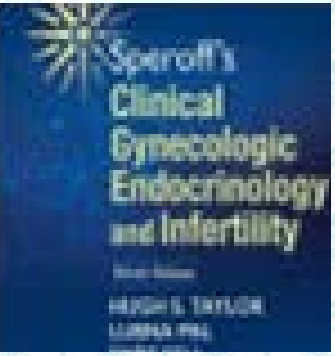

UpTo Date
2021

Hysterosalpingography

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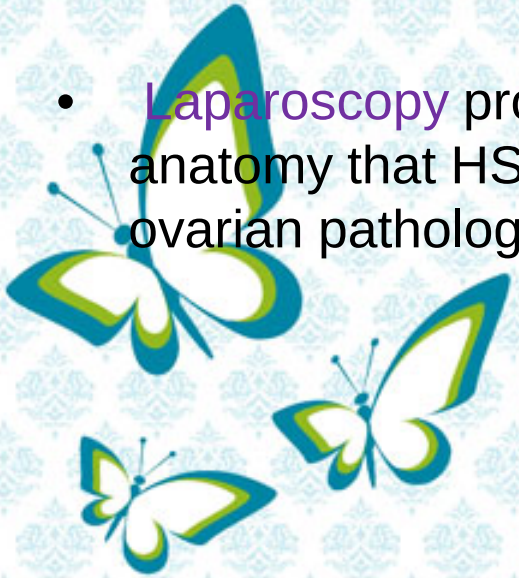
OB & GYN

Infertility Fellowship

- HSG and laparoscopy are the two classic methods for evaluation of tubal patency in infertile women and are complementary rather than mutually exclusive; each provides information the other does not and each has advantages and disadvantages.

- HSG images the uterine cavity and reveals the internal architecture of the tubal lumen, neither of which can be evaluated by laparoscopy.

- Laparoscopy provides detailed information about the pelvic anatomy that HSG cannot, including adhesions, endometriosis, and ovarian pathology.

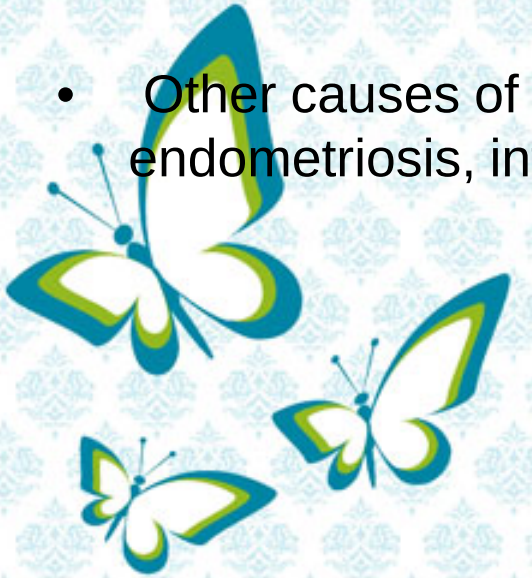


INTRODUCTION AND DEFINITION

- Tubal and peritoneal pathology is among the most common causes of infertility and tubal pathology accounts for 25-35% of female infertility.

- A history of PID, septic abortion, ruptured appendix, tubal surgery, or EP strongly suggests the possibility of tubal damage.

- Other causes of tubal factor infertility include inflammation related to endometriosis, inflammatory bowel disease, or surgical trauma.



- Hysterosalpingography (HSG) is an outpatient fluoroscopy procedure that following the injection of contrast material through the cervical canal , evaluates :

✓ the uterine cavity ,
✓ fallopian tube patency , and
✓ adjacent peritoneal cavity

- HSG is commonly performed as part of an infertility evaluation.

CLINICAL APPLICATIONS

- Indications
  - ✓ Infertility evaluation
  - ✓ Suspected congenital uterine anomalies
  - ✓ Pre procedure planning (pre procedure planning for hysteroscopy, post procedure assessment following TL or tubal reversal procedures)

- Contraindications
  - ✓ pregnancy,
  - ✓ active undiagnosed vaginal bleeding,
  - ✓ active pelvic infection (even if the patient is receiving antibiotic),
  - ✓ history of a moderate or severe reaction to iodinated contrast

Active menstruation is a relative contraindication

PATIENT PREPARATION

- History :

To ensure there are no contraindications to the procedure

- ✓ Examination indication,
- ✓ The duration of any gynecologic symptoms,
- ✓ History of previous pelvic infections or surgery,
- ✓ Obstetric history
- ✓ Contraceptive use
- ✓ Date of the last menstrual period (LMP), and
- ✓ Prior contrast reactions are discussed

Consent :

- The operating clinician explains the procedural steps
- Answers the patient's questions prior to obtaining written consent.

- Informed consent includes :

✓ The possibility of pelvic discomfort, vaginal bleeding, infection, contrast reaction, and irradiation of an unsuspected pregnancy .

✓ Those patients with indwelling fallopian tube micro-inserts or intrauterine devices are advised about the small risk of implant dislodgement that could require a separate procedure for replacement.

Screening for pregnancy

- ✓ HSG perform on days 6 through 11 from the LMP to avoid both pregnancy and menstrual bleeding (during the 2-5-day interval immediately following the end of menses - speroff) .

- ✓ Neither serum nor urine pregnancy tests reliably exclude pregnancy during the first three weeks following the LMP and therefore are not routinely required

- ✓ reported LMPs are typically accurate and adequate.

PREPROCEDURE CONSIDERATIONS

- Infection

✓ The reported rates of pelvic infection following HSG ranged between 0.3 and 3.4 %

✓ Prophylactic antibiotics are not routinely prescribed before the procedure.

✓ However, antibiotics are given to those with a history of PID or a finding of dilated tubes or peritubal adhesions at the time of the study because these findings have been associated with increased risk of post procedure infection.

✓ *One common regimen for prophylaxis is doxycycline 100 mg by mouth twice a day for five days*

Speroff

- Even though prophylactic antibiotic treatment is not absolutely necessary for everyone, it can be justified considering the potential consequences of a postprocedure infection.

- Treatment with antibiotics (doxycycline 100 mg twice daily for 5 days, beginning 1-2 days before HSG) is prudent when :

✓ tubal disease is highly suspected, and

✓ specifically indicated when HSG reveals distal tubal obstruction, because risk for acute salpingitis is increased (approximately 10%) and treatment can prevent clinical infection .

