

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

HSG

Technique & Finding

For 6th year students

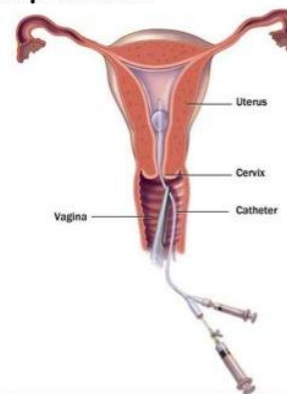
By

Ahmad Mokhtar Abodahab

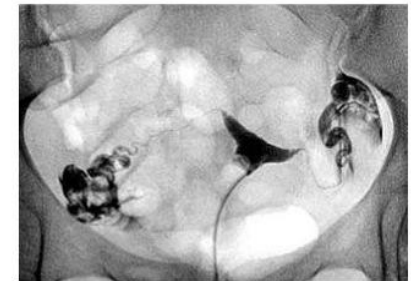
*Assistant Lecturer of Radiology
Faculty of Medicine - Sohag University*

Hysterosalpingogram (HSG)

HSG procedure



Normal HSG



Introduction

- **Hysterosalpingography (HSG) :**

is

the radiographic evaluation of the uterine cavity
and fallopian tubes

after

the administration of a radio-opaque medium
through the cervical canal.



