**ANAESTHESIA FOR HYSTEROSCOPY**

**PROF.L.PARTHASARATHY MD,DA.**

 **PROF OF ANAESTHESIOLOGY**

**TAMILNADU GOVT MULTI SUPER SPECIALITY HOSPITAL.CHENNAI -2**

**INTRODUCTION:**

 Hysteroscopy is a simple method of visualization of the uterine cavity used both as a diagnostic and therapeutic tool. Diagnostic hysteroscopy is generally performed as outpatient procedure, without the need for general anaesthesia and is replacing dilatation and curettage as a diagnostic tool in the diagnosis of abnormal uterine bleeding. Therapeutic hysteroscopy offers for e.g., a minimally invasive alternative to hysterectomy for specific indications with reduced hospital stay, early recovery and lower postoperative morbidity as compared to conventional surgery.

**1.HISTORY:**

 Visualization of the uterine cavity by an endoscope was first described by Pantaleoni as long ago as 1869 isolated and cauterized a uterine polyp with silver nitrate. Later in 1905 Bozzine used a light conductor made of a tin lantern with a system of mirror and tubes through which candle-light was reflected via a tube shaped speculum. With this device he inspected the nasal cavity, urethra, vagina and rectum. In 1943, due to his pioneering work in the study of the uterine canal, W.B. Norment was called the ‘Father of Hysteroscopy’. Later on Hamous, in 1979 introduced the technique of microhysteroscopy and studied its applications in gynaecology.

**ІІ. INDICATIONS FOR HYSTEROSCOPY**

1. **Therapeutic and Diagnostic Indications**
* Division/ ablation of uterine septum
* Treatment of uterine synechiae
* Removal of IUCD (intrauterine contraceptive device)
* Evaluation of intrauterine filling defects
* Removal of endometrial polyps
1. **May be useful in**
* Evaluation of carcinoma in situ
* Evaluation of unexplained infertility
* Removal of submucosal leiomyomato
* Evaluation of unexplained uterine bleeding
* Evaluation of uterine scars
1. **Investigational uses**
* diagnosis and staging of endometrial neoplasia
* Endosalpinx evaluation
* Tubal occlusion for recanalisation

**ІІІ. CONTRAINDICATIONS FOR HYSTEROSCOPY**

The absolute contraindications to either diagnostic or surgical hysteroscopy are few. It should be avoided in:

* Pregnancy
* Active uterine infections or salphingitis
* Vaginal sepsis and cervicitis due to fungal infections
* During menstruation as the view is obscured and diagnosis is difficult. The open blood vessels of the endometrium also increase chances of gas embolism.

**ІV. SURGICAL TECHNIQUE**

This technique involves placing of a rigid or flexible small gauge fibreoptic scope for therapeutic or diagnostic procedures respectively. Since the uterine cavity is a potential space, to visualize the endometrium, a suitable distension medium is required to distend it. A variety of media have been used and to date, none of them meet the requirements of an ideal medium. The risks associated with hysteroscopy are more with therapeutic procedures as compared to diagnostic procedure. Higher distention pressures, longer duration of procedure, a more vascular endothelium, all increase the risks of greater vascular absorption.

**V. DISTENDING MEDIUM**

Distending medium is necessary during hysteroscopy to distend the uterine cavity and facilitate clear visualization of the underlying problems.

Various distending media are used for diagnostic hysteroscopy and for operative procedures.

1. **Gaseous Distension**

Gaseous distention is suitable only for diagnostic procedure because the risk of embolus is too great when blood vessels are breached during therapeutic hysteroscopies.

**Carbon Dioxide**

It is the most widely used distending medium for diagnostic hysteroscopy. It is noncombustible and highly soluble in blood hence it is associated with a very low risk of gas embolism during diagnostic hysteroscopy. It has a high refractive index of 1.00, which provides perfect image transmission and thus a clear view of the uterine cavity. The use of inappropriate insufflation equipment such as that used for laparoscopy should be avoided as it can achieve a maximal insufflations rate of upto 16 L/ min, which, can potentially force cause cardiac arrest. Similarly, lasers requiring coaxial gas cooling are usually avoided for use in the uterine cavity. Thus, carbon dioxide hysteroscopic specific insufflators (Hysteroflators) with gauges to display pressure and flow rates should be used. Gaseous insufflation equipment for hysteroscopy must limit the flow rate to 100 ml/min with a maximal distending pressure limited to 100 mmHg.