- *To minimize the risk of infection, HSG is best avoided altogether for at least several weeks following any episode of acute PID.*

Analgesia

- ✓ HSG can be associated with some discomfort, primarily from uterine distention
- ✓ Pain can be minimized by *slowly injecting* the contrast medium and using *isosmolar contrast* agents
- ✓ With counseling, most patients tolerate the uterine cramps, and thus analgesia is not routinely administered (do not use paracervical block as injection itself is painful).
- ✓ We inform patients that the pain is typically mild and self-limited.
- ✓ We advise patients to use over-the-counter analgesics such as NSAIDs if bothersome uterine cramping occurs on the days following the examination.
- ✓ *Severe postprocedure pain is not typical after an HSG; individuals with severe pain are evaluated for possible complication*

Contrast

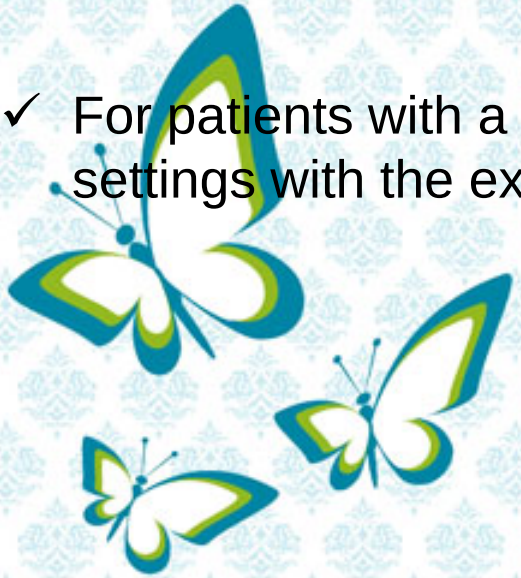
- ✓ During an HSG, iodinated contrast is injected retrograde into the uterine cavity, through the fallopian tubes, and into the peritoneal cavity.
- ✓ While the amount varies with uterine size and peritoneal spillage, 10 to 30 mL is a typical dose.
- ✓ Some of this material is cleared intravascularly, and hence the patient is exposed indirectly to small quantities of systemic contrast.
- ✓ Nonionic, water-soluble contrast is used because the rates of *allergic reaction* are much lower compared with ionic contrast .

- ✓ In patients with a history of a moderate contrast reaction, the examination is usually contraindicated .

- ✓ *It is performed (with premedication) only if alternative methods for assessing tubal patency (ie, laparoscopy with chromopertubation) are unavailable .*

- ✓ Patients with a history of a mild reaction can undergo HSG safely after receiving prophylactic prednisone and diphenhydramine .

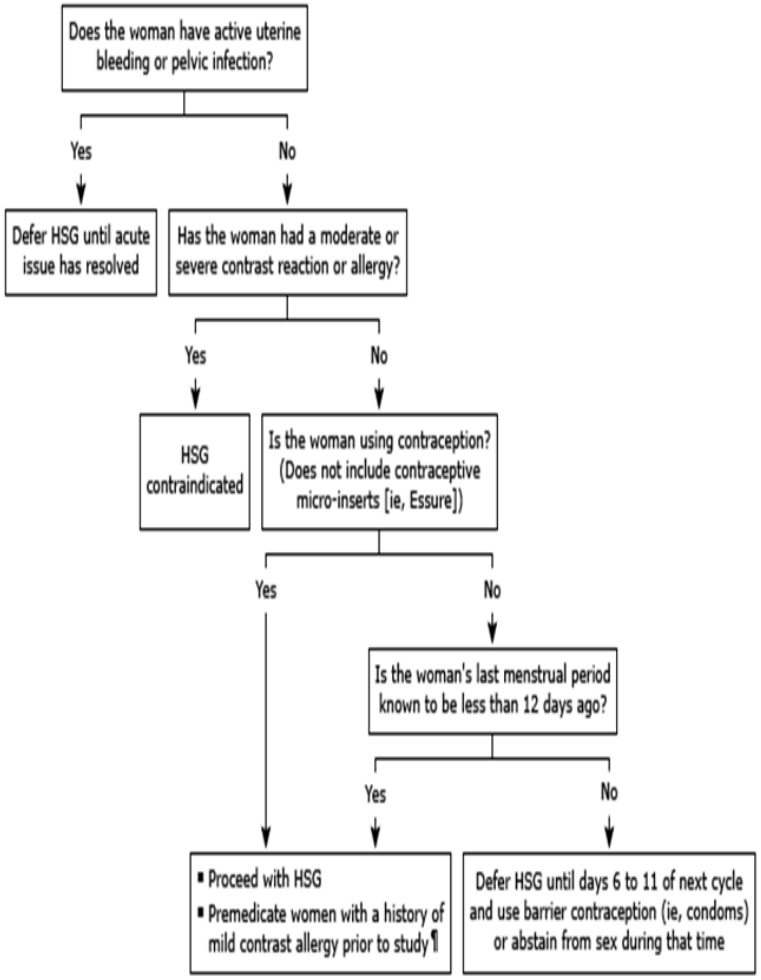
- ✓ For patients with a history of any contrast allergy, HSG is performed in settings with the expertise and resources to manage a contrast reaction.



Contrast allergies

Type	Incidence	Management	Symptoms
Mild	3%	Self-limited	Pruritus, urticaria, nausea, vomiting, flushing, headache
Moderate	0.2 to 0.4%	Treatment required	Symptoms in mild category requiring therapy, laryngeal edema, dyspnea
Severe	0.04%	Hospitalization required	Cardiac arrhythmia or arrest, circulatory collapse, seizures, unconsciousness

Screening for contraindications to HSG



Water–soluble or Oil-based Contrast

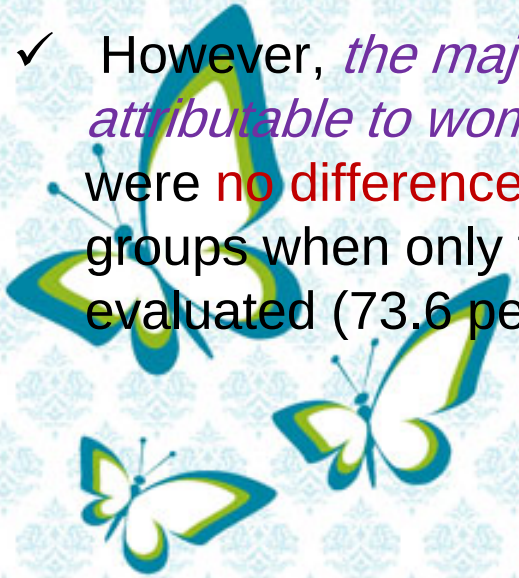
water-soluble contrast is prefered to oil-based contrast for diagnostic HSGs because :

- ✓ Provides higher quality images
- ✓ Doesn't require precautionary measures to avoid the small risk of pulmonary and cerebral embolism that can occur with intravascular injection of oil-based contrast .
- ✓ Rates of adverse events were low and equivalent between both contrast types.

Have Diagnostic HSG any therapeutic effects ?

- ✓ A multicenter trial that randomly assigned over 1100 women with infertility, but low risk for tubal disease (as indicated by no history of pelvic inflammatory disease, previous chlamydia infection, or known endometriosis), to HSG with either oil-based or water-soluble contrast reported a 37 percent higher rate of ongoing pregnancy and a 38 percent higher rate of live birth in the oil-based contrast group .

- ✓ However, *the majority of the difference in ongoing pregnancy rates was attributable to women who then underwent infertility treatment*; there were no differences in the ongoing pregnancy rates between the two groups when only the women who conceived spontaneously were evaluated (73.6 percent for oil compared with 72.7 for water).



- ✓ *Oil-based contrast may be preferred in infertile female patients with low risk of tubal disease* because use of oil-based contrast appears to improve live birth rates for the subgroup of individuals who receive oil-based contrast and then proceed with fertility therapy.