Alpha Reproductive Care
& Research Centre

MakeAGIF.com

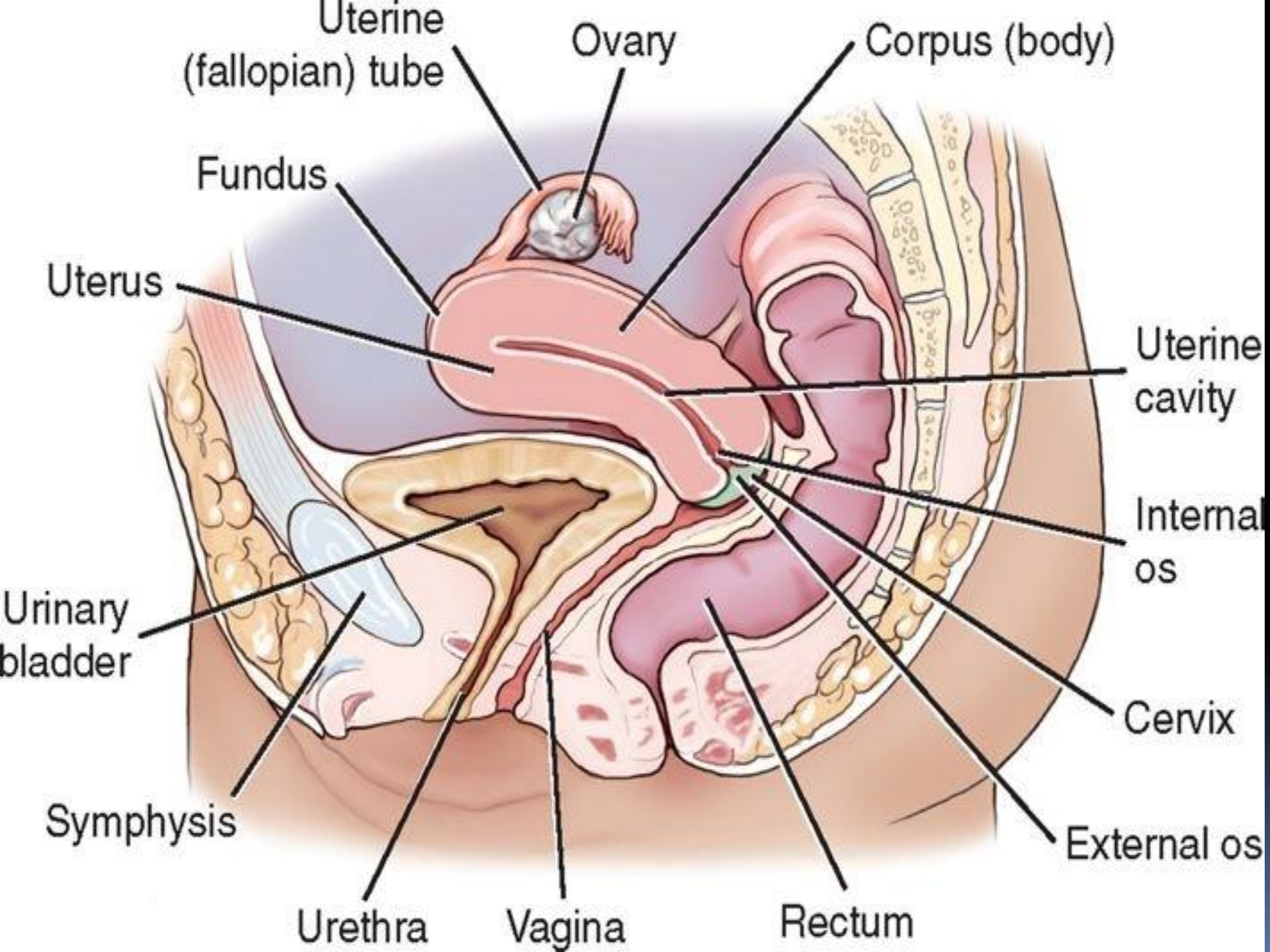
- **Hysterosalpingography (HSG)**

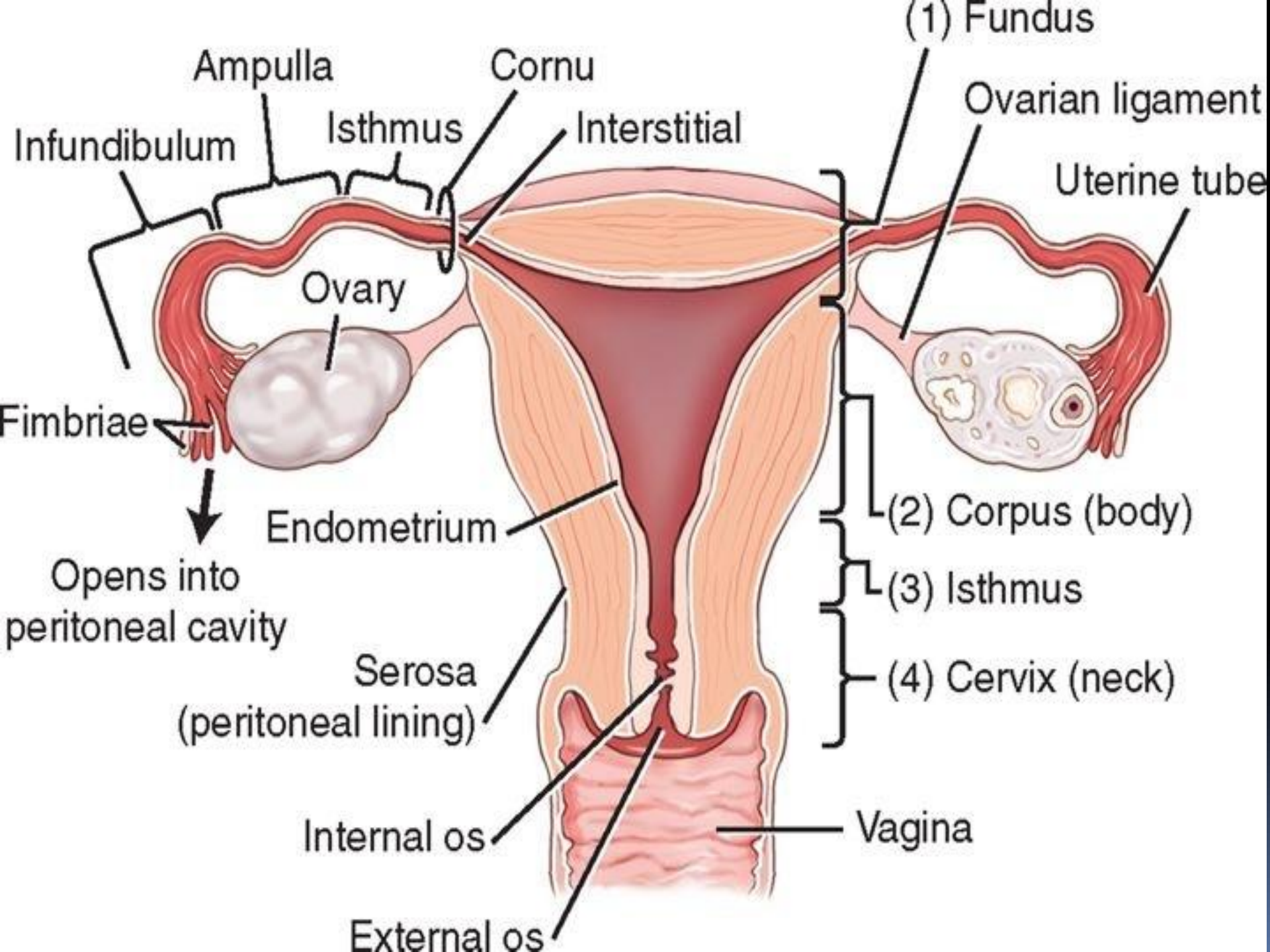
remains an important radiologic procedure in the investigation of infertility .