1. **Fluid Distension Medium**

Surgical hysteroscopy requires distension of the uterine cavity by a fluid medium. Fluid instillation into the uterus serves two purposes- to facilitate good visualization and compression vessels to avoid bleeding. This requires a distension system capable of generating inflow pressure of 80 mmHg to 110 mmHg. There is significant risk of inadvertent absorption of the irrigant due to truncated uterine blood vessels with varying clinical presentation depending on the nature and amount of irrigant fluid.

In 1947 Creevy reported the TURP syndrome in patients undergoing TURP, due to absorption of sterile water. Thus, less hypotonic, low-viscosity irrigation solutions such as glycine, and sorbitol were introduced which reduced the risk of haemolysis.

An ideal fluid should have the following qualities:

* Good optical conductivity
* Physiological compatibility
* Absence of electrical conductivity
* Easy availability in appropriate packing
* Less sticky and mixing with blood
1. **Hyskon (32 % Dextran 70 in 10 % Dextrose)**

It is a clear, high-viscosity, polysaccharide composed of glucose units. Its molecular weight is 70,000 and it is presented in sterile solution of dextrose 10% with excellent optical property and is very viscous and sticky. It can be diluted to reduce viscosity. It doesn’t mix readily with blood and its forms a suspension that can interfere with visualization. It is helpful to have a suction cannula available to aspirate any blood or debris that may impair vision. It does not require special equipment and is delivered in small amounts in a 50 ml hand-held syringe.

The major disadvantages of Hyskon is its propensity to act like glue when its dries. The instruments must be disassembled and washed in hot water immediately after use to avoid caramelization and bonding of the components and valves.

Due to its potentially serious side effects and the availability of continuous flow hysteroscopes, its use has been limited. Dextran is antigenic and can result in acute anaphylactic shock. Dextran syndrome may occur, presenting with a clinical picture of oedema, anaemia and coagulopathy. Patients with greatest risk include those with surgical time greater than 45 min, or if more than 500 ml of distending fluid is used, or when large areas of endometrium are traumatized. Distending pressures greater than 150 mmHg have also been implicated.

1. **Low – Viscosity Fluid distending Medium**

5% Dextrose, Normal saline, Sorbitol, Ringer Lactate, Glycine

Low- viscosity media do not cause problems with instrument maintenance as found with Hyskon. Blood in the endometrial cavity will mix with these solutions and could the view. No special equipment is needed to supply low- viscosity fluids as they can be delivered by a large syringe or by gravity.

1. **Normal Saline:** can be used as a distending medium only for diagnostic hysteroscopy, but should never be used in the presence of electric current. It is safe with the use of laser and since it is isotonic it is theoretically less dangerous.
2. **Ringer Lactate:** This fluid is preferred where electrosurgery is not used, like diagnostic hysteroscopy, hysteroscopic biopsy, adhesiolysis and septum resection with scissors. Electrical conductivity preclude its use in electrosurgery. It has good optical conductivity, is physiological, totally non-sticky and does not procedure hyponatremia. The inherent danger of fluid overload is definitely present on prolonged use.
3. **Glycine:** A 1.5% solution of the amino acid glycine is non-conductive and nonhaemolytic , has good optical properties, and is therefore well suited for surgical hysteroscopy. It is hypotonic relative to extracellular fluid, with an osmolarity of 200 mmol/ L. Because glycine is electrolyte free, excessive systemic absorbtion can result in hyponatremia, hypokalemia, hypocalcemia, and hypo-osmolarity.
4. **Sorbitol and Mannitol:** Sorbitol 2.7% with mannitol 0.54% is available as a commercial mixture and is reported to produce minimal changes in serum electrolytes and osmolality. The fluid, however, is devoid of electrolyted. Although appropriate for electrocautery, it again carries the risk of dilutionalhyponatremia and development of the TURP syndrome. An advantage of sorbitol is its short half life of 35 minutes, being metabolized in the liver to fructose and glucose. Hyperglycaemia is thus a potential complication of excessive absorption. Over 90% of absorbed mannitol is freely filtered by the kidneys,causing an osmotic diuresis. This could offset the potential for fluid overload from systemic absorption of the irrigating fluid. Higher concentrations of mannitol can cause visual distortion and can crystallize on the hysteroscope, causing surgical difficulties.

