. Adequate uterine distention is achieved with 75 mm Hg of intrauterine pressure and it is seldom necessary to use more than 100 mm Hg. A low viscosity bag at 1 meter (100 cm) above the patients provides this pressure by gravity. An elevation of one and one-half meters (150 cm) results in 110 mm Hg of pressure.

***Carbon dioxide Gas (CO2)***

Carbon dioxide is useful for office and outpatient hysteroscopy. It has a refractive index of 1.0, the same as air, and is the optimal choice for clarity and documentation. It is a simple, clean and clear media for distending the uterine cavity during diagnostic procedures. However, if there is blood present in the uterine cavity, the gas bubbles through the blood will limit viewing. CO2 gas media cannot be used in operative procedures, as once bleeding occurs, the lens of the scope becomes blood-covered and the view is severely restricted.

Special instruments (hysteroflators) are necessary for controlling carbon dioxide flow and pressure during hysteroscopy. Flow should be limited to 100 ml/min, and intrauterine pressure should be held to less than 100 mmHg.

***Fluid distention media***

Fluid media provide and effective symmetric distention of the uterine cavity. They are superior to CO2 in flushing blood, mucus, bubbles, and small tissue fragments from the operative field. Viscosity and electrolyte composition of the available media vary and are important to consider in their selection. Unlike carbon dioxide, less expensive delivery systems can be used, but adverse sequelae occur more frequently.

## High-viscosity fluid

***Hyskon (Dextran 70) 32%***

High viscosity dextran is a clear, viscid, sterile, nonpyrogenic solution of dextran-70 (32% w/v) in dextrose 10% w/v). Dextran 70 is a fraction of dextran, a branch polysaccharide compound of glucose units, having an average molecular weight of 70,000. It is electrolyte free and nonconductive. Optically it is clear, and since electrolytes are not in the solution, it can be used with electrosurgery. This medium does not mix with blood, therefore, it is useful in hysteroscopic procedure if bleeding is anticipated or encountered. Its high viscosity results in minimal spillage through the tubes and cervix. Dextran 32% can be delivered through a 50 mL plastic syringe attached directly to the hysteroscope. Moving parts of instruments will become immobile if not cleaned promptly.

Dextran pumps controlled by a foot pedal were developed and simplified the instillation. They were withdrawn because of complication caused by the pressure required to push the material through the system.

***Low viscosity fluids***

These media have the largest number of solutions available. They are grouped into those containing electrolytes and those that are electrolyte-free.

## Electrolyte solutions

### *Sodium Chloride and Lactated Ringer's*

Sodium chloride 0.9% injection USP contains 154 mEq/L each of sodium and chloride, is isotonic, and is used intravenous therapy. Electrosurgery is not possible because the conduction provided by the electrolytes distributes the current throughout the uterus, preventing a focusing of the energy necessary to do the operation.

Lactated Ringer's injection USP is a solution of sodium chloride, sodium lactate, potassium chloride, and calcium chloride, and is used also as an intravenous solution. It is conductive and cannot be used with electrosurgery. If injeced into the vascular system, it is a physiologic solution and the effect is volume expansion. The advantages of both solutions are their availability and tolerance to vascular intravasation. Both mix readily with blood, requiring large volume for prolonged cases.

## Nonelectrolyte Solutions

### *Glycine*

Glycine (aminoacetic acid) is used an isotonic 2.2% solution or hypotonic 1.5% irrigating solution, and urologists introduced glycine as an alternate irrigation fluid to sterile water for cystoscopy. It has a calculated osmolarity of 200 mOsm/L, does not contain electrolytes, and can be used with electrosurgical procedures. Systemically absorbed, glycine is metabolized mainly by deamination to ammonia and transamination to other amnio acids, principally serine. Glycine should be used with caution in patients with known or suspected liver impairment. It is available in 2 or 3-L containers, simplifying the delivery of large volumes of the liquid.