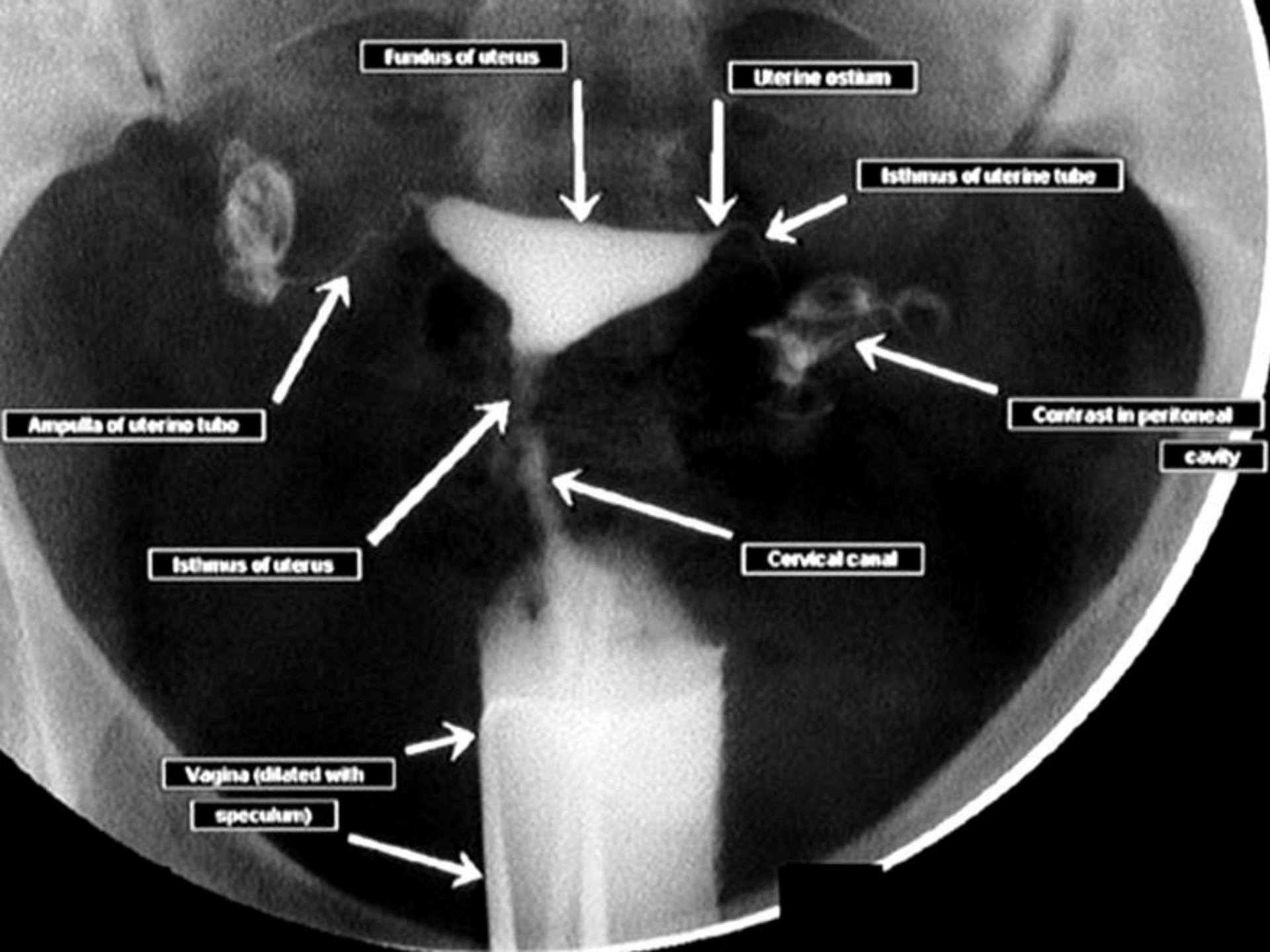
- **HSG demonstrates :**

- morphology of the uterine cavity,
- Patency of the fallopian tubes.

ANATOMY









Items To be discussed

- Technical parameters of the examination,
 - indications,
 - contraindications,
 - Possible complications .
 - Variety of abnormalities of the uterus and fallopian tubes , that can be detected accurately with HSG.
- 

History

- The first HSG → 1910
- was considered to be the first special radiologic procedure.



Indications

1- *Infertility assessment:*

- *most common* indications for HSG
- Diagnose functional or structural defects.
- A blockage of one or both tubes may inhibit fertilization.
- In some cases, HSG can be a *therapeutic tool*.
- Injection of contrast media → dilate or straighten a narrowed, tortuous, or occluded uterine tube

- 2- Evaluate patients with *frequent miscarriages*
- 3- Evaluate *uterine abnormalities*
 - *Congenital* uterine anomalies
 - Fibroids or tumor *masses*
 - Adhesions
- 4- Evaluate *tubal patency*
 - Following tubal *ligation* reversal procedure
 - Following pelvic inflammatory disease

- 
- 
- 5-Evaluation of *Abnormal menses*
 - 6- sometimes used as a *preoperative control*
→ uterine or tubal surgery.