**VІ. ANAESTHETIC CONSIDERAATIONS**

1. **Diagnostic Hysteroscopy**

These procedures are generally performed with minimal sedation and without anaesthesia as office-based techniques. However, various forms of anaesthesia ranging from no anaesthesia, topical anaesthesia of the uterine cavity, simple infiltration of local anaesthetic and paracervical block have been used. Regional of general anaesthesia are required for those who cannot tolerate the procedure. Adequate cardioresipratory monitoring is of paramount importance for early diagnosis and management of complications like vasovagal attacks, local anaesthetic toxicity and gas embolism. Shoulder-tip pain from diaphragmatic irrigation by co₂ may also occur. Acceptance and satisfaction with office based techniques greatly improves if patients are adequately counselled.

1. **Surgical Hysteroscopy**

Operative hysteroscopy (OH) is now an accepted alternative to hysterectomy for women with menorrhagia. The advantages of OH are associated with its short operating time, rapid post-operative recovery and low morbidity. Anaesthetic techniques and agents that allow early ambulation and “street readiness” are required with adequate analgesia and antiemesis. A preoperative evaluation should focus on the degree of uterine bleeding and anaemia. If bleeding is excessive, pretreatment with GnRH agonists may reduce the endometrial vascularity and thus reduce bleeding of irrigant fluid.

Regional anaesthesia may offer an advantage over general anaesthesia in early recognition of fluid accumulation and the “female TURP syndrome”. A sensory blockade upto T₁₀ or above is required for adequate anaesthesia of the uterus. Local anaesthesia with a short duration of action like mepivacaine, lignocaine, ropivacaine etc. can be used. Bupivacaine, a longer lasting alternative, despite good return of sensory and motor function, may delay discharge due to failure to void postoperatively. Incidence of post spinal head ache can be significantly reduced by using pencil-point, non-cutting needles such as the Whitacre or Sprotte models. General anaesthesia can be achieved with propofol for induction and O₂ Nitrous oxide and a volatile anaesthetic for maintenance. Total intravenous anaesthesia (TIVA) with propofol infusion instead of inhalational anaesthesia reduces nausea and vomiting (PONV). For shorter cases, the airway can be maintained with face mask or laryngeal mask airway (LMA) with spontaneous ventilation. For major endometrial resections, tracheal intubation and controlled ventilation may be required. Appropriate monitoring should include fluid balance, routine monitoring as well as temperature, electrolytes, SPO₂, ETCO₂ and blood sugar measurements. In high-risk patient who are more sensitive to intravasation of irrigation fluid, central venous and/or pulmonary artery pressure measurements may be of help in detecting as well as treating carbon dioxide and or/ air embolism and fluid imbalance in this group of patients. In prolonged resections, cold irrigating fluids may lead to significant drop in body temperature so monitoring of core temperature is indicated. The following guidelines have been proposed by ananthanarayan et al (1996)⁷ for fluid balance:

* 500 ml deficit- measure serum electrolytes
* 1000 ml deficit- furosemide 20mg IV and measure serum electrolytes
* 2000 ml deficit- terminate procedure.

If at any stage, hyponatremia is detected, then procedure should be abandoned.

**VІІ. COMPLICATIONS OF HYSTEROSCOPY**

Complications can occur both during the procedure and throughout the postoperative period either due to distending medium (or) directly related to the procedure.