- ✓ A systematic review of 12 randomized trials found that :

- pregnancy rates were significantly higher in subfertile women who underwent tubal flushing with oil soluble media than in those who did not undergo HSG (odds ratio [OR] 3.30, 95% CI 2.00-5.43),

- and that *pregnancy rates were similar whether oil or water soluble media were used* (OR 1.21, 95%CI 0.95-1.54) .

- ✓ In contrast, a meta-analysis of this trial that included infertile women at *high risk for tubal disease did not report higher live birth rates with oil-based contrast .*

- ✓ As the rates of spontaneous conception in the larger trial comparing oil-based and water-soluble contrast were the same , we continue to use water-soluble contrast

Radiation

- ✓ HSG involves ionizing radiation using real-time fluoroscopy during which selected spot radiographs are acquired.
- ✓ Average dose to the female gonads is 2.7 mGy
- ✓ The mean fluoroscopic time is 20-30 seconds
- ✓ Only three basic films are required (a scout, one film to document the uterine contours and tubal patency, and a postevaluation film to detect any areas of contrast loculation)

- In terms of biological effects of the radiation conferred by HSG, the risk for anomalies in a future embryo and for fatal cancer induction in an exposed woman ages 20 to 29 years are estimated at 2.7 x 10-5 and 14.5 x 10-5, respectively. *These risks are over 1000-fold lower than the background rates of birth defects and of spontaneous cancers in the United States .*

- *HSG does not appear to increase the risk of subsequent cancer* .

- In individuals who have occult endometrial cancer, HSG could disseminate tumor cells into the peritoneal cavity.

- Positive peritoneal washings would increase the surgical stage to at least IIIA.

- However, the clinical significance of this finding is not known as transport of these cells does not necessarily result in implantation and persistence.

PROCEDURE

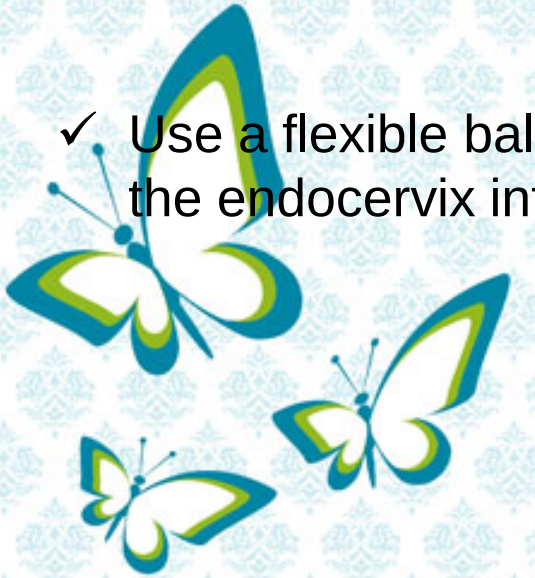
- Catheter placement

✓ Placing the patient in the dorsal lithotomy position

✓ Performing a bimanual vaginal examination

✓ Places a speculum into the vagina, visualizes the cervix, and swabs the cervix with antiseptic soap (or saline in the case of allergy)

✓ Use a flexible balloon-tipped catheter or a Jarcho cannula through the endocervix into the uterine cavity



•Image acquisition

✓ The following radiographic images are typically obtained:

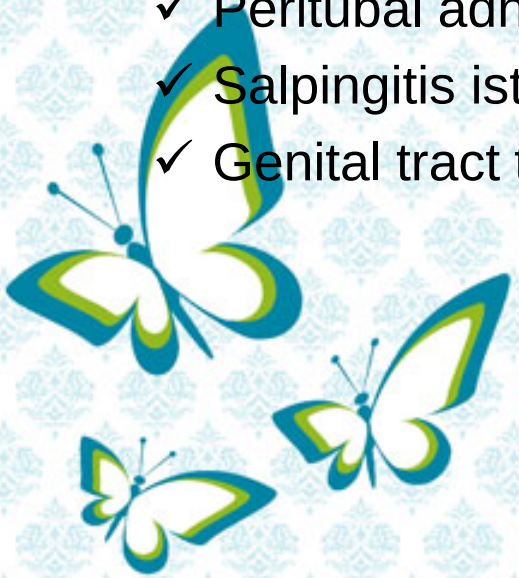
1. Scout before contrast injectio
2. Early filling anteroposterior view of the uterus
3. Anterolateral oblique view of one tube demonstrating spill
4. Anterolateral oblique view of the other tube demonstrating spill
5. En face anteroposterior view of the uterus. To achieve this view, the clinician gently pulls down on the catheter to lay the uterine cavity out in the imaging plane

- The contrast is injected slowly under fluoroscopy
- The early filling anteroposterior view of the uterus is taken after injection of a few mL of contrast because *lesions such as polyps, submucous myomas, or synechiae could be concealed when the uterus is distended with contrast*
- Further incremental injections outline the cornua, isthmic, and ampullary portions of the tubes, which normally demonstrate rugal folds
- The contrast then spills from the ends of patent tubes
- Peritubal adhesions are suggested by the collection of contrast around the distal end of a tube that persists on delayed imaging following catheter removal

FINDINGS AND RELATED DIAGNOSES

- Tubes
  - ✓ Obstruction
  - ✓ Cornual spasm
  - ✓ Hydrosalpinx

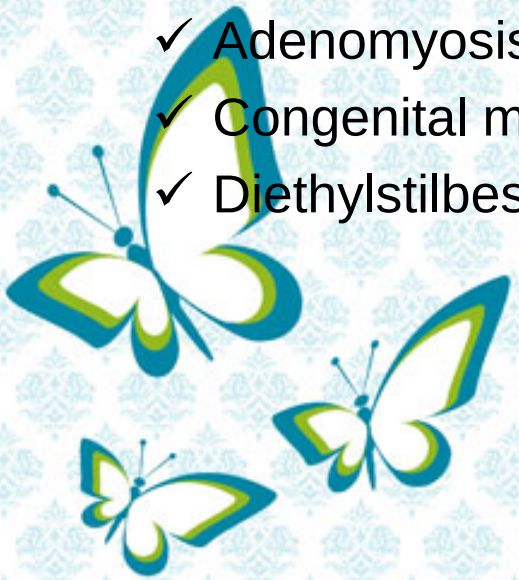
- Other abnormalities
  - ✓ Peritubal adhesions
  - ✓ Salpingitis isthmica nodosa
  - ✓ Genital tract tuberculosis



