*Section A -Research paper*

# Pipelle, Curretage Biopsy and Hysteroscopic Biopsy as Diagnostic Tools in cases of Postmenopausal Bleeding

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**Abstract:**

Postmenopausal bleeding might occur due to many benign and malignant underlying diseases. Differentiating between these diseases poses a great importance. This study was designed to compare the diagnostic value of pipelle endometrial sampling and curettage in patients with postmenopausal bleeding. Further, the results were compared with hysterectomy if performed.

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## Introduction:

Postmenopausal bleeding is an important chief complain that makes about 5% of patients' referral to gynecologists' office.**(1,2,3)** Patients with postmenopausal bleeding should be evaluated by endometrial sampling to rule out malignancy because of the incidence of endometrial cancer as 10% in postmenopausal women.**(4,5)** Assessment of abnormal uterine bleeding (AUB) in patients older than 40 years or those in the menopausal period is very important. Regarding the benign lesions are usually treated with medical or conservative treatment, unnecessary radical surgery can be avoided.**(6)**

There are many methods for endometrial assessment including ultrasonography, endometrial curettage, and office-based methods, such as endometrial samples using a pipelle.**(1,7)** Diagnostic dilatation and curettage (D&C) is a gold standard modality to obtain an endometrial biopsy, but it necessitates anesthesia and hospitalization and might have some complications such as infection or uterine perforation.**(8,9)** However, in most cases, <60% of the uterus cavity is curetted. Therefore, there has been a tendency toward less aggressive techniques in the recent years.

The pipelle device is a cost–benefit procedure for endometrial biopsy compared to

curettage and can be done in an office setting.**(10,11,12)** According to the literature, pipelle technique has been suggested as a sensitive and specific diagnosis measure for the evaluation of endometrial cancer **(13,14,15).**

Pipelle technique is more accepted by patients as it does not need any hospitalization or anesthesia. In addition, patients are not admitted in the hospital. Therefore, it has been more popular in the recent years.

Despite the fact, there are still much concerns in terms of sampling adequacy and diagnostic value that may lead to miss some malignant lesions in the uterus cavity. Many studies have compared the efficacy of pipelle and D&C, but very few evidence is available regarding the efficacy of these two techniques and hysterectomy pathology reports. Therefore, the aim of this study was to compare the diagnostic values of pipelle biopsy and D&C with the standard permanent pathology after surgical hysterectomy.

**Dilatation and Curettage**

This procedure is a primary tool for diagnostic, evaluation and treatment of abnormal uterine bleeding. However, the indications for dilatation and sharp curettage (D & C) have decreased with the development of less invasive methods such as plastic endometrial samplers and transvaginal sonography. **(16)**

For evaluation of abnormal uterine bleeding, sharp curettage may be used alone or more commonly in combination with hysteroscopy for those women with persistent bleeding despite normal findings with sonography and endometrial biopsy **(17).**

Also, if uterine malignancy is suspected and initial biopsy is incomplete, D & C may permit a more thorough removal and interrogation of endometrial tissue.

In the treatment of severe acute menorrhagia, D & C may be used to remove hypertrophic endometrium if bleeding must be stopped promptly or if bleeding is refractory to medical management. Although suction curettage is used more commonly for removal of first-trimester pregnancy products, sharp D & C may also be an option. Finally, in women with suspected ectopic pregnancy, D & C sometimes is used to document the absence of intrauterine trophoblastic tissue. **(16)**

**Preoperative**

- **Consent**

For most women, sharp dilatation and curettage poses only a small risk of complication, and rates are typically below 1 percent.Infection and uterine perforation are among the most frequent. With uterine perforation, concern or adjacent organ injury may require diagnostic laparoscopy or laparotomy and injury repair. Although rare, the possibility of hysterectomy is also discussed. **(18).**

- **Patient Preparation**

Because the indications for sharp D & C are diverse, diagnostic testing prior to evacuation will vary. Sonography is a frequent evaluation tool, and images are reviewed preoperatively

to reorient the surgeon to uterine inclination and pathology.

Prophylactic antibiotic administration is typically not required when sharp D & C is performed for gynecologic indications.

However, because pelvic infection may follow this procedure when performed in an obstetric setting, antibiotics are usually prescribed postoperatively. Doxycycline, 100 mg orally twice daily or 10 days, is a frequent choice **(19).**

The risk of bowel injury or venous thromboembolism (V E) with this procedure is rare. Thus, preoperative enema or V E prophylaxis in those without additional risk factors is not mandatory. **(18).**

**Intraoperative**

- **Surgical Steps**
  - **Anesthesia and Patient Positioning.**

Dilatation and curettage is typically performed as an outpatient procedure under general or regional anesthesia or with local nerve blockade combined with intravenous sedation. The patient is placed in standard dorsal lithotomy position, the vagina is surgically prepared, and the bladder drained. A bimanual examination to determine uterine size and inclination is performed prior to introduction of vaginal instruments. Information obtained from this examination helps avoid uterine perforation. With insertion of instruments along the long axis of the uterus, there is less chance of injury. **(18).**