### *Sorbitol*

Sorbitol is a 5% isotonic hexitol sugar solution that is electrolyte free and can be used with electrosurgery. It is broken down by the liver into fructose and glucose and may be associated with hyponatremia and postoperative hyperglycemia. It is used commonly as a nonelectrolyte distention fluid. Diuresis is produced through the increase in renal blood flow and the lowering of renal vascular resistance associated with its use. Hyponatremia and hemodilution can result from excessive intravasation, and hyperglycemia may occur from its breakdown products.

### *Mannitol*

Mannitol 5% is an isotonic, electrolyte-free, hexahydroxy alcohol solution used with electrosurgical procedures. When administered intravenously it remains confined to the extracellular compartment. Mannitol is metabolized slightly to glycogen in the liver and is filtered freely by the glomeruli with less than 10% tubular reabsorption. The elimination half-life in adults 100 minutes. Rapid administration intravenously can cause fluid and electrolyte imbalance, overexpansion of the extracellular fluid, and pulmonary edema.

### *Delivery systems*

The simplest delivery system for fluid media is a syringe that is used most often with high-viscosity dextran. Several large (50 mL) plastic syringes are filled carefully to avoid forming bubbles. The syringe is attached directly either to the hysteroscope or through a large-caliber connecting tube. High pressure needed to deliver the viscid fluid through the narrow channels of the hysteroscope can be provided by a mechanical screw-type device.

Another method is the use of gravity and hanging container(s) These are elevated on an IV stand with the height deciding the pressure. Additional pressure can be provided through compression cuffs surrounding the plastic-bag reservoirs. Pressure cuff systems can not provide constant pressure and are unreliable for operative cases because the pressure decreases as the bag empties

Pumps that control and monitor flow rate and intrauterine pressure are used primarily with CO2 and liquid distention media. Only equipment designed specially for hysteroscopy can be used to deliver CO2. Most insufflators are either fixed flow/variable pressure or fixed pressure/variable flow. The microinsufflator

controls both the flow rate and the pressure. Mechanical pump for delivery of liquid distention media is marketed as the hysteromat. It is similar to the microhysteroflator. It automatically controls the rate of flow and pressure.

**Table 1.** Indications for diagnostic hysteroscopy

- Abnormal uterine bleeding in pre or postmenopausal patients
- As part of the basic infertility work up: abnormal HSG with suspected intrauterine lesions: diagnosis of uterine synechiae, endometrial polyps or submucous myoma
- Investigation of causes of recurrent pregnancy loss (RPL)
- Localization of a lost intrauterine contraceptive device or foreign body
- Diagnosis of cervical and uterine neoplasia
- Investigation of scars after uterine surgery

## Indications for diagnostic hysteroscopy (Table 1)

### *Abnormal uterine bleeding*

Abnormal uterine bleeding (AUB) is one of the most common problems to confront the gynecologists. It can be caused by hormonal, systemic or pathologic conditions in the uterine cavity. In the clinical practice, dilatation and curettage is a traditional method for detection of intrauterine pathologies. However, it is a blind technique and may miss pathologies such as focal lesions. Panoramic hysteroscopy is superior to curettage in making an accurate diagnosis of intrauterine pathology.[1,2] Uterine causes of AUB, such as submucous myomas, endometrial polyps and cancer, can be accurately diagnosed by hysteroscopy with directed biopsy.[1,2] Hysteroscopy permits the diagnosis and biopsy of focal lesions under vision or at least will allow the surgeon to identify the site of a directed curettage.[3,4] Between 40-85% of patients with abnormal uterine bleeding will demonstrate a uterine abnormality.[2,5,6] Our study demonstrated that of the 52 hysteroscopic examinations on premenopausal patients with AUB, 45(86.54%) had intrauterine abnormalities. These included endometrial polyps in 22, submucous leiomyomas in 19, and endometrial hyperplasia in 4 patients. One of the most consistent findings in this study was the detection of endometrial polyps and submucous myomas by hysteroscopy in patients who had multiple curettage procedures with no pathologic conditions demonstrated.[2] Since hysteroscopy is not widely available therefore, patients who should be referred to hysteroscopists are those with AUB who fail with previous hormonal or medical treatment or fail to detect intrauterine pathologies after traditional D&C, and whom there is a high suspicion of intrauterine pathology.