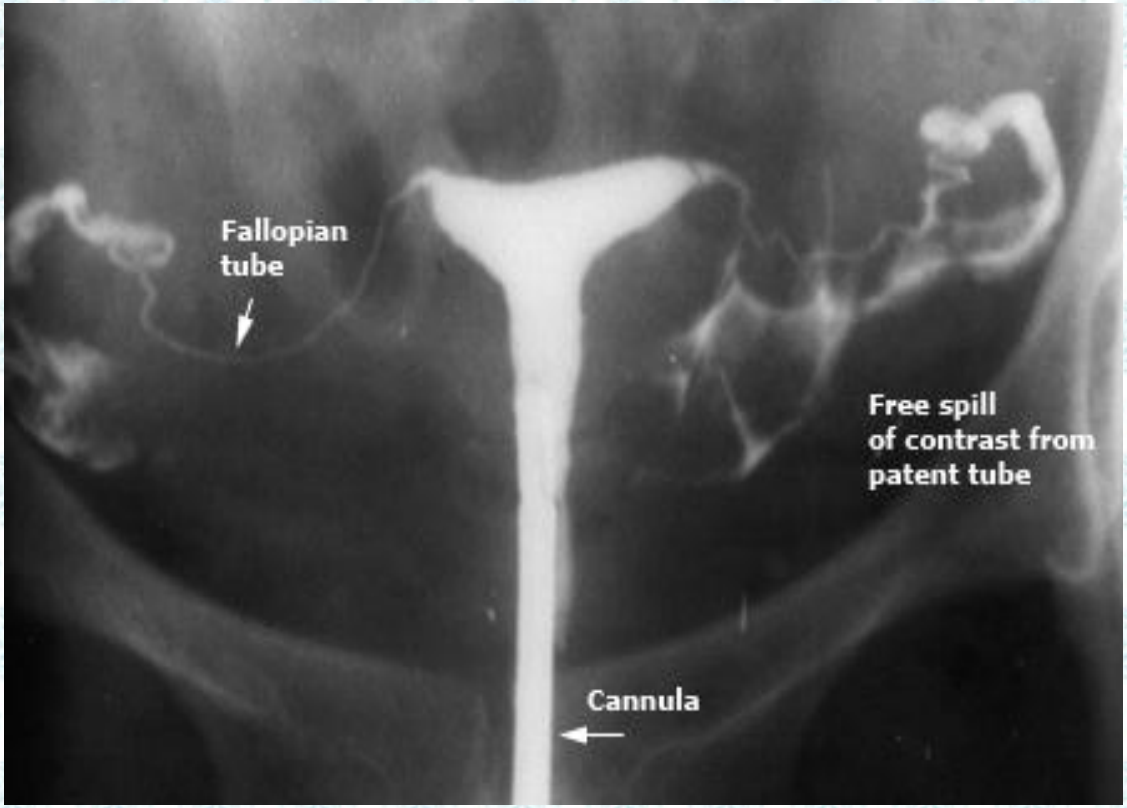
- Uterus

✓ Uterine filling defects
  - ✓ Leiomyomas
  - ✓ Endometrial polyps
  - ✓ Uterine synechiae

✓ Uterine contour abnormalities
  - ✓ Adenomyosis
  - ✓ Congenital müllerian anomalies
  - ✓ Diethylstilbestrol exposure

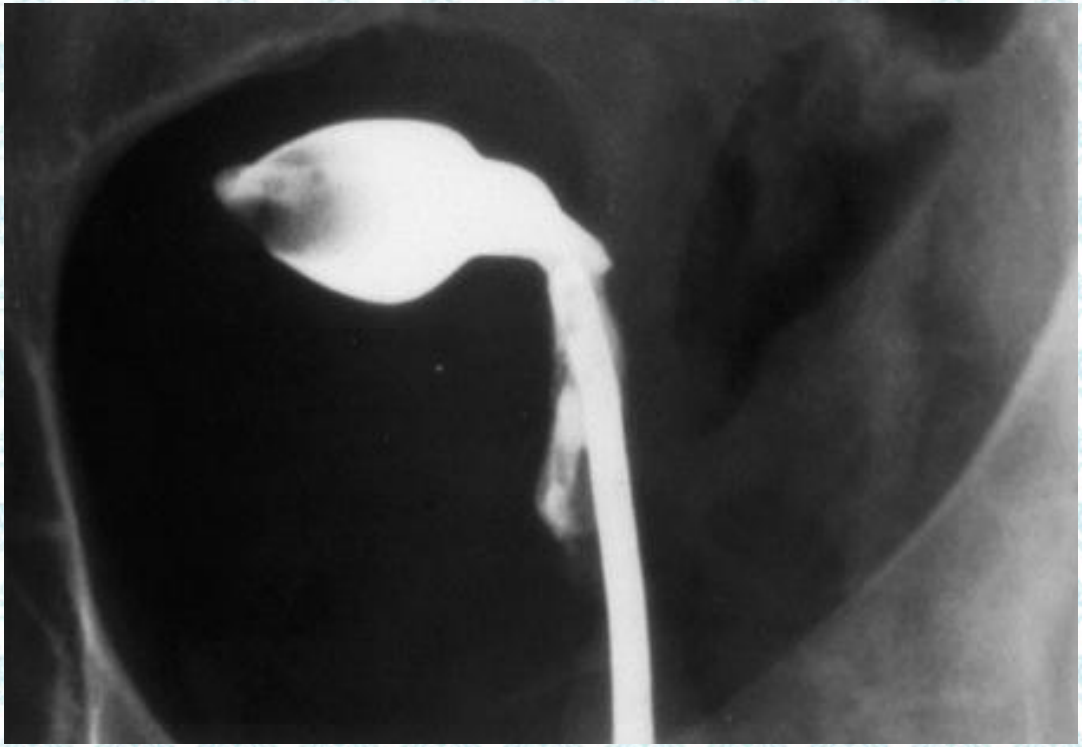


Normal HSG with a Jarcho cannula



HSG showing multiple filling defects due to endometrial polyps

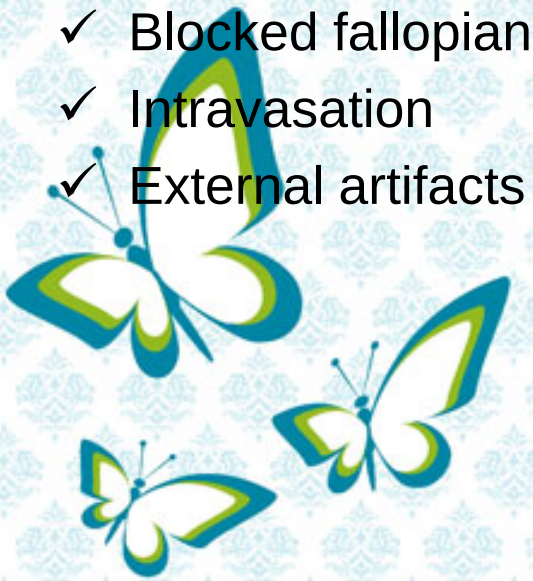
HSG with an oblique view showing a submucous myoma that disappeared when more dye was injected