1. **Early Complication: (During Procedure)**
2. **Secondary to uterine distension**
	* 1. CO₂ gas embolism
		2. Anaphylactic reaction to dextran 70(Hyskon)
		3. Dilutional hyponatraemia syndrome
		4. Female TURP syndrome
		5. **Carbon Dioxide gas embolism:** carbon dioxide is not an ideal distending medium for operative hysteroscopy as it forms bubbles in the blood and hampers vision. During surgery due to the high intra – uterine pressure of carbon dioxide (which is greater than the patients’ blood pressure), it is forcefully injected into the blood steam.

A sudden decrease in end-tidal carbon dioxide (ET CO₂) as the right outflow of the heart becomes increasingly obstructed, (which is often accompanied by arterial oxygen desaturation), is likely to be the first indication of gas embolus and impending cardiovascular collapse (corson et al,1996).

If a gas embolus is suspected then,

* administer 100% oxygen
* stop nitrous oxide
* cease insufflations of CO₂
* terminate procedure immediately.

in severe cases, the patient should, be placed in the left lateral decubitus position, so that embolus is trapped in the heart and does not pass into the pulmonary arteries. Aspiration of the gas by a central venous catheter may then be possible. To reduce the risk of embolus.

* Pretreatment of patient with gonadotropin releasing hormone (GnRH) agonists to reduce endometrial vascularity.
* Avoidance of steep trendelenburg position.
* Careful deairation of equipment by operators.

Use of pre-cordial Doppler may provide an earlier warning than reduction in ET CO₂ though it does not give an accurate diagnosis.

* + 1. **Anaphylactic reaction to dextran 70(Hyskon):** The incidence of life-threatening anaphylaxis to dextran is estimated to be between 3and 8 per 10,000 cases. Life- threatening allergic reactions are not dependent on the amount given and often occurs early in the infusion process. Prior exposure to dextran may not be necessary because the body may have produced antibodies prior to exposure to native dextran producing organisms in the gastrointestinal tract , dietary sugars or food additives containing polysaccharides. Because of the risk and despite the fact that large quantities are not mandatory to initiate the reaction, it is recommended that to minimize risk, only 300ml should be allowed to be absorbed during operative use of the resectoscope.
		2. **Dilutional Hyponatremia Syndrome:** fluid overload may occur in 0.2% cases and result in significant morbidity and mortality, depending on the individual distension media used. It is describes as the “Dextran Syndrome”. Dextran 70 infusion can result in haemodilution and fluid overload, because of colloid osmotic property of dextran, as each gram of dextran 70 holds about 27ml of water. Therefore, each 100ml of 32% dextran 70 solution that is absorbed intravascularly would expand circulating volume by about 860ml. when it is used in excess of 1.5 gm/kg body weight, it interferes with coagulation by inhibiting factor VIII resulting in coagulopathy. Thus the clinical picture of fluid overload, dilutional hyponatremia, non cardiogenic (hyper volemic) pulmonary oedema, anaemia and coagulopathy is referred to as “Dextran Syndrome”. Treatment of dextran syndrome involves maintenance of oxygenation with supplementary oxygen and controlled ventilation when appropriate, and promotion of diuresis to offload fluid. Monitoring of central venous pressure can be useful in diagnosing volume overload and directing therapy. If improvement is not rapid, a pulmonary artery floatation catheter and monitoring of pulmonary capillary wedge pressure are sometimes required. Blood products can be required to treat the coagulopathy and anaemia.
		3. **Female TURP Syndrome:** intravascular absorption of electrolyte- poor irrigation fluid has been implicated in the TURP syndrome. More recently, a similar syndrome has been described in several case reports in women undergoing surgical hysteroscopy. The clinical picture of TURP syndrome varies from a transient mild disorder to life threatening cerebral oedema and cardiorespiratory arrest. This has a complex etiology resulting from a combination of volume overload, dilutional hyponatremia, and hypo-osmolality