  - **Uterine Sounding.**

Suitable vaginal exposure can be achieved with either a Graves speculum or individual vaginal retractors. The anterior lip of the cervix is grasped with a single tooth tenaculum to stabilize the uterus during dilatation and curettage. A Sims uterine sound **(Fig. 1)** is then held like a pencil with the thumb and first two fingers. The sound is slowly guided through the cervical os, into the uterine cavity, and to the fundus. To minimize perforation risks, instruments are not forced and are kept in the midline. **(20)**

**Figure (1):** Sims uterine sound. **(18).**

Once gentle resistance is met at the fundus, the distance from the fundus to the external os is measured by score marks along the length of the sound. Knowledge of the depth to which dilators and curettes can safely be inserted also decreases perforation risk.At times, cervical stenosis may preclude easy access to the endocervical canal. In these cases, smaller caliber tools, such as a lacrimal duct probe, can be guided into the external cervical os to define the canal path. **(18).**

Sonography may be helpful when done simultaneously with D & C in these situations. Sonographic visualization of instruments as they are being passed may help assure proper placement **(21).**

In addition, pretreatment with the prostaglandin E1 analogue misoprostol (Cytotec) may allow adequate cervical softening for instrument passage. Commonly used dosing options include 200 or 400 μg vaginally or 400 μg orally or sublingually once 12 to 24 hours prior to surgery. **(20)** noted equal efficacy but a patient preference for oral administration. Common side effects include cramping, uterine bleeding, or nausea.

- **Uterine Dilatation.**

After the uterus is sounded, dilators of sequentially increasing caliber are inserted to open the endocervical canal and internal cervical os. A Hegar, Hank, or Pratt dilator is held by the thumb and first two fingers, while the fourth and fifth fingers and heel of the hand rest on the perineum and buttock. Each dilator is gently and gradually advanced through the internal cervical os. Serial dilatation continues until the cervix will admit the selected curette **(20)(Fig. 2).**

During sounding for dilatation, uterine perforation may occur and is suspected when the instrument travels deeper than previously measured. Because of the blunt, narrow shape of these tools, risk of significant uterine or abdominal organ injury is low. In such cases, insignificant bleeding is absent, reassessment of uterine inclination and completion of the D & C is reasonable. Alternatively, surgery may be terminated and repeated at a later date to allow myometrial healing. Importantly, lateral perforation

May create a broad ligament hematoma, which if suspected merits laparoscopic evaluation or postoperative surveillance of hemodynamic status. **(20)**

**Figure (2):** Uterine curettes

**Uterine Curettage.**

Prior to curettage, a sheet of nonadherent wound dressing material is spread out in the vagina beneath the cervix (Telfa pad). The uterine curette is then inserted and advanced to the fundus, following the long axis of the corpus. The concave curve of the curette loop has a sharp edge, which allows curettage. On reaching the fundus, the sharp surface is positioned to contact the adjacent endometrium. Pressure is exerted against the endometrium as the curette is pulled toward the internal cervical os. After reaching the os,

the curette is redirected to the fundus and positioned immediately adjacent to the path of the first curettage pass. After several passes, tissue accumulated in the isthmic region is scraped out onto the Telfa pad. In this fashion, the entire uterine cavity is sequentially and circumferentially curetted. The collected specimen is sent for pathologic evaluation. As with dilatation, the uterus may be perforated during curettage. In contrast to the metal sound or dilator, the sharp curette has the potential to lacerate bowel, vessels, and other abdominal organs. Accordingly, diagnostic laparoscopy is considered to evaluate for such injuries. **(18).**

