

# Hysterosalpingography (HSG) at the Start of the New Millennium

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## SUMMARY

*Hysterosalpingography (HSG) outlines the uterine cavity and the fallopian tubes. Since the first hysterosalpingogram performed in 1910, a great deal of information is available regarding strengths and limitations of this procedure. Despite the advent of MRI sonohysterosalpingography, laparoscopy and hysteroscopy, hysterosalpingography is still useful and a widely employed test for the evaluation of uterine and tubal pathology. This article reviews the fundamentals and advances in techniques for performing a proper HSG and describes the abnormalities encountered and their interpretation. This procedure is most appropriate for evaluating women with problems of infertility, recurrent abortion and to monitor the effects of tubal surgery. Contraindications to this procedure and complications are discussed. HSG is an invaluable study to demonstrate uterine abnormalities like polyps, fibroids, intrauterine adhesions and mullerian duct anomalies. Tubal pathology like blockage, hydrosalpinx, tuberculosis salpingitis and salpingitis isthmica nodosa are well delineated. In general, hysterosalpingography is a worthwhile procedure of evaluating internal architecture of female reproductive tract and provides a wide range of information, which can be extremely useful in the diagnosis and management of infertile women.*

## INTRODUCTION

The first hysterosalpingogram (HSG) was performed 89 years ago by using Bismuth emulsion as the contrast medium. Since then HSG has been a primary technique in the evaluation of infertility. With the advent of new modalities like ultrasound and MRI the procedure has been performed less frequently at some centres. However, with recent development of selective fallopian tube catheterization and ultrasound contrast medium (Sonohysterosalpingo-graphy), there is renewed interest in the technique of the test and anatomy of uterus and fallopian tubes<sup>1</sup>. Hysterosalpingography remains an integral part of gynaecological investigation and its value has not diminished in modern practice<sup>2</sup>. It is the only currently available technique to provide images of lumina of fallopian tubes, their patency and gives accurate outline of the uterine cavity. Utilizing HSG, it may be possible to minimize the use of

more invasive procedures like hysteroscopy and laparoscopy in the evaluation of infertility<sup>3</sup>.

### Indications<sup>4-8</sup>

- \* **Infertility:** to demonstrate the patency of fallopian tubes. Majorities of abnormalities are related to tubal occlusion or peritubal adhesions from pelvic inflammatory disease or endometriosis.
- \* **Recurrent abortions:** to demonstrate congenital abnormalities of the uterus, which account for about 20% of primary infertility.
- \* **After tubal surgery:** to confirm tubal occlusion in a sterilization procedure, to demonstrate patency after reversal procedure, to monitor effects of operations like salpingolysis, salpingostomy, tubal resection and anastomosis.

- \* Following myomectomy and after hysteroscopic surgery: for residual disease or complications of surgery like synechiae or diverticula.

#### Contra-indications<sup>4,9,10</sup>

- \* **Pregnancy:** HSG performed during pregnancy carries a high risk of abortion as well as teratogenic hazards of radiation.
- \* **Pelvic infection:** There is every likelihood of spread of infection.
- \* **Immediate pre- and postmenstrual phases:** Thickened and denuded endometrium in the pre- and postmenstrual period increases the chance of venous intravasation, also there is risk of performing the procedure in the presence of pregnancy in the premenstrual phase.
- \* Recent dilatation and curettage.
- \* **Sensitivity to contrast media.**

#### Technique<sup>9-11</sup>

The optimal time to perform HSG is towards the end of first week after the menstrual period. At this time tubal filling is readily achieved, isthmus distends well and there is no risk of performing the test during early pregnancy.

##### \* Preparation

Pre-medication is generally not required provided the procedure has been explained and adequate reassurance given. However in anxious patients 5-10 mg Diazepam would suffice. Morphine and pethidine are contraindicated as these induce smooth muscle spasm and interfere with tubal filling.

##### \* Method

This requires injection of contrast medium through a cannula or a self-retaining catheter under fluoroscopic control. Patient is placed in lithotomy position on the screening table. The cervix is exposed with the vaginal speculum and external os is thoroughly swabbed with mild antiseptic solution. Cannula is then introduced into the cervix with the help of volsellum/tenaculum forceps followed by removal of the vaginal speculum. Injection

cannulas commonly used are Leech-Wilkinson cannula and suction cannula (Malstrom-Westamann cannula).

A preliminary radiograph is only required if some density is seen on screening. The contrast medium is warmed to body temperature and is then injected under fluoroscopic control. Usually 8-12ml is sufficient. Generally three films are taken; one during early uterine filling, another to show uterine / tubal filling and early spill and a delayed 20-minute film to show the pattern of peritoneal spillage. A prone radiograph may sometimes be helpful in questionable loculation. All the contrast generally disappears by one hour after injection. The mean radiation dose to the ovaries is 2 mGy (van der Weiden & van Zijl, 1989).