### *As part of the basic infertility work up*

One of the basic steps of the infertility work up is to assess the shape and regularity of the uterine cavity. Historically, and still today as it turns out, the HSG has been the most commonly used test for this purpose. During the last two decades, however, several studies have demonstrated that when the uterine cavity has to be investigated in the infertility work up, hysteroscopy is much more accurate than HSG.[7-9] Hysteroscopy provides much more specific information and clarifies uncertain aspects of indirect techniques. We have shown that patients with abnormal hysterosalpingograms, hysteroscope not only helps to confirm the presence of a lesion but also helps to determine the location and nature of it. We have reported the results of hysteroscopic examinations in 143 infertile patients with suspected intrauterine lesions. Intrauterine abnormalities were shown on HSG in 86 patients and confirmed in 51 patients at hysteroscopy giving an accuracy rate of 59.30% and a false positive rate of 40.70%. The differences between HSG and hysteroscopy were observed mainly in the cases of intrauterine adhesion, endometrial polyp, and submucous myoma in which hysteroscopy presented more accurate diagnosis. Hysteroscopy can rule out a condition of cervical stenosis from HSG diagnosed intrauterine adhesion and distinguish between endometrial polyps and submucous myoma. We concluded that hysteroscopy

is a safe, accurate, and useful diagnostic method in the evaluation of the uterine cavity in an infertile woman. HSG is a simple, noninvasive, and important screening procedure for the study of the uterine cavity and whenever it is combined with hysteroscopy the two techniques are complementary in their application to female infertility.[9]

***Investigation of causes of recurrent pregnancy loss (RPL)***

Uterine anomalies may contribute to RPL. When in the course of the investigation of such couples it is deemed appropriate to seek such lesions. Clinically significant incomplete mullerian fusion or septum resorption occurs in 0.1% of females. Approximately 20-25% of women with unicornuate, bicornuate, didelphys, and or septate uteri will experience difficulty with reproductive functioning, including RPL.[10] Uterine fusion defects are generally associated with recurrent losses occurring in the second trimester. The incidence of spontaneous abortion in a woman with a unicornuate uterus is 48%; with uterine didelphys 43%; with bicornuate uterus 35% and with septate uterus 67%.[11] Hysteroscopy provides an instant diagnosis upon which further treatment can be planned or started. However, differentiation between a septate and a bicornuate uterus needs simultaneous laparoscopy for assessing the external configuration of the uterus. Hysteroscopic resection is currently a good treatment of choice for the patients with RPL and a uterine septum.

***Misplaced intrauterine contraceptive device***

When the intrauterine contraceptive device (IUCD) is misplaced. Radiologic investigation in the form of abdominal or pelvic x-ray or ultrasound is usually required to determine the site of a misplaced (IUCD). However, misdiagnoses of these two techniques may occur. The hysteroscope permits immediate confirmation of the presence and the position of a lost IUCD in the uterine cavity. If the device is identified, removal is easily performed under hysteroscopic control by introducing the grasping forceps and pulling out the string as well as the IUCD. Therefore, hysteroscopy is probably an ideal method of removing the device, the missing piece or other foreign body.[2]

***Diagnosis of endometrial and cervical neoplasia***

The most common form of malignancy found in the endometrium is adenocarcinoma. The most common symptom associated with endometrial carcinoma is AUB. Since this tumor occurs most frequently in postmenopausal patients, the onset of unexpected spotting or bleeding usually causes a woman to seek gynecologic consultation. Fractional dilatation and curettage has been the traditional way to evaluate such patients. Since curettage is a blind technique, intrauterine lesions may be missed easily. Hysteroscopy is now playing an important role to detect these lesions. Hysteroscopy is useful for excluding those patients with AUB who show no signs of intrauterine pathology. The combination of hysteroscopy and endometrial biopsy is ideal for use in symptomatic patients for the early detection of endometrial neoplasia, its precursors, and benign lesions that cause AUB.[12]