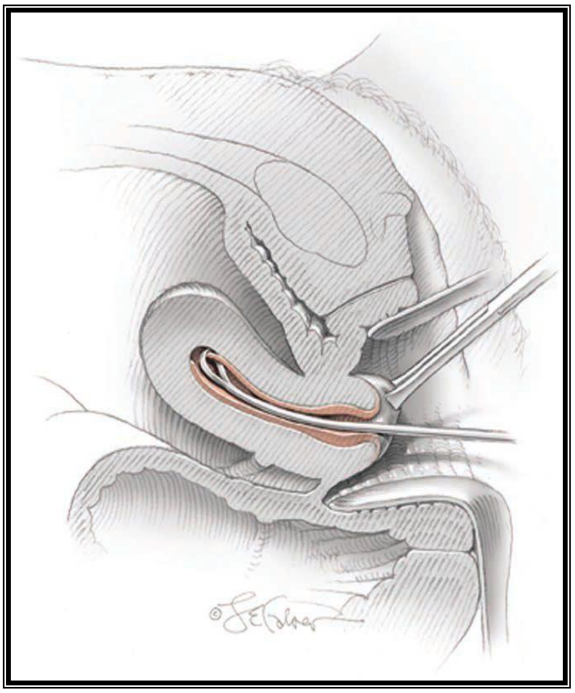

**Figure (3):** Uterine curettage. **(18).**

- **Uterine Exploration.**

Uterine polyps, both large and small, may be missed with sharp curettage. Hysteroscopy is a more accurate means to diagnose and remove focal lesions and is often coupled with D & C. In areas without these resources for expertise, uterine exploration with Randall kidney stone forceps can be used to secure and remove polyps. For this, closed forceps are inserted into the endometrial cavity. Upon reaching the fundus, forceps are opened against the uterine walls, closed, and then pulled away from the endometrium. With this technique, anterior, posterior, proximal, and distal cavity surfaces are explored. With capture of a polyp within the jaws, a tug against the closed forceps is felt as they are pulled away from the uterine wall. Firm traction typically frees the polyp. Removed tissue is sent for pathologic evaluation. **(18).**

**Postoperative**

Recovery from sharp D & C is typically fast and without complication. Light bleeding or spotting is expected, and patients may resume normal activities at their own pace. (**22)**

**Suction Pipelle**

In 1980's Endometrial Pipelle was introduced as an outpatient device to obtain an endometrial biopsy, the Pipelle device is 23.5 cm in length, with a polypropylene sheath with an outer diameter of 3.1 mm. Suction is created along a negative pressure gradient when the inner plunger is withdrawn (**22).**

The Pipelle will pass through the cervical canal to the uterine cavity and endometrium to obtain a sample for histological analysis. It is mainly used in women with abnormal uterine bleeding who are mainly from perimenopausal or postmenopausal age group **(16)**


**Figure (4):** Endometrial aspirator (pipelle) **(23).**

For years, dilatation and curettage (D & C) was used for endometrial sampling. However, because of associated surgical risks, expense, postoperative pain, and need for operative anesthesia, other suitable substitutes were evaluated. In addition, investigators have demonstrated incomplete sampling and missed pathology even with D & C **(8).**

Initial office techniques used metal curettes. Endometrial samples that are removed with these curettes show significant positive correlation with histologic results obtained from hysterectomy specimens **(10).** Thus, they are deemed adequate sampling methods. However, disadvantages include patient discomfort and rare procedural complications such as uterine perforation and infection.

To sampling, flexible plastic samplers have been evaluated for endometrial biopsy. Advantageously, samples from these catheters have comparable histologic findings with tissues obtained by D & C, hysterectomy, or stiff metal curette **(24).** Moreover, they afford greater patient comfort.

As compared to traditional D&C, Pipelle sampling is a less time-consuming procedure **(25).** The specimen satisfaction rate of Pipelle, according to articles from 1994 to 2015, ranged from 73.9 to 100 %. Meanwhile, pathological accuracy was 62.0 to 96.9 % for endometrial lesions (**22)** with greater acceptability for patients than D&C.

It is constructed of flexible polypropylene with an outer sheath measuring 3.1 mm in diameter with a 2.4 mm distal side port, through which the endometrial sample is obtained **(16)** Its flexibility allows the cannula to conform to the contour of the uterus and minimizes cramping **(26).**

**Figure (5):** suction pipelle **(18).**

**How to use it**

Prior to performing endometrial biopsy, pregnancy is excluded in women of reproductive age. With Pipelle insertion, patients frequently note cramping, which can be allayed by a preprocedural NSAID. For some, slow transcervical intrauterine instillation of 5 mL of 2-percent lidocaine using an 18-gauge angiocatheter can lower perceived pain scores **(27).**

Most often, the Pipelle can be inserted without the aid of a tenaculum. Once the cannula is placed within the uterus, the clinician stabilizes the sheath with one hand and pulls the piston out as far as possible to create suction. The sheath is rotated 360 degrees while the distal port is withdrawn from the fundus to the internal os, with multiple passes being performed as necessary. The specimen is expelled into the formalin container by pushing the piston into the sheath **(28).**

If there appears to be insufficient tissue for diagnosis, a second pass of the catheter is performed using the same catheter if it has not touched the formalin. At the conclusion of the procedure, the tip of the catheter containing the specimen can be cut off and dropped into the formalin **(29).**

The Pipelle sample consists of tissue fragments that are aspirated from the uterine cavity. The specimen is submitted for evaluation in 10% neutral buffered formalin (the routine fixative for most histology specimens). The pathology laboratory personnel describe the specimen grossly, filter the specimen to collect the tissue fragments and discard the fluid. **(29).**