- \* **Catheter technique:** This is a fairly popular method involving the introduction of 8-F Foley catheter into the uterine cavity. The balloon is then distended with 1-1.5 ml of water and is pulled downwards towards the internal Os prior to injection of the contrast medium. The isthmus and internal Os may be demonstrated by injecting contrast medium during deflation and catheter withdrawal. Catheter HSG is generally less traumatic and more comfortable for the patients and allows turning the patient to oblique and prone positions during the procedure. Both catheter and cannula techniques produce excellent filling of the uterus and fallopian tubes.

- \* **Contrast media:** Lipiodol ultra-fluid is oily contrast medium. It carries the risk of inducing peritoneal fibrosis and oil embolism, if intravasation occurs. Water-soluble contrast media like Urograffin 370 give highly satisfactory results. This may be replaced by non-ionic contrast media, which cause less peritoneal irritation and pain. Water-soluble contrast media provide better uterine and ampullary mucosal details. Some studies credit oil soluble contrast media for higher pregnancy rates after the procedure whereas others conclude there is no statistical difference. Use of oily contrast media is no longer recommended<sup>12-14</sup>.

### Complications<sup>4,9,10,11,14,15</sup>

- \* **Pain:** Lower abdominal discomfort and pain is caused by insertion of cannula and distension of uterus and fallopian tubes but this subsides within 10 to 15 minutes. There is sometimes generalized lower abdominal pain due to peritoneal irritation and is more frequent with HOCM. This usually disappears within 24 hours but may persist for several days. Balloon catheter produces less discomfort than the standard cannula.
- \* **Pelvic infection:** There is reported incidence of 0.25 - 3.0 % after HSG and is usually due to exacerbation of previous infection.
- \* **Haemorrhage:** Slight spotting due to application of forceps.
- \* **Allergic phenomena:** Urticaria, asthma and laryngeal edema may occur as hypersensitivity reactions.
- \* **Vasovagal attacks**
- \* **Venous intravasation:** Intravasation of contrast medium into venous plexus of uterus shows a fine interlacing network obscuring the uterus with simultaneous outlining of larger pelvic veins. Intravasation occurs due to a) excessive injection pressure b) trauma to the endometrium by the tip of the cannula c) deficient endometrium as after menstruation or curettage (Fig. 1).

### Normal hysterosalpingogram (Fig. 2)

The normal uterine cavity is triangular in shape, both the average length and intercornual diameter are 3.5 cms. The cervical canal is usually 2.5-3.5 cm and shows serrated borders caused by plicae palmatae. The isthmus is a narrow segment between the uterine body and cervical canal and is distinctly visible in only half of the normal hysterograms. There is a constriction at the cornutubal junction reflecting a sphincter. The fallopian tubes have an average length of 10-12 cm with isthmic portion opening laterally into the wide ampulla. Non-filling of the fallopian tubes is sometimes due to cornual spasm. Gentle injection pressure with or without I.V. Buscopan / Glucagon may help<sup>4,9</sup>.



Fig.1: Normal Hysterosalpingogram showing normal uterine cavity, both fallopian tubes and free peritoneal spill.

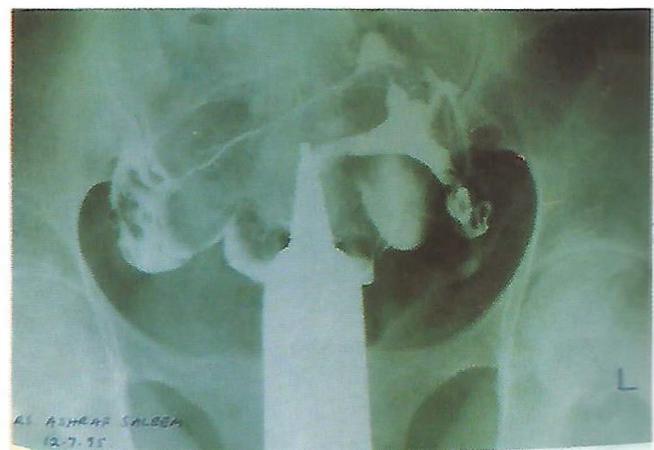


Fig.2: Venous intravasation into uterine venous plexus draining into pelvic veins.

### ABNORMAL HYSTEROSALPINGOGRAM

#### Uterine abnormalities

The normal uterine cavity on HSG is triangular with a smooth outline. Filling defects within the uterine cavity are due to air bubbles, polyps, blood clot, adhesions, submucous myomas, carcinoma and endometrial hyperplasia.

- **Uterine Fibroids/Polyps:** Submucosal fibroid

cause filling defects and distortion of the uterine cavity, which is often enlarged. Endometrial polyps may appear as filling defects<sup>7,16</sup> (Fig. 3).