Hysteroscopy is not indicated for evaluation of invasive squamous cell carcinoma of the cervix. The information that could potentially be added would not change the treatment plan. Also, very heavy bleeding could occur. Although panoramic and contact hysteroscopy are of no value in case of cervical neoplasia, the magnifying power of the microcolpohysteroscope and its ability to penetrate the cervical canal to regions inaccessible to the colposcope permit the role in the assessment of pre-cancerous and CIS lesions of the cervix. However, this skill is difficult to acquire and is best performed only by those who have extensive experience.[13]

***Investigation of scars after uterine surgery***

Uterine rupture during pregnancy is unlikely in women who have undergone cesarean section for non-obstructive obstetric causes, myomectomy, metroplasty or tubal reimplantation. In the event that

information about such a scar is required, the degree of fibrosis and depth of any defect can be accurately assessed hysteroscopically.[14]

**Table 2.** Therapeutic hysteroscopy
- Hysteroscopic submucous myomectomy
- Hysteroscopic polypectomy
- Lysis of intrauterine adhesions
- Transection and/or resection of uterine septum
- Endometrial ablation

## Therapeutic hysteroscopy (Table 2)

### *Hysteroscopic submucous myomectomy*

Leiomyomas uteri are found in 20-25% of women over the age of 35 years. These tumors can cause menorrhagia, infertility, spontaneous abortion, premature labor, and pelvic pain depending upon their size and location. Surgical management is either hysterectomy or myomectomy. Although myomectomy was introduced to gynecologic surgery nearly 150 years ago, it has been, during recent years, becoming an increasingly important procedure performed with greater frequency. This increased use of myomectomy rather than hysterectomy results from the desire and necessity of patients to retain or improve reproductive potential. In the past, myomectomy was performed abdominally by laparotomy and removal of the myoma through a uterine incision followed by repair of the uterine incision. This procedure is potentially hazardous because of the limited exposure and difficulty in controlling bleeding from the hysterotomy. In addition this procedure often disrupts the integrity of the uterine cavity. Neuwirth and Amin[15] have suggested that transcervical hysteroscopy may be the procedure of choice for the diagnosis and treatment of submucous myoma. The use of resectoscopic technique is a less invasive surgical alternative than an abdominal myomectomy for symptomatic s ubmucous myomas while maintaining the patient's fertility. The immediate advantages of this procedure are apparent. The need for laparotomy is avoided as it is possible to remove the myoma without dissecting through the uterine wall. This results in reduced morbidity and eliminates the need for elective cesarean section at delivery.

We reported an initial result of the safety and efficacy of myomectomies performed by the hysteroscopic resectoscope in 50 patients. The indications for hysteroscopy and/or hysteroscopic myomectomy were menorrhagia in 23, metrorrhagia in 3, menometrorrhagia in 2, infertility with abnormal uterine bleeding in 12, abnormal uterine bleeding during hormonal replacement therapy (HRT) in 4, and suspected submucous myomas detected by ultrasonography and/or sonohysterography in 6 patients. The mean age of the 50 patients was 39.5 years with a range of 26 to 66 years. The sizes of the submucous myomas ranged from 1-5 cm. The mean of operation time was 32 minutes. (range 15-60 minutes) The mean volume of 1.5% glycine required for irrigation was 800 with a range of 600-2000 ml, and the mean deficit at the end of operation was 300 with a range of 200-1000 ml. The mean estimation of blood loss during the operation was 80 ml with a range of 50-200 ml. Postoperatively 28 out of 30 patients with menorrhagia had improvement in excessive bleeding (93.33%). One patient has undergone subsequent hysterectomy due to persistent heavy uterine bleeding from recurrent submucous myoma. All patients with infertility and patients under HRT had normal menstruation after this procedure. 2 out of 12 (16.67%) patients with infertility became pregnant after submucous resection. No serious complications occurred. One patient had a cervical laceration repaired by simple stitches. One patient had mild endometritis responding to outpatient antibiotics. Forty-eight patients were discharged from hospital the day after the operation, the remaining two staying overnight for observing post-operative bleeding. We have shown that resectoscopic myomectomy is a safe and effective surgical procedure. The procedure offers the advantage to the patients of a shorter hospital stay along with a low complication rate. The hysteroscopic approach to the symptomatic submucous myoma has dramatically changed the treatment options for patients who classically would be

offered abdominal myomectomy or hysterectomy.[16]