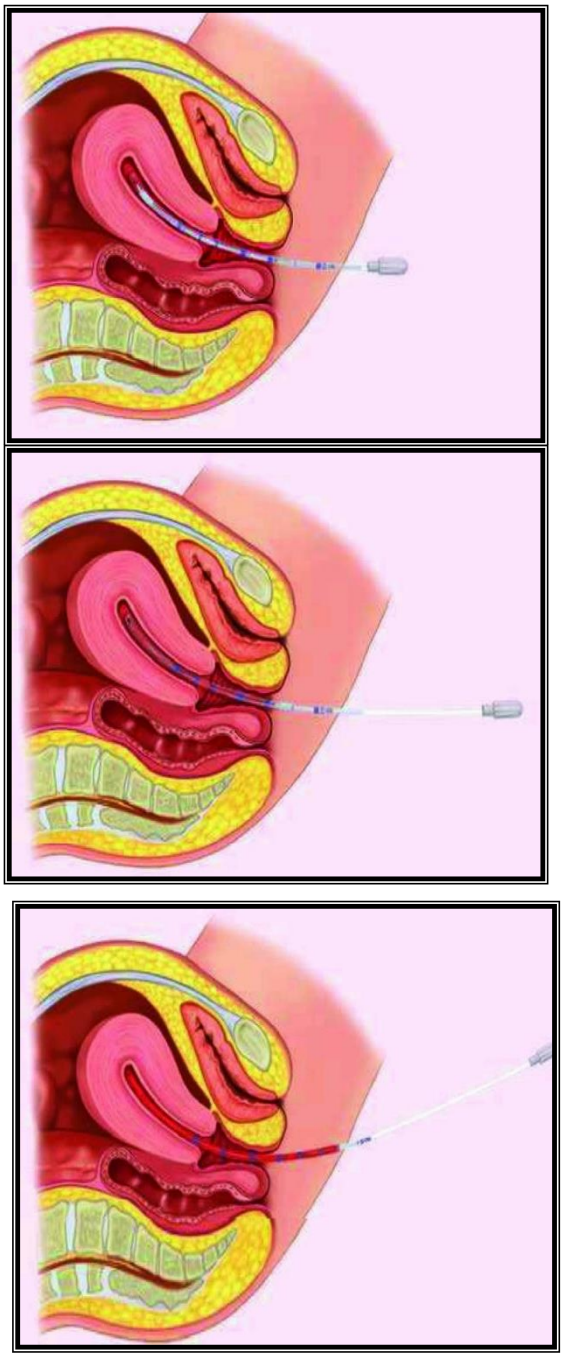

**Figure (6):** Steps of pipelle endometrial biopsy **(29).**

**Limitation and Disadvantages**

Despite its advantages, there are limitations to endometrial sampling with the Pipelle device.

First, a tissue sample that is inadequate or histologic evaluation, such as from endometrial atrophy, or an inability to pass the catheter into the endometrial cavity is encountered in up to 28 percent of biopsy attempts **(30).**

Cervical stenosis and large submucous leiomyomas are classic obstructions. An incomplete evaluation often necessitates further investigation with D & C, transvaginal sonography with or without saline infusion, or diagnostic hysteroscopy **(31).**

Second, endometrial biopsy has a cancer-detection failure rate of 0.9 percent. Thus, a positive histologic result is accurate to diagnose cancer, but a negative result does not definitively exclude it. Therefore, if an endometrial biopsy with normal tissue is obtained, but abnormal bleeding continues despite conservative treatment or if the suspicion of endometrial cancer is high, then further diagnostic efforts are warranted **(16).**

**HYSTEROSCOPY**

**Indications for diagnostic hysteroscopy:**

**Diagnostic hysteroscopy:**

By the mid 1980s, hysteroscopy nearly replaced dilatation and curettage (D&C) for diagnosis of intrauterine pathology and now considered an integral part of residency training programs ***(32).*** Many studies have shown that blind dilation and curettage may miss up to 60% of endometrial pathology, such as endometrial polyps and submucous leiomyoma. Office hysteroscopy as a first-line diagnostic tool for the investigation of abnormal uterine bleeding (AUB) and reported abnormal findings at ultrasound, hysterosalpingography, magnetic resonance image or blind biopsy, and follow-up of certain intrauterine surgery ***(33).***

**Operative hysteroscopy:**

Resection of myomas, and endometrial destruction through resection, electrosurgical desiccation, or vaporization with the Nd:YAG laser can be performed hysteroscopically ***(34).***

**Insufflation and distension for optimal visualization:**

***1- Gaseous Media:***

Carbon dioxide (CO2) is the most common diagnostic medium for office hysteroscopy. It is clean, safe, and inexpensive; but has the disadvantages of creating bubbles that may obscure vision, providing poor uterine distension because of leakage, and providing poor visualization when there is uterine bleeding ***(35).***