Approach to technical challenges

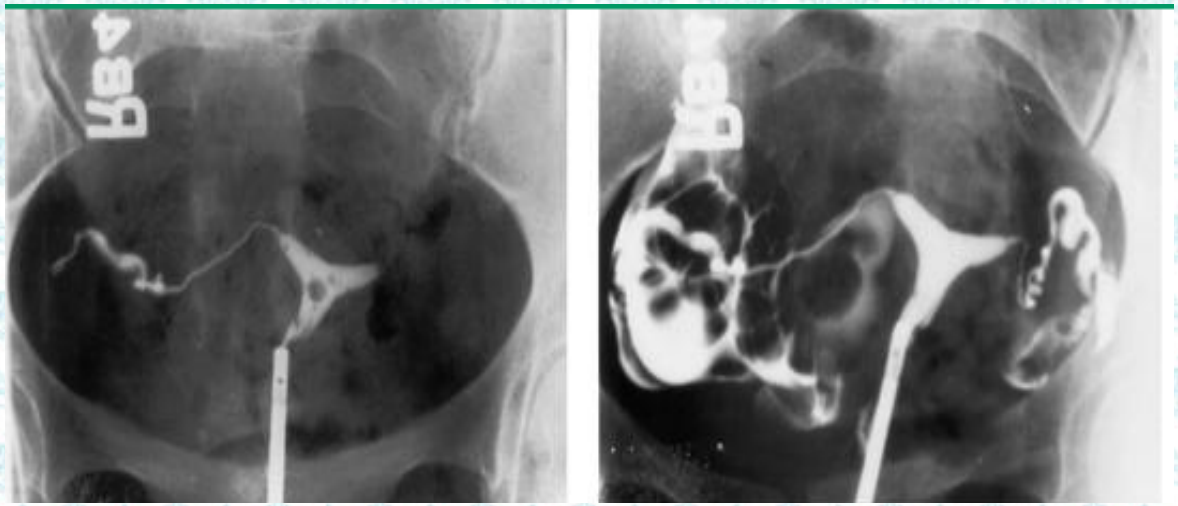
Technical difficulties can arise during any part of the HSG examination. Some common difficulties include:

- ✓ Leaking of contrast media
- ✓ Cervical stenosis
- ✓ Air bubbles
- ✓ Inadequate visualization of the uterine cavity
- ✓ Blocked fallopian tube
- ✓ Intravasation
- ✓ External artifacts



HSG showing air bubbles in uterus

(A) HSG showing air bubbles in the uterine cavity and non-filling of the left tube. This is an incomplete study.
(B) HSG for the same patient shown in (A) after more contrast was injected.



(A) HSG showing an irregular uterine cavity interpreted by the radiologist as showing multiple submucous myomas

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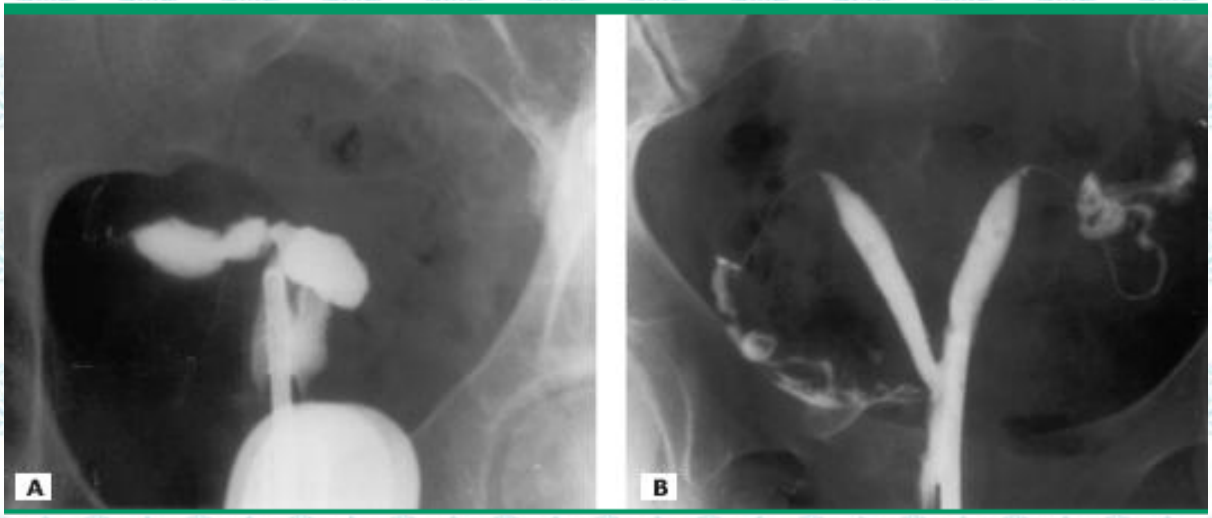
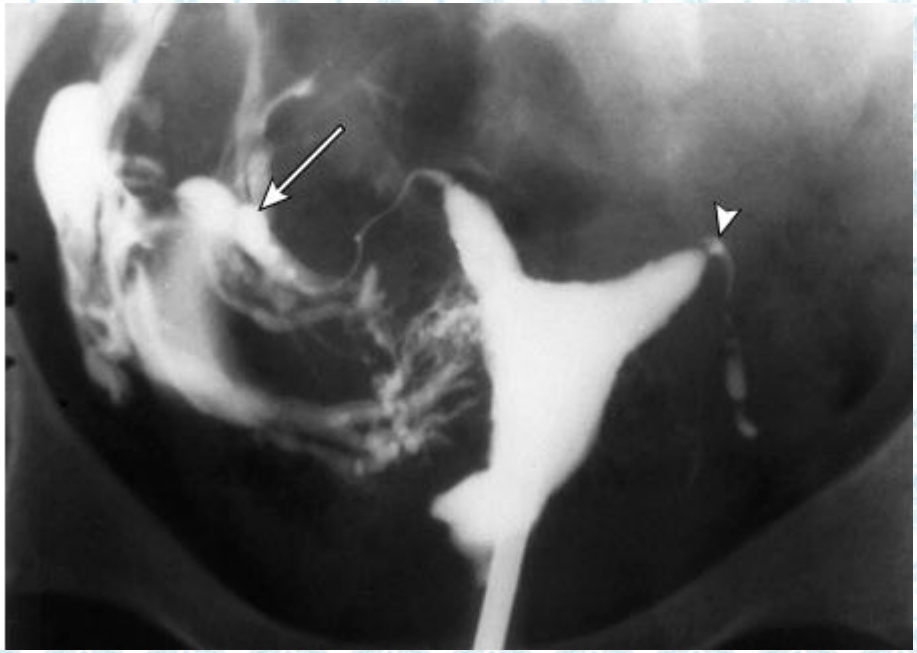
(B) Repeat HSG of the same patient shown in (A) but with the cervix pulled down. Now a septate uterus is obvious, not submucous myomas



HSG showing tubal occlusion and contrast backflow

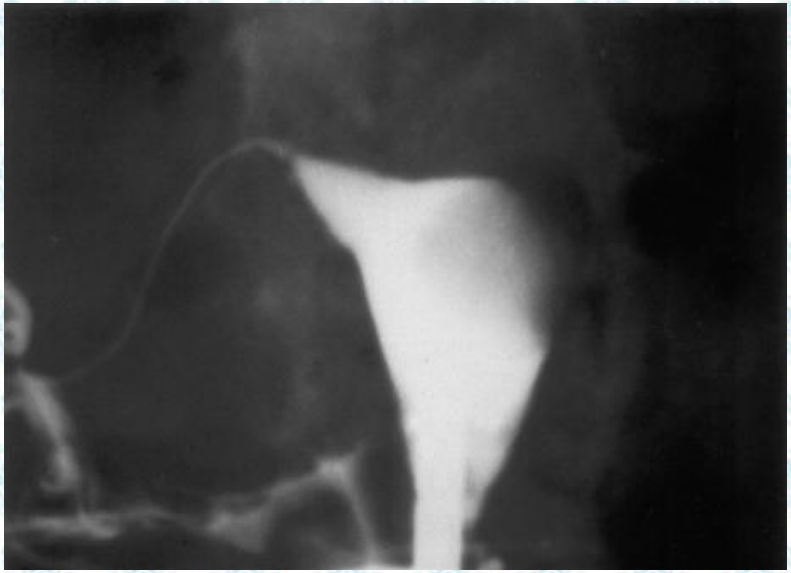
HSG shows left tubal occlusion (arrowhead) and contrast backflow into the uterine veins of the myometrium (arrow).