***Hysteroscopic polypectomy***

Endometrial polyps may be implicated as possible cause of infertility and repeated pregnancy loss or they may be totally asymptomatic. When they become symptomatic, they most commonly cause abnormal uterine bleeding and usually intermittent menstrual bleeding. The removal of endometrial polyps is very easily and safely accomplished hysteroscopically using either scissors, biopsy forceps, electric probe or resectoscope. Reproductive outcome following surgery is improved, with approximately 33% of patients with infertility achieving term pregnancy. The success rates for improving bleeding problem was 91% after hysteroscopic surgery.[17]

***Lysis of intrauterine adhesion (IUA)***

Intrauterine adhesions may result in infertility and/or recurrent pregnancy loss. The incidence of intrauterine adhesions is steadily increasing. The main offender in the etiology of this disorder is trauma to a pregnant uterus, especially after curettage in puerperium or after missed abortion. Other causes include genital tuberculosis and previous uterine surgery.

Amenorrhea and/or menstrual aberations, infertility, and recurrent pregnancy loss after any uterine trauma should cause the physician to suspect the presence of IUA. Pregnancy achieved after IUA may be complicated by RPL, premature labor, placenta previa and placenta increta, andplacenta accreta. The diagnosis of this condition is mainly made by hysterosalpingography and/or hysteroscopy. The clinical use of hysterosalpingography (HSG) has made it possible to diagnose the condition of IUA fairly accurately. However, hysteroscopy is of great help in avoiding misleading of HSG, in that it can confirm the presence and location of the adhesions more distinctly.

One significant advantage of hysteroscopic lysis of adhesions is its ability to cut only scar tissue during dissection under direct vision. Thus, normal endometrium is not traumatized as it is with curettage, and hence the risk of reformation of adhesions is diminished.

In our study, 65 cases of intrauterine adhesions were reported. The characteristic clinical pictures were amenorrhea or hypomenorrhea accompanied by periodic lower abdominal pain in 50 patients, complained of recurrent pregnancy loss (RPL) in 5 and infertility in 45 patients. Of the 65 patients studied, 29 had mild adhesions, 26 had moderate adhesions, and 10 had severe adhesions. Adhesions were lysed with hysteroscopic scissors in 25, with biopsy forceps through hysteroscope in 10, with electrosurgery using a monopolar probe in 22 patients, and with resectoscope in 8 patients. The mean duration of the procedure was 15 minutes (range 10-45 minutes). Of the 44 patients who originally presented with secondary amenorrhea, 40(90.9%) have normal menses, 4 (9.1%) have hypomenorrhea. Of the 6 patients who had hypomenorrhea, 5(83.3%) have normal menses. Cyclic abdominal pain disappeared after treatment in all patients. Of the 45 patients with intrauterine adhesions and infertility, 18 (40%) conceived. Two (20%) of the infertile patients with initially severe adhesions conceived. One out of five patients with RPL delivered a premature baby at 29 weeks of gestation. All 19 patients who delivered, had live births. Adhesion reformation was absent in patients with initially mild and moderate adhesion but occured in 2 out of 10(20%) patients with severe adhesions. There was no complications attributed to this study.

In conclusion, hysteroscopy is a good method of choice to diagnose, classify, treat, and follow-up patients with intrauterine adhesions. Hysteroscopic adhesiolysis is a safe, effective procedure and benefit patients suffering from infertility and amenorrhea, hypomenorrhea and/or periodic lower abdominal pain.[18]

***Transection and/or resection of uterine septum***

A uterine septum is the most frequent malformation (60%) related to Mullerian defects. It is

found in 1.9-3 % of the female population.[19] Reproductive results in women with a septate uterus include increased incidence of spontaneous abortion, premature birth, and abnormal presentations. Septate uterus is seen most often in women with reproductive wastage. When this defect is present, Fedele et al[20] reported 30-75% of miscarriages of first trimester, with also a high rate of late miscarriages, dystocia presentation in 30%, and 15-58% premature deliveries. Overall, 33% will not have a term delivery. Infertility that is related to a septum is still controversial.