***2- Liquid viscous media:***

Thirty-two percent high-molecular-weights Dextran-70, (Hyskon), was used commonly as a liquid distension medium for operative hysteroscopy. When using Hyskon as the distension medium, its delivery requires significant constant pressure to overcome the resistance of a high-viscosity fluid flowing through a standard diagnostic sheath ***(36).*** This fluid is clear, sterile, electrolyte free and nonconductive, and not easily miscible with

blood. Instruments must be thoroughly cleaned to prevent crystallization of this viscous material, which will occlude channels and valves ***(32).*** Dextran 70 is useful for patients who have bleeding because it does not mix with blood however, it is expensive and tends to caramelize on instruments, which must be disassembled and thoroughly cleaned in warm water immediately after each use. Anaphylactic reactions, fluid overload and electrolyte disturbances can occur ***(37).***

***3- Liquid non-viscous media:***

**i. Saline and lactated Ringer: -** Cannot be used in the presence of electrosurgical instruments, such as the resectoscope because their electrolytes will conduct the electrical current and dissipate it throughout the uterine cavity ***(38).*** Normal saline is a useful and safe medium for procedures that do not require electricity. Even if there is absorption of a significant volume of solution, Saline does not cause electrolyte imbalance. Therefore, saline is a good fluid for minor procedures performed in the office ***(34).***

**ii. Glycine 1.5%:-** When electrical energy is used inside the uterine cavity it is essential to use a distention media which is electrolyte free. Glycine is optically clear and non-haemolytic and does not conduct electricity. But excessive absorption of such of an electrolyte-free solution can be associated with volume over-load, pulmonary edema, congestive heart failure and hyponatremia ***(39).*** Also glycine is metabolized in the liver and its breakdown can be associated with an increase in ammonia radicals producing confusion, coma, transient blindness, memory loss and death ***(40).***

**iii. Sorbitol: -** It is a non-conducting 3% sugar solution. It is optically clear and is being used as alternative to glycine. It is hyperosmolar solution (165-180 mosmol) and excessive absorption can produce disturbance in blood glucose levels and diabetic features as well as overload and electrolyte disturbance ***(39).***

**iv. Sorbitol and Mannitol (Sorbitol-Mannitol Irrigation):-** Sorbitol 2.7% and mannitol 0.54% are nonelectrolytes,slightly hypotonic solutions, addition of mannitol provides an osmotic diuresis and sorbitol metabolized to fructose and glucose while mannitol is inert ***(41).***

**Instrumentation:**

A diagnostic hysteroscope consists of an optical telescope with a diameter of about 3.5 mm, surrounded by a sheath which increases the diameter to 4 mm and allows the circulation of the distension fluid or CO2. There are different angles of view varying from 0° to 12° or 30° depending on the preference of the operator, but for simple diagnostic laparoscopy a 0° or 12° is the most suitable and allows easier orientation within the uterine cavity and still allows biopsy forceps and the resectoscope loop to remain in the field of view ***(36).***

Some hysteroscopes have a separate channel for biopsy forceps or scissors, or for the introduction of a small flexible laser fiber ***(42).***

Rigid hysteroscopes Fig. (7) Usually incorporate the Hopkins rod lens system and gives a bright, undistorted image that is as clear at the periphery of the fields of view as at

the centre. Although this allows for super optical visualization, it has the disadvantage - at the moment- that dilatation of the cervix is necessary usually up to about 5 mm to incorporate the outer sheath ***(43).*** Although each year the diameter of these rigid hysteroscopes seems to get smaller to avoid dilatation of the cervix, some hysteroscopists prefer a flexible hysteroscope Fig. (8) Similar to a gastroscope, which probably allows easier visualization of the cornual orifice. Unfortunately, however, it produces a grid effect due to the flexible nature of the optical fibres and this produces rather a grainy view, which is far inferior to that obtained with a rigid hysteroscope ***(36).***