Glycine enters the vascular system directly through truncated blood vessels in the surgical field, and also more slowly from the peritoneum, when it reaches the fallopian tubes of the uterus. Its effected on body fluid homeostasis are complex and appears to be biphasic. At first , because it is electrolyte free, as the glycine initially helps to maintain the serum osmolality. Although calculated osmolality will drop as the serum sodium is reduced, actual or measures osmolality remains unchanged or decreases to a lesser extent. Glycine has an intravascular half-life of 85 minutes. It is both absorbed intracelluarly and metabolized, leaving excessive free water extracellularly hyponatremia will result. Excess ADH secretion, which occurs in the stress response to surgery, can confound this effect by reducing renal elimination of the excess water. The clinical implication of this is that as water moves along its osmotic and hydrostatic gradients extravascularly, it can result in noncardiogenic pulmonary oedema and hypotension. The picture is complicated further because glycine itself is an inhibitory neurotransmitter within the CNS and also potentiates the excitatory neurotransmitter N-methyl-D-aspartate (NMDA) by potentiation of its receptor activity. This can contribute to seizure activity. Glycine toxicity also manifests itself as nausea, vomiting, headache, malaise, and weakness. It also been implicated in visual disturbances including complete but transient blindness seen after TURP and also after operative hysteroscopy. In addition, a major metabolite of glycine produced by oxidative deamination is ammonia, and this could also contribute to the CNS symptomatology seen in TURP syndrome. Treatment of the syndrome is both supportive and aimed at reducing fluid overload and returning serum sodium and osmolality to normal. In symptomatic patients with reduced serum sodium and reduced serum osmolality, treatment goals are clear replacement of sodium and elimination of excess body water to reduce the risk of cerebral oedema-and brain herniation. The patient should be treated in an intensive care unit (ICU) with monitoring of central venous pressures to monitor volume status. Avoidance of hypoxia, which can worsen cerebral ischaemia and brain swelling, may require tracheal intubation and controlled hyperventilation. Seizure can cause cerebral hypoxia and should be treated promptly. If both the measured sodium and osmolaity are low (i.e., sodium <115 mmol/L; osmolity<230 mOsm/L).then, hypertonic saline can be infused to correct the existing water intoxification partially. The rate and extent of correction are debateable. Too slow a correction for such acute hyponatremia can be associated with excess mortality. Excessive speed of correction has been implicated in causing central pontine demyelination (CPM). Recommendations to avoid CPM include correction of not more than 12 m Eq /L serum sodium in 24 hours. Aiming for mildly hyponatremic levels is probably safer than risking overcorrection.

**2.secondary to interventions**

**i) Uterine perforation:** it is, the most common complication of hysteroscopy, with an incidence of approximately 1.4% it is higher in individuals with asherman’s syndrome and cervical stenosis with an incidence as higher as 10%. There is a risk of thermal injury to internal viscera if electrocautery or laser energy has been used, so that diagnostic laparoscopy is performed in such cases to assess any such damage.

**ii) Haemorrhage:** significant haemorrhage during hysteroscopy is rare because the distension pressure probably acts as a “tamponade” for the transected vessels. Thus, with release of pressure at the end of ablation, postoperative bleeding can be more of a problem. Treatment ranges from simple tamponade with a Foleys catheter to intracervical oxytocin (pitressin) injection or packing, if simple measures fail, bilateral uterine artery embolization or, ultimately emergency hysterectomy can be performed. Resuscitation with intravenous fluid und blood products as required must accompany these measures.

**iii) cervical trauma:** it is a relatively common occurrence when larger gauge scopes are used. Patients with pre exisiting cervical stenosis are at maximum risk. The use of smaller scopes significantly reduces the incidence of cervical tears.

1. **Late complications: (after the procedure is completed)**

**Infection:**

Infection is a rare complication and prophylactic antibiotics are not universally required unless the patient has a history of pelvic inflammatory disease or requires prophylaxis for some other reason recurrent bleeding, synechiae, endometrial cancer, haematometra and the need for reoperation are some of the other complication.

**Due to lithotomy position:**

The procedure is carried out eith the patient in the lithotomy position which in itself carries risk, particularly like nerve injury. Careful padding and correct led position are therefore correct leg position. Are therefore essential minimize of nerve damage.

Length of surgery also can affect the amount of intravasation of irrigation fluid. Hyponatremia is directly related to fluid uterine perfortation and rarely gas or air embolism.

**Conclusions:**

Thus with proper preoperative evaluation meticulous technique and vigilance for impending problems, introperative and early postoperations of OH largerly preventable.