Transection the septum with scissors is the simplest method. The laser may be used to excise the septum in a fasion very similar to the scissors. The uterine septum may be rapidly and safely resected using the resectoscope. Reproductive outcome following surgery is improved, with approximately 80-90% of patients achieving term pregnancy.[21,22]

***Endometrial ablation***

Abnormal uterine bleeding is a condition that may afflict women from menarche through the reproductive years, to the menopause and beyond. About 85% of women with AUB during the reproductive years have dysfunctional uterine bleeding with no organic etiology. In the remaining 20%, an organic lesion or systemic disorder may cause the bleeding.[23] Endometrial ablation is indicated when a woman with excessive vaginal bleeding satisfied the following conditions: patient has completed childbearing, has been shown to suffer from dysfunctional bleeding without organic causes, has exhausted reasonable non-surgical alternatives, would previously have been offered the option of hysterectomy, and in whom the procedure is believed to have a good likelihood of success. Hysteroscopic endometrial ablation can be performed either using the cutting loop for endometrial resection, or rollerball for electrocoagulation of the endometrium, or laser energy for endometrial ablation.

We reported the outcome of treatment in 90 patients with menorrhagia who underwent transcervical resection of the endometrium (TCRE) as an alternative to hysterectomy. The mean duration of the operation was 40.0 (range 20-90) minutes. The mean deficit of glycine at the end of operation was 480 (range 200-800) ml. The mean clinical estimation of blood loss during the operation was 150 ml (range 100-350 ml). The mean number of days in hospital for the patients was 2 days (range 1-6 days). Overall, the patients were able to return to normal everyday activities after a mean of 1.8 (0.5-4.1) weeks. There was a total of 4 (4.4%) complications including 1 case of uterine perforation which required a hysterectomy, 1 case of immediate postoperative bleeding requiring tamponade with a foley catheter, and 2 cases of low grade fever which resolved spontaneously within 24 hours. Of the 90 patients 42 (46.7%) women who underwent endometrial resection became amenorhoeic during follow up of up to 6 months. Of the remaining 48 patients, 38 (42.2%) reported regular but shorter and lighter periods, 8 (8.9%) resumed normal menstruation, 2 (2.2%) continued to have a menstrual problem which required hysterectomies. We have shown that healthy women with abnormal uterine bleeding may also be a candidates for TCRE as an alternative to hysterectomy. Transcervical resection of the endometrium appears to be a safe, effective and readily acceptable solution to menstrual problems allowing women to lead normal social lives and avoid major surgery.[24]

***Contraindications***

Hysteroscopy is absolutely contraindicated in acute pelvic infection, the presence of desired intrauterine pregnancy, and cervical cancer. Acute uterine bleeding, recent uterine perforation, and patients with cardiovascular diseases are relative contra-indications to hysteroscopy.

***Complications of Hysteroscopy***

Complications tend to occur mostly when contraindications are ignored, improper patients are selected and when incorrect surgical techniques or instruments are used. Some potential problems are inherent in the therapeutic or operative hysteroscopic

procedures and are more frequent than with diagnostic hysteroscopy. Complications with serious sequelae should be and are infrequent occurrences in the hand of experienced hysteroscopists. In the 1993 survey by the American Association of Gynecologic Laparoscopists (AAGL), there were 14,707 hysteroscopies reported with a complication rate of 3%,[25] however, in a review of advanced operative procedures, the overall intra-operative and postoperative rate of complication was 24%.[26]

***Infection***

Infection, including endometritis, parametritis, and pyometra is a rare complication of hysteroscopy. In a large series of 473 diagnostic hysteroscopies, the rate of postoperative endometritis was 0.5%.[27] Post-hysteroscopic infection is only slightly more common following operative hysteroscopy. Vilos et al[28] reported their experience with 800 hysteroscopic endometrial ablations in which the infection rate was 3.9%. Management of post hysteroscopic endometritis should be no different from that of any other form of endometritis. For prevention of post-hysteroscopic infection, sterile technique should be used, and prophylactic antibiotics for operative procedures should be given in a selective case.