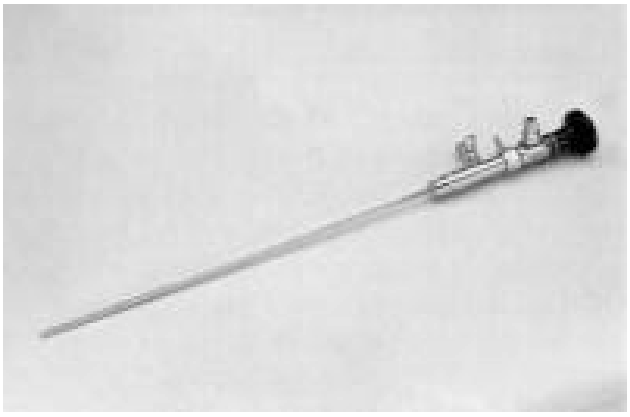

**Figure (7):** 5 mm Rigid hysteroscope (Storz Instruments).

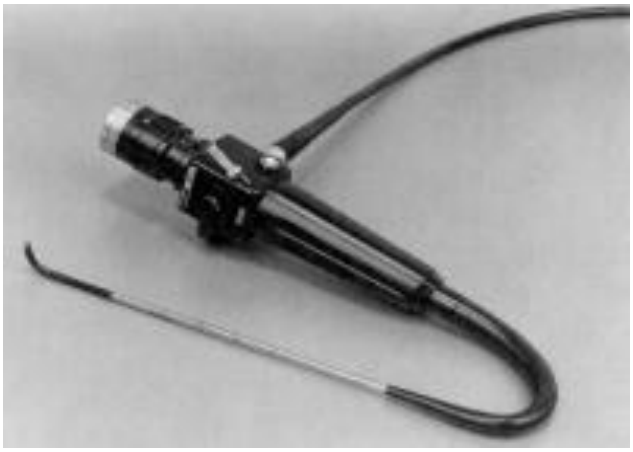

**Figure (**8**):** Flexible diagnostic hysteroscope, 3.3-mm outer diameters for office use(Storz Instruments)..

**The cold light source:**

Developed by Forestiere means that the light is away from the patient and is transmitted via optical cables, which avoids the dissipation of heat inside the uterine cavity. It is very important to handle these cables carefully, otherwise the fibres can break and, after a period of time, there is considerable loss of light intensity. A low-power source of about 150 watts is adequate for simple diagnostic hysteroscopy, but if a video camera is used, a higher intensity zenon or halogen light of at least 250 watts is essential; with this increased intensity the above precautions are even more important ***(44).***

**Pathological findings**

***Polyps: -***

Endometrial polyps are more successfully treated with hysteroscopic guidance, which can often be performed in a clinic or office using local anesthesia. Hysteroscopy may be used either to evaluate the result of blind curettage, or preferably, to guide a grasping

forceps. Alternatively, for larger polyps, a uterine resectoscope may be used to sever the stalk or morcellate the lesion ***(34).***

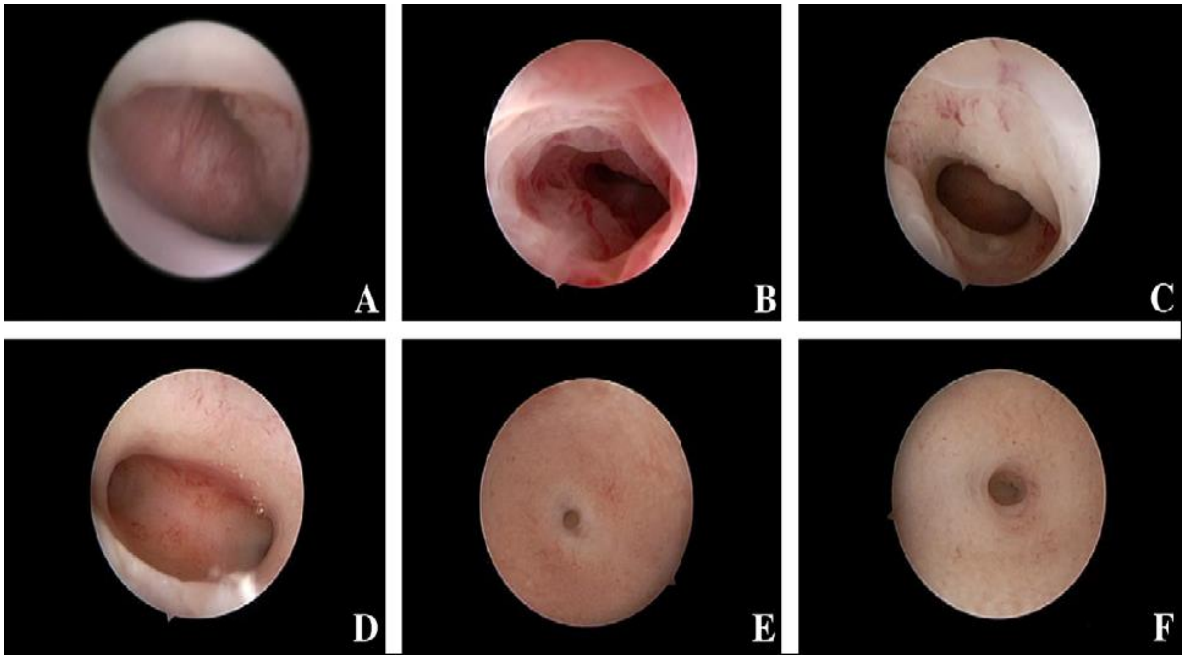


**Figure (**9**):** Hysteroscopy with Visualization of (A) the external cervical os, (B) cervical canal,(C) internal cervical os,(D) uterine cavity overview (D), (E) right tubal ostium and (F) left tubal ostium.