An arcuate configuration of the uterine cavity is noted



HSG showing a filling defect in the left cornual area

It proved to be a superimposed gas bubble from the bowel over the uterine shadow

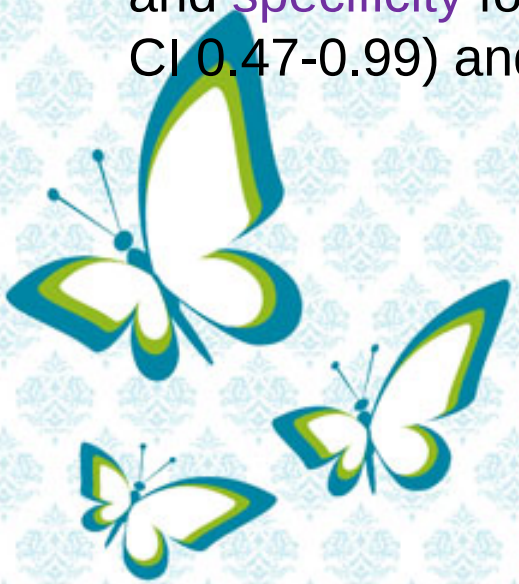


Tubes Obstruction

- *HSG is most useful for predicting tubal occlusion*
- While obstruction can be seen along any part of the tube*, the ampulla is the most common site*
- Isthmic obstruction of the fallopian tube is seen following salpingectomy and tubal ligation
- Obstruction at the cornua can reflect true obstruction or cornual spasm
- Common nonsurgical causes for tubal obstruction include prior PID, prior EP , or endometriosis

- Both false-positive (obstructions that are not real) and false negative results (patency that is not real) occur

- In a meta-analysis of nine studies comparing HSG or sono-HSG with laparoscopy as the standard, the pooled estimates of sensitivity and specificity for HSG in identifying tubal occlusion were 0.94 (95% CI 0.47-0.99) and 0.92 (95% CI 0.87-0.95), respectively .



HSG demonstrates occlusion at the isthmus of both fallopian tubes (arrows) in patient with infertility

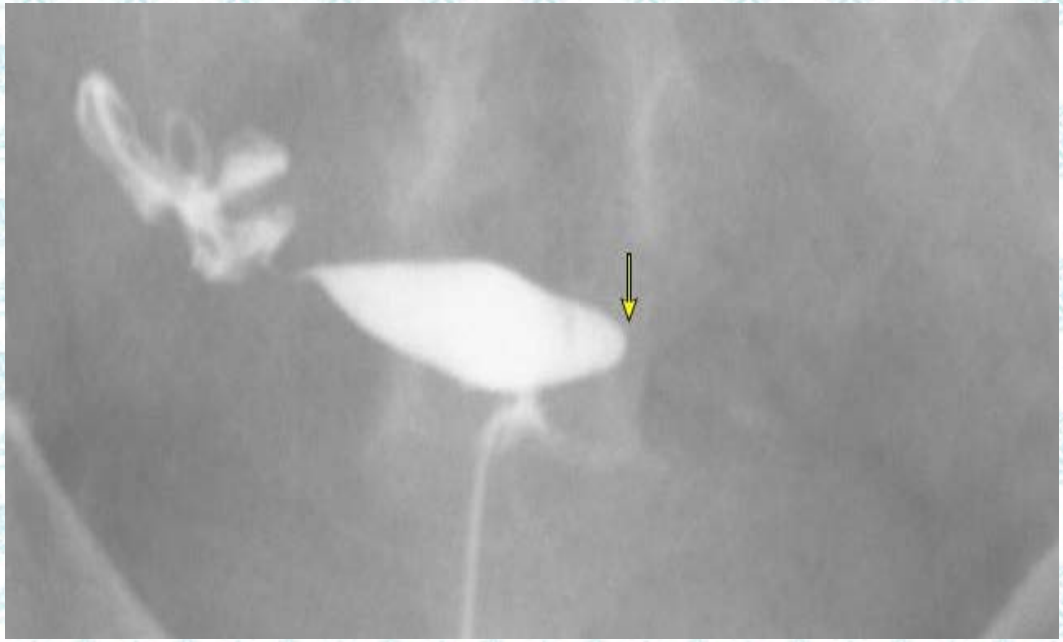
Cornual spasm

- The cornual portion of the fallopian tube is encased in smooth muscle; muscle spasm can cause transient tubal occlusion .

- Spasm is characterized by a rounded smooth cornual margin, whereas cornual occlusion is characterized by pointed or irregular cornual margin, although these changes can be difficult to distinguish definitively .

Hysterosalpingogram of cornual spasm

The uterus and right fallopian tube are normal. The left fallopian tube does not opacify (arrow).
This could represent occlusion or spasm.
A repeat examination one month later demonstrated a normal left fallopian tube.

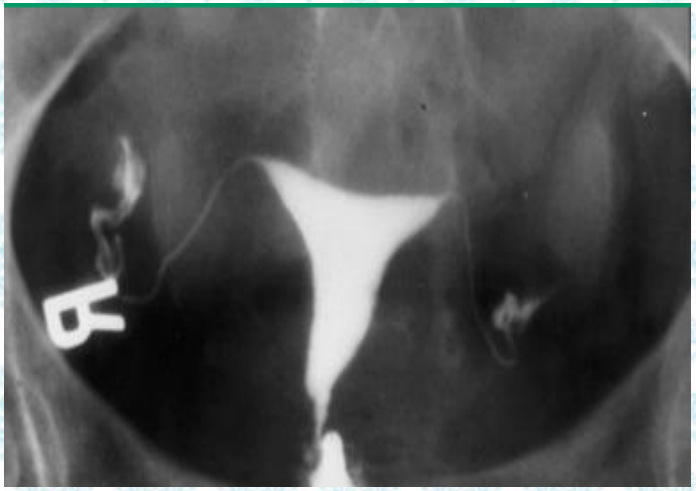


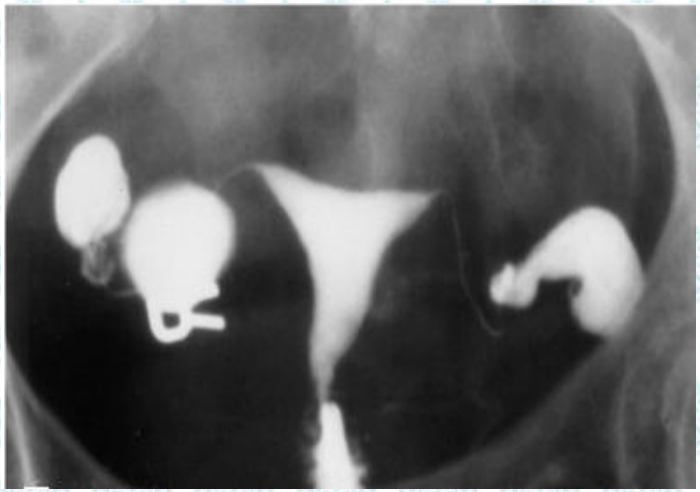
Hydrosalpinx

- Is defined *as fluid-filled dilation of the fallopian tube and is most commonly caused by peritubal adhesions .*