***Cervical trauma***

The cervix or uterus may be perforated during cervical dilatation. This is a potential problem especially in an acutely anteflexed or retroflexed uterus and in women with narrow cervical os particulary in nulliparous or menopausal women. The incidence is probably to that associated with endometrial curattage, 4-13/1000 procedures.[29] Often the most difficult component of an operative hysteroscopy is achieving the cervical dilatation necessary to insert an operative hysteroscope or resectoscope. Cervical trauma from a tenaculum tear is a common complication when a hysteroscope or resectoscope of greater than 24-F diameter is used. Cervical bleeding may occur from tenaculum trauma. They may cause post-operative bleeding. When a cervical tear occurs, it can easily be repaired with interrupted 0-chromic sutures.

***Uterine perforation***

Uterine perforation is one the most common complication of diagnostic and operative hysteroscopy. It occurred at rate ranging from 1-10%.[25,28,30,31] Uterine perforation can occur if the hysteroscope is forcibly advanced without panoramic, unobstructed vision. The scope should always be advanced gently under direct vision. Perforation with an operative instrument especially cautery or laser may cause bowl or bladder injury and laparoscopic assessment may be useful in this situation. Preventive measures against perforation include preoperative uterine palpation and sounding to reveal the actual size and position of the uterus, adequate cervical dilatation, and proper technique of hysteroscopy. The most common time that the uterine perforation occurred is during a difficult cervical dilatation.

In order to avoid the common complications such as cervical tear, creation of false track, and uterine perforation associated with the difficult cervical dilatation especially when using the operative hysteroscope and/or resectoscope. Many researchers have been searching for methods of cervical priming and dilatation. Several methods have been employed for cervical priming and dilatation in the past.[32-34]

We reported an initial result of vaginal misoprostol in facilitating cervical dilatation in non-pregnant women before hysteroscopy. Ninety-one women scheduled to have hysteroscopy were randomized to receive either vaginal misoprostol or a placebo. Cervical response, outcome of hysteroscopy, and side-effects of vaginal misoprostol were assessed. We found that the mean cervical dilatation estimated by Hegar dilator and the mean time for hysteroscopy were significantly different between the treated group 7.0(1.0 mm (range 6-8.5 mm), 90.0(38.4 seconds (range 60-240 seconds) and the control group 3.8(1.2 mm ( range 2-5.5 mm), 142.0(38.7 second (range 60-270 seconds). In the misoprostol group, only 3

(6.5%) patients needed cervical dilatation before hysteroscopy compared to 14 (31.1%) patients in the placebo group (P=0.006). Cervical tears during hysteroscopy occurred in 2 (4.4%) patients in the control group and none in the misoprostol group. The two most common side-effects of vaginal misoprostol were mild lower abdominal pain occurring in 15 (32.6%) patients and slight vaginal bleeding occurring in 12 (26.1%) patients. Both side-effects were significantly different when compared with the placebo (P<0.001). We concluded that vaginal misoprostol lessens the cervical resistance in women undergoing hysteroscopy and facilitates the procedure with mild side-effects.[35]

***Complication from distention media***

There are three basic distention media: carbon dioxide, 32% high molecular weight dextran, and low-viscosity fluid, each having advantages, disadvantages, and risks.

Carbon dioxide is the most commonly used medium for office and diagnostic hysteroscopy because it is rapidly absorbed into the blood and released during pulmonary ventilation. When it is used at a maximal pressure of 100 mmHg and a maximal flow rate of 100 ml/ min, carbon dioxide is a safe medium. Although embolization can occur at these levels, it does not produce hazard.[36] Lower pressures result in less frequent embolization. When excessive CO2 has been absorbed, metabolic changes, embolization, and death may occur. Treatment of CO2 embolization should be the same as for all types of air embolism. For prevention, CO2 has to be administered through a designed hysteroflator. Deaths and serious sequelae have occurred with the use of inappropriate equipment.[37]

Hyskon (32% dextran 70 and water) is a viscous solution that is rarely used today owing to the availability of continuous-flow hysteroscopes. Complications that have resulted from the use of Hyskon include pulmonary edema, allergic reactions including anaphylaxis and coagulopathy. For every 100 ml of Hyskon absorbed into the blood stream, the plasma volume will increase by 860 ml. It is therefore recommended that if more than 350 ml is absorbed, the operation should be discontinued to prevent pulmonary edema.