Submucous fibroids are classified loosely on the basis of how much of the fibroid is projecting into the endometrial cavity and how much is within the myometrium. They usually have a whitish appearance and are relatively avascular, although occasionally they do have large blood vessels coursing over the surface ***(45).***

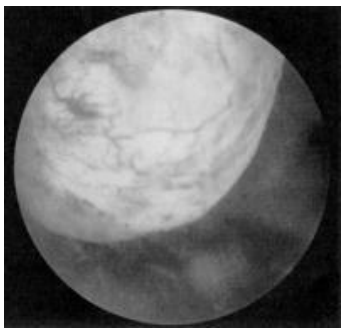

**Figure (10):** Submucous leiomyoma with typical peripheral vascularization seen throughout an atrophic endometrium.

**Endometrial hyperplasia: -**

Cystic glandular hyperplasia often has a specific hysteroscopic appearance of widened glandular ostia with cystic glandular formation approximately one millimetre in diameter. The stroma is soft and boggy due to an increased endometrial thickness and it can easily be compressed by pushing the hysteroscope against it, which leaves a series of deep indentations ***(46).***

Adenomatous hyperplasia can give rise to various appearances: the superficial vascularization can take on an arborescent

pattern with vessel branches of different sizes, there is sometimes a 'corkscrew' appearance of the vasculature, and occasionally straight vessels give an appearance similar to microinvasive carcinoma of the cervix at colposcopy. The differentiation between adenomatous hyperplasia, especially the atypical variety, and endometrial cancer can be extremely difficult and the final diagnosis must always rest on histology; multiple biopsies are essential ***(47).***

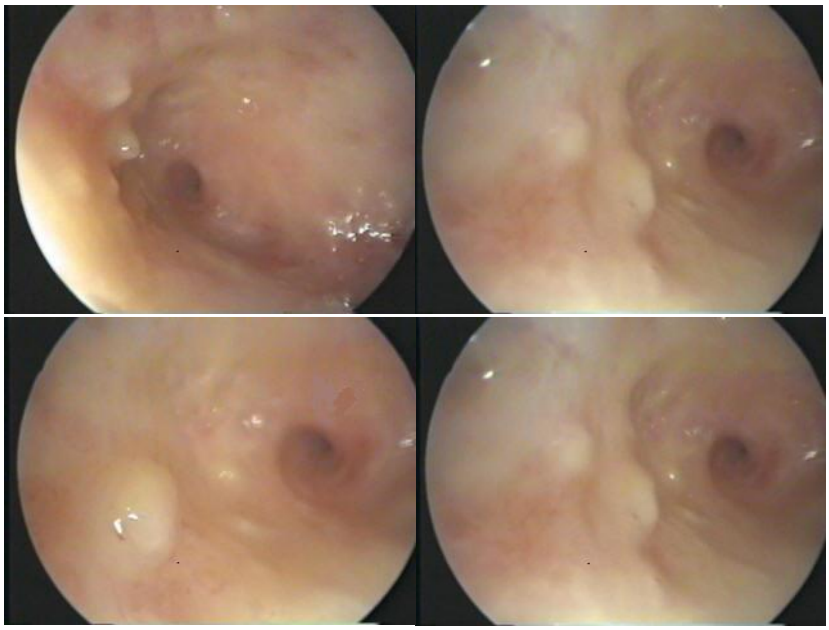

**Figure (11):** Hysteroscopic image of endometrial hyperplasia.

**Endometrial neoplasia:-**

It is usually fairly obvious but the tissue quite often bleeds profusely and sometimes the view inside the uterine cavity is obscured. In its early stage, adenocarcinoma shows irregular, polylobular, delicate excrescences, which are partly nectrotic or bleeding, and the vascularisation is irregular or anarchic with no arborising pattern discernable ***(47).***

**Contraindications of Hysteroscopy:- *(48).***

***(A) Absolute contraindications:***

1- Recent or Current Uterine or Cervical Infection.

2- Profuse Uterine Bleeding.

5- Known Cervical Malignancy.

***(B) Relative Contraindications***

Relative contraindications to hysteroscopy are: known adenocarcinoma of the endometrium, marked cervical stenosis not relieved by dilation, and an operator's unfamiliarity with the instrumentation and technique, particularly unfamiliarity with the distending medium ***(45).***

***Complications of Hysteroscopy***

The most common complications after hysteroscopy are bleeding and uterine trauma. An accepted rate for all complications during surgical hysteroscopy is 3.8% ***(Clark et al., 2018).***

In general, hysteroscopy is one of the safest, easiest, and easily learned surgical procedures in gynecology**.** Diagnostic hysteroscopy is a safe procedure. Complications mainly occur when inappropriate instruments or techniques are used ***(44).*** The potential risks of diagnostic hysteroscopy include uterine perforation; infection, excessive bleeding, and complications related to the distention media ***(38).***

Although hysteroscopic complications are uncommon, they are potentially severe. An accepted rate for all complications during operative hysteroscopy is 3.8%. Perforation and cervical trauma are 2 of the most common complications of hysteroscopy, with uterine perforation approximately 0.7-0.8% ***(38).***

**Anesthetic complications:-**

***1- General anesthesia***

1- Hypoventillation.

2- Oesophageal intubation.

3- Gastrooesophageal reflux.

4- Bronchospasm.

5- Hypotension. 6- Narcotic overdose.