- On HSG, hydrosalpinx appears as a contrast filled and dilated fallopian tube, often without free spill of contrast into the peritoneum.

Hysterosalpingogram showing bilateral hydrosalpinges





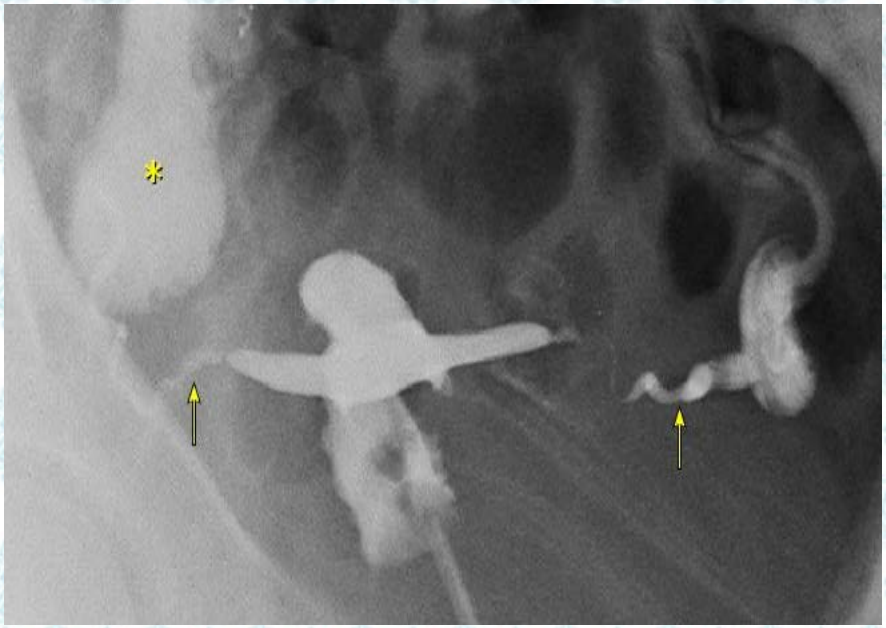
Peritubal adhesions

- On a normal HSG, contrast spills freely from the fallopian tubes into the peritoneal cavity .

- In patients with peritubal adhesions, the spill appears contained as *contrast loculi in amorphous collections adjacent to the ampullary ends of the tube*, which are the most commonly involved sites .

Hysterosalpingogram of peritubal adhesions and contained spill

Both fallopian tubes (arrows) are patent and mildly dilated. Contrast spills bilaterally into the periampullary loculated spaces (asterisks), indicating pelvic adhesions.



Salpingitis isthmica nodosa

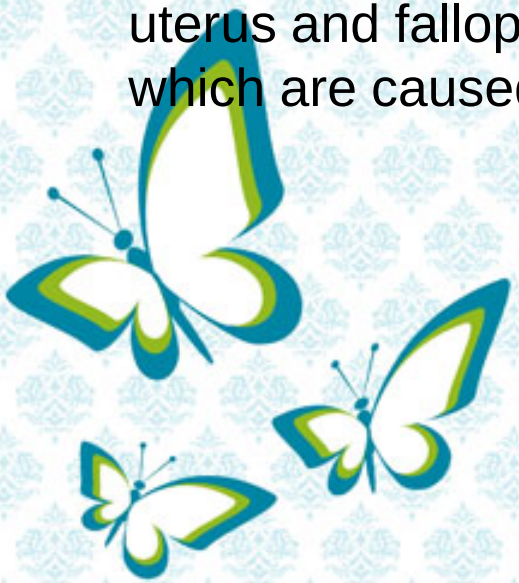
- SIN is an acquired condition in which mucosal glands penetrate the myosalpinx with resultant hyperplasia and hypertrophy.
- The characteristic appearance on HSG is that of *multiple, small diverticula extending from the isthmic lumen into the wall,* which is sometimes described as tubal diverticulosis .
- It affects both tubes in 80 % of cases and is frequently associated with ampullary dilatation or obstruction proximally.
- The condition is strongly associated with infertility and EP.

Hysterosalpingogram of SIN

Outpouchings of contrast (arrows) fill diverticuli of the isthmic portions of the fallopian tubes bilaterally.

Genital tract tuberculosis

- The genital tract is affected in 1 to 2 % of females with tuberculosis .
- When pelvic tuberculosis occurs, fallopian tube involvement occurs in approximately one-third of these females.
- While *no radiographic features are pathognomonic for genital tract tuberculosis*, typical HSG findings include a shriveled and deformed uterus and fallopian tubes with ragged outlines and multiple strictures, which are caused by caseous ulceration of the tubal mucosa .



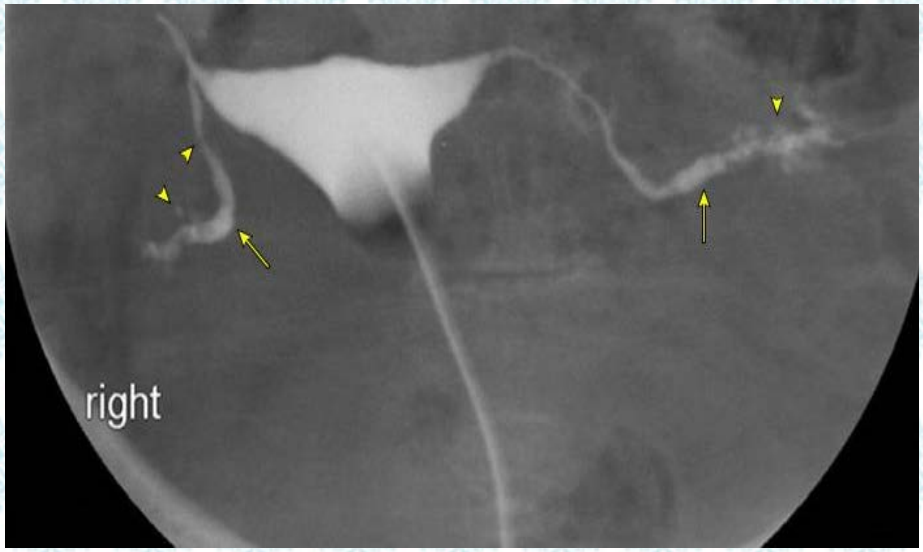
- *Tubal occlusion is the most common HSG finding* and occurs most frequently in the isthmic and ampullary portions .