**Adenomyosis:** refers to presence of endometrium within the myometrium and associated myometrial hyperplasia. On hysteroscopy uterine cavity is enlarged and shows short outpouchings along the body and fundus of uterus<sup>11</sup> (Fig. 4).



Fig.3: Uterine myoma: enlarged and distorted uterine cavity showing filling defects due to myomas.

- **Intrauterine Adhesions (Asherman's Syndrome):** Filling defects of variable shapes and bizarre pattern may be seen on hysteroscopy<sup>11,17</sup> (Fig. 5).



Fig. 5: Intrauterine adhesions: distorted uterine cavity showing irregular filling defects.

- **Diethylstilbestrol (DES) Exposure in Utero:** This can cause uterine abnormality shown on HSG as irregular constrictions and T-shaped uterine cavity<sup>11,18</sup>.
- **Congenital anomalies of uterus:** represent varying degrees of failure of fusion of mullerian ducts<sup>19-21</sup>.



Fig. 4: Adenomyosis: short diverticular outpouchings along the body and fundus of uterus.

- **Uterus Didelphys:** Complete duplication of vagina, cervix and uterus.
- **Uterus Bicornis bicollis:** There is close connection of the moieties in the cervical region.
- **Bicornuate Uterus:** The two separate horns are joined together just above the cervix (Fig. 6).
- **Septate / Arcuate Uterus:** These represent minor degrees of division. HSG will show two separate and symmetric cavities in both septate and bicornuate uteri. However, if the angle of divergence is acute (< 75 degrees) it is more likely a septate uterus. If the horns are divergent with an obtuse angle between them, bicornuate uterus is more likely diagnosis<sup>22,23</sup>.

- **Unicornuate Uterus:** A single uterine cavity lying on one side of the midline with single fallopian tube. A rudimentary opposite horn may be seen.
- **Infantile Uterus:** Uterus is small with long cervix relative to the body.



Fig. 6: Bicornuate uterus.

#### Tubal abnormalities

Fallopian tubes have a limited reaction to disease and this is either obstruction and/or dilatation.

- **Obstruction:** Obstruction of various portions of fallopian tubes is commonly due to infection (SIN), endometriosis, tubal ligation and previous surgery<sup>11,17</sup> (Fig. 7).
- **Hydrosalpinx:** This specifically represents the dilatation of ampillary portion of the tube due to distal obstruction<sup>11,17</sup> (Fig. 8).
- **Diverticulosis (Salpingitis Isthmica Nodosa):** Multiple small diverticula of fallopian tubes are demonstrated. The abnormalities are bilateral (in 80% of cases) and uniform and tubal obstruction is usual<sup>11,17</sup> (Fig. 9).
- **Tuberculosis:** Tubal occlusion is usually bilateral. There may be alternate areas of tubal narrowing which gives a beaded appearance. When the uterus is involved the cavity may be small, irregular and contracted<sup>4,9</sup> (Fig. 10).



Fig. 7: Bilateral tubal occlusion of interstitial and isthmic portions.



Fig. 8: Bilateral hydrosalpinx.

- **Peritubal Adhesions:** Adhesions are difficult to evaluate by HSG and are major source of discrepancy between results of laparoscopy and HSG. Endometriosis, infection and surgery are the commonest sources of adhesions. Laparoscopy gives direct visualization of

adhesions whereas HSG gives indirect evidence of their presence like convoluted/vertical fallopian tubes, ampullary dilatation and / or loculated spill<sup>24-26</sup> (Fig. 11).



Fig. 9: Unilateral Salpingitis Isthmica Nodosa & Tubal Occlusions.



Fig. 11: Peritubal adhesions: convoluted tubes showing loculated spill.



Fig. 10: Tuberculosis: Small uterine cavity with alternate tubal narrowing and dilatation.

#### Cervical canal

Cervical canal is best seen when contrast medium is injected through suction cum cannula device. The diameter of the internal Os should not be more than 6mm.<sup>4,10</sup>

#### Comparison to other techniques

Laparoscopy is a superior technique in the identification and evaluation of the peritubal adhesions<sup>25,27</sup>. Hysteroscopy / Salpingoscopy are fibreoptic microendoscopic methods which are gaining popularity allowing direct access to uterine cavity and lumina of fallopian tubes and also have therapeutic potential. Transvaginal ultrasonography gives detailed evaluation of the myometrium. Use of ultrasound contrast media (Echovist) has shown significant promise in the evaluation of tubal patency<sup>28,29</sup>. MRI is highly accurate in the detection and diagnosis of uterine anomalies and leiomyomas<sup>16,21</sup>. There is also reported high degree of accuracy of Technetium-99 m labeled human albumin microspheres introduced directly into the uterine cavity for assessment of tubal patency, but is associated with high radiation dose to ovaries<sup>30</sup>.

## ACKNOWLEDGEMENTS

I am thankful to Dr. Arifa and Dr. Fareeha for helping in the preparation of the manuscript and Miss Yaamina Rahim for formatting.

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