7- Cardiac arrhythmia & cardiac arrest.

8- Inadequate endotracheal intubations result in ventilation of single lung ***(34).***

***2- Local anesthesia***

Complications of intravasular injection of local anesthesia or anesthetic overdose ***(34).***

***B) Complications related to distension media:-***

The risk of gas embolism is the primary complication associated with the use of CO2 as the distention medium. Because of its solubility in plasma, CO2 has a wide margin of safety. Trendelenburg positioning, cervical trauma, and overdilation of the cervix should be avoided to help prevent embolus formation. Intrauterine pressures should be maintained below 100 mm Hg, with maximal flow rates less than 100 mL/min ***(50).***

Fluid overload is rare with electrolyte-containing fluids. When excessive intravasation occurs, isotonic fluid overload occurs. This is relatively easy to treat. However, these fluids are uncommonly used in operative procedures ***(49).***

On the contrary, nonelectrolytes, hypotonic media, which are nonconductive, are most often used for the prolonged, complicated electrosurgical procedures. These media have relatively serious adverse effect profiles. When large volumes of these solutions are absorbed, subsequent hyponatremia, hypervolemia, hypotension, pulmonary edema, cerebral edema, and cardiovascular collapse can occur. Absorption (or deficit) of nonelectrolyte solutions must be closely monitored throughout operative hysteroscopy ***(51).***

For every liter of hypotonic media absorbed, the patient's serum sodium decreases by 10 mEq/L. If the patient's sodium level is less than 120 mEq/L, she is at increased risk for having devastating complications. Hyponatremia can occur rapidly, resulting in generalized cerebral edema, seizures, and even death. In general, if a deficit of serum sodium

that is greater than 1500 mL or if the sodium level is less than 125 mEq/L, the procedure should be terminated. Some suggest that of all nonelectrolyte media, 5% mannitol has the safest adverse-effect profile because it can maintain a patient's osmolality despite hyponatremia, improving neurologic outcomes ***(52).***

If the patient's sodium osmolality is less than 125 mOsm, forced diuresis with furosemide (Lasix) 40 mg IV, fluid restriction, and administration of 3% sodium chloride at a rate to correct hyponatremia by 1.5-2.0 mOsm/L/h is required. To limit any cerebral effects, do not correct the osmolality to more than 135 mOsm. Frequent assessments of the patient's sodium levels every 30 minutes may be appropriate to follow up this titration ***(52).***

**The best measures to take to prevent complications of distension media are:**

1. The operator should select a distension medium that is less likely to cause harm when absorbed;
2. If electo-surgical current is not being used, isotonic solution like saline or Ringer's lactate are preferable;
3. The control of intrauterine and pressure measuring of inflow and outflow should be the job of a designated member of the operative team;
4. An infusion apparatus that measures inflow is necessary, as well as a collection device that allows easy measure of outflow;
5. The first clinical sign of fluid overload is the rapid production of dilute urine. We therefore place an indwelling urinary catheter in all patients to monitor urine output ***(32).***

***C) Complications related to the surgical procedure:-***

Perforation and cervical trauma are 2 of the most common complications of hysteroscopy, with uterine perforation rates of approximately 0.7-0.8%, risk factors for perforation include cervical stenosis, severe uterine anteflexion or retroflexion, infection, myomas of lower uterine segments, and synechiae, Most cervical traumas and uterine perforations occur during dilation of the cervix ***(38).***

Uterine perforations can occur during operative maneuvers as well. Care should be taken during procedures in the cornua because this is the thinnest portion of the myometrium. In general, a small midline or fundal injury with a blunt instrument does not have clinically significant sequelae if bleeding is minimal, but large rents or those caused by sharp or electrosurgical instruments may result in a need for diagnostic laparoscopy to completely evaluate the patient for bleeding or visceral injury. Lateral perforations involve risk of injury to vessels and should be further inspected with diagnostic laparoscopy or interventional radiology and/or angiography ***(34).***

Whenever electrical or laser injury to the bowel or bladder is suspected, laparoscopy or laparotomy is required for complete evaluation. The risk of peritonitis, sepsis, and death are most often

associated with unrecognized and untreated thermal injuries to the viscera. Some of these thermal visceral injuries occur without apparent perforation of the uterus. For procedures in which electrical or laser energy is used, the surgical tip should be kept in direct view to avoid thermal injury ***(38).***

**Limitation of Hysteroscopy**

In the following conditions, although hysteroscopy is not contraindicated, it must be done with great care or with special arrangements.

***A- Extensive intrauterine adhesions:*** There is increased risk of uterine perforation during inspection or dissection of extensive intrauterine adhesions.

***B- Stenosed cervix:*** As in cases following cone biopsy or pelvic irradiation, which may limit of cervical dilatation ***(48).***

***C- Patients with advanced cardiac or pulmonary diseases:*** As with all surgical procedures, these patients are at increased risk of operative and postoperative complications ***(53).***

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