- Multiple strictures along the fallopian tube create a "beaded" appearance and scarring leads to a "rigid pipe stem" appearance .

HSG image of pelvic tuberculosis

The distal ampullary and infundibular portions of the tubes demonstrate dilated caliber (arrows) as well as filling defects and diverticulae (arrowheads) bilaterally.

Lack of free spillage into the peritoneal cavity indicates bilateral tubal occlusion.



POSTPROCEDURE FOLLOW-UP AND COMPLICATIONS

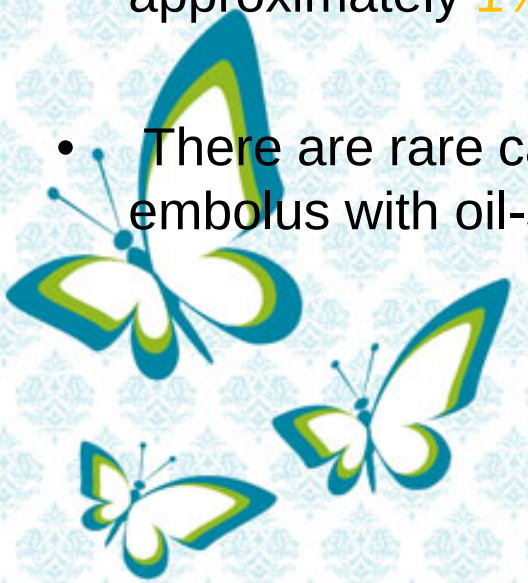
- Mild pain is common during the procedure and can last for a few hours afterwards.
- Treatment with NSAIDs usually relieves this discomfort.
- We inform patients that leaking of contrast and a small amount of bleeding from the vagina are common for a day or two after an HSG.
- *Usual activities can be resumed immediately, including vaginal intercourse*.

- *Heavy bleeding, fever, or increasing pain are not normal and require evaluation for possible complication.*

- Complications of HSG are very uncommon and include infection, allergic reaction, and syncope .

- The rate of infection of the upper genital tract is typically approximately 1% to 3% of patients after HSG .

- There are rare case reports of shock and pulmonary and cerebral embolus with oil-soluble contrast media



HSG versus laparoscopy

- *HSG is the most useful and standard of care to look for tubal occlusion in all patients*.
- It also provides information about the uterine cavity.
- *HSG is not useful for detecting peritubal adhesions or endometriosis.*
- We perform *diagnostic laparoscopy and chromotubation in women suspected of having endometriosis or pelvic adhesions* related to a previous pelvic infection or surgery.
- Ablation of implants and lysis of adhesions, when indicated, can be performed at the same procedure.

- Compared to laparoscopy (the gold standard method) as a test of tubal patency, HSG has an overall

✓ sensitivity (ability to detect obstruction when the tubes appear obstructed at laparoscopy) of 94% (95% CI = 74-99%) and

✓ specificity (confirmation at laparoscopy when obstruction is detected by HSG) of 92% (95% CI = 87-95%).

- Thus, *if HSG shows patent tubes, tubal blockage is highly unlikely.*

- However, after a HSG that showed proximal tubal blockage, 60% of such women had tubal patency with a repeat HSG (1 month later) or laparoscopy . (Tubal spasm or poor catheter positioning leading to unilateral tubal perfusion) .

- The PPV and NPV of HSG for tubal occlusion are 38% and 94%, respectively.
- The clinical implications are that *when HSG reveals obstruction, there is still a relatively high probability (~ 60%) that the tube is open*
- but *when HSG demonstrates patency, there is little chance the tube is actually occluded (approximately 5%).*
- HSG appeared to have very high specificity and sensitivity for diagnosing distal tubal occlusion or major distal tubal adhesions

LAPAROSCOPY

- *The role of laparoscopy in the evaluation of infertility is controversial.*
- Laparoscopy is invasive and expensive.
- Most importantly, laparoscopy offers the opportunity to treat disease at the time of diagnosis.
- When we perform laparoscopy, we also perform chromotubation to assess tubal patency and hysteroscopy to evaluate the uterine cavity.
- For this reason, if laparoscopy is planned, then HSG can be omitted .

- Laparoscopy may be indicated in women in whom :

✓ endometriosis or

✓ pelvic adhesions/tubal disease

is suspected based on physical examination, HSG, or history (eg, current dysmenorrhea, pelvic pain, or deep dyspareunia; previous complicated appendicitis, pelvic infection, pelvic surgery, or ectopic pregnancy).

- Findings at laparoscopy usually do not alter the initial treatment of the infertile couple when :

✓ The initial infertility evaluation is normal or

✓ When it shows severe male factor infertility.

- laparoscopy can be useful in the infertility evaluation of young women with a history of :

✓ pelvic inflammatory disease,

✓ ectopic pregnancy,

✓ pelvic surgery, or

✓ chronic pelvic pain.

- In our practice, we usually perform diagnostic laparoscopy or IVF treatment if 3 cycles of ovulation induction with IUI are unsuccessful.

Sono-HSG and Hysterosalpingo-contrast sonography (HyCoSy)

- Uses ultrasound to view the uterus, tubes, and adnexa before and after transcervical injection of echogenic contrast media (either microbubble contrast or agitated saline).

- It is a safe, well tolerated, quick and easy method for obtaining information on tubal status, the uterine cavity, the ovaries, and the myometrium using conventional ultrasound.

- SonoHSG relied on observations of *fluid accumulation in the cul-de-sac as an indication of tubal patency*.

- *It provided no information regarding tubal anatomy and could not determine whether one or both tubes were patent.*

- It is recognized as having greater sensitivity than HSG for detection of intrauterine pathology.

- patients tolerate HyCoSy better than HSG .

- Additional advantages of sonoHSG/HyCoSy are :

✓ avoiding the risk of ionizing radiation,

✓ higher sensitivity and specificity for the detection of intrauterine pathologies,

✓ concomitant visualization of the ovaries and myometrium, and

✓ completion of assessment at the office without referral to radiology.

- It is increasingly utilized as an alternative method to image the uterus and determine tubal patency if available.
- Tubal spasm and tubal fistula, as well as operator error could account for misdiagnoses .
- the standard 2-D imaging in the sagittal and transverse planes was still inadequate to visualize the 3-D tubal anatomy.
- 3-D TVUS provides the means to generate coronal images.
- Color-coded Doppler techniques have improved visualization of fluid movement through the fallopian tubes.

- In a 2014 systematic review of studies that compared HyCoSy with HSG for diagnosis of tubal occlusion in subfertile women,

✓ both tests had high diagnostic accuracy compared with laparoscopy (reference standard),

✓ with no significant difference between them.

- Even though more recent studies suggest higher diagnostic performance of HyCoSy using the gel foam as the sonographic contrast as compared with sonoHSG using saline, widespread use is possibly limited with availability of and experience with the required equipment.


Thanks all with best wishes