Low-viscosity fluids are the most common frequently used distending media for operative hysteroscopy. They are suited ideally for use with the continuous flow hysteroscopies. Solutions that are electrolyte-free include dextrose and water, 1.5% glycine, sorbitol, and mannitol. When excessive vascular intravasation of non-electrolyte solution occurs, hypo-osmolarity, hyponatremia, and pulmonary edema may develop. If this condition is not recognized promptly and treated aggressively, cerebral edema and herniation of the brain stem can cause death. Preventive measures against fluid overload include meticulous fluid balance checking while doing the procedures. It is recommended that the case be discontinued when a deficit of 2000 ml of 1.5 % glycine is reached.

***Postoperative bleeding***

The pressure of the intrauterine-distending media generally is enough to overcome intrauterine bleeding during hysteroscopic procedures. After the procedure has been completed and the uterus deflated, active bleeding may recur, and corrective measure must be undertaken to stop it. Bimanual compression should be attempted first. Should that fail, the use of a foley catheter with a 30-ml balloon to temponade the endometrial cavity. These balloon can be removed after a few hours or left overnight. The use of diluted vasopressin by injecting into the cervical stroma has been advocated.

**Table 3.** Classification of hysteroscopic operations 3

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|---|---|
| Level 1 | Diagnostic hysteroscopy and target biopsy |
| | Removal of simple polyps |
| | Removal of IUCD |
| Level 2 | Division of minor synechiae |
| | Division of pedunculated myoma |
| | Proximal fallopian tube cannulation |
| Level 3 | Transection and/or resection of uterine septum |

Resection of submucous myoma
Division of major synechiae
Endometrial resection/ablation
Repeat endometrial resection/ablation

### *Training in Hysteroscopy*

The trainees must first become familiar with the instruments and their assembly and then learn to perform diagnostic hysteroscopy. When the skills of diagnostic hysteroscopy have been mastered, progress may be made to operative hysteroscopy.

The development of expertise in hysteroscopic surgery involves the surgeon undergoing a change in attitude, acquiring the appropriate knowledge, undergoing formal training and then practicing the new techniques.

Hysteroscopic surgery has been classified into 3 levels of minor, intermediate and advanced operation (Table 3). This classification has merit in that it gives some indication of the progression which surgeons in training should undertake. Surgeons should commence with simple procedures before attempting complicated ones and should recognize the degree of difficulty of each operation.[38]

### *The future trend of hysteroscopy*

Hysteroscopy is rapidly becoming a common examination for every gynecologist. Hysteroscopy is no longer a procedure looking for an indication. With improved optical systems and thinner endoscopes, the cervical canal will be passed easily with minimal discomfort to the patient and hysteroscopy will become an indispensable out-patient, office procedure. As an office hysteroscopy at the out patient department, the hysteroscopic findings enable the physician to plan future therapy with greater precision. In most instances, hospital based curettage can be avoided to search for the cause of abnormal uterine bleeding.

Regarding operative hysteroscopy, smaller with high quality instruments and hysteroscopic electrosurgical instruments using electrolyte-containing distention media are continuing developed in order to make operative procedures easier and also to avoid most problems associated with electrolyte-free distention media.

New approaches to endometrial ablation including the thermal balloon endometrial ablation, microwave endometrial ablation, and radiofrequency induced endometrial ablation are undergoing clinical evaluation. These procedures suppose to have less complications comparing to traditional resectoscopic endometrial ablation.

In conclusion:Hysteroscopy has become a standard investigational and therapeutic tool in the current practice of gynecology. It is a most reliable procedure for the direct inspection of the uterine cavity and enable the correction of many intrauterine abnormalities without the need for major surgery. The advantages of hysteroscopic surgery include less hospitalization and expense, reduce disability and morbidity, and rapid return to normal activity. Operative hysteroscopy will be a mainstay in the practice of modern gynecology.

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