Risks Vs Benefits

- Minimally invasive procedure
- Rare complications
- Can provide valuable information
- Minimal exposure to radiation
 - *Effective radiation dose ~ 1 mSv (comparable to average amount of background radiation over 4 mo)*
- **Must not** be performed if patient is query *pregnant* at the time of the procedure

- 
- Despite the of *newer imaging* modalities, HSG still *remains the best* procedure to image the fallopian tubes.
- 

Sensitivity

- Some studies says that HSG had a sensitivity of :
- 58% → for polypoid lesions,
- 0% → for *endometrial hyperplasia*.
- 44.4% → for uterine malformations,
- 75% → for the detection of intrauterine adhesions.

Contraindications:

1- *Possible Pregnancy :*

- main contraindication .
- Avoided by : performing HSG before the ovulation phase, “between the 7th to 10th day of the menstrual cycle”

2- Active intrapelvic inflammation .

3- vaginal or uterine bleeding

4- Recent uterine or tubal surgery

➔ General contraindications :

- severe cardiac or renal deficiency,

Patient Preparation

- Timing:

the first half of the menstrual cycle following cessation of bleeding. Due to

- Endometrium is thin during this proliferative phase,
→ facilitates better image interpretation
- Ensure that there is no pregnancy.

- 
- 
- **Second half** of the cycle is avoided because :
 - the thickened secretory-phase endometrium → increases the risk of venous intravasation and may cause a false-positive diagnosis of cornual occlusion.
 - Possibility of pregnancy.

Bowel preparation :

To reproductive tract obscuring by bowel gas and/or feces.

→ Preparation may include a mild laxative, suppositories, and/or a cleansing enema be

Bladder Voiding : emptying bladder immediately before the examination → To prevent displacement of the uterus and uterine tubes,.

- 
- *Antibiotics :*
 - *Pain Killer:*
 - *Steroid (prednisolone)*
 - *Antispasmodics :*
- 

TECHNIQUE



Procedure

.....In a simple words

- A speculum is inserted into the vagina
- A catheter is then inserted into the cervix
- Contrast material is injected into the uterine cavity through the catheter
- Fluoroscopic images are then taken

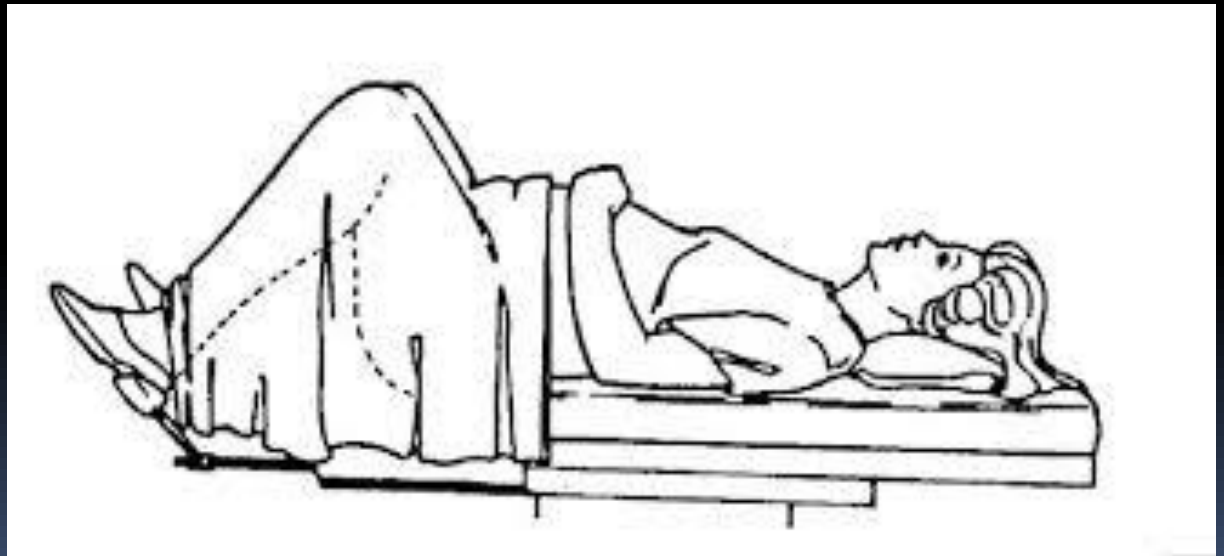


Technique

- The patient is placed on the *fluoroscopic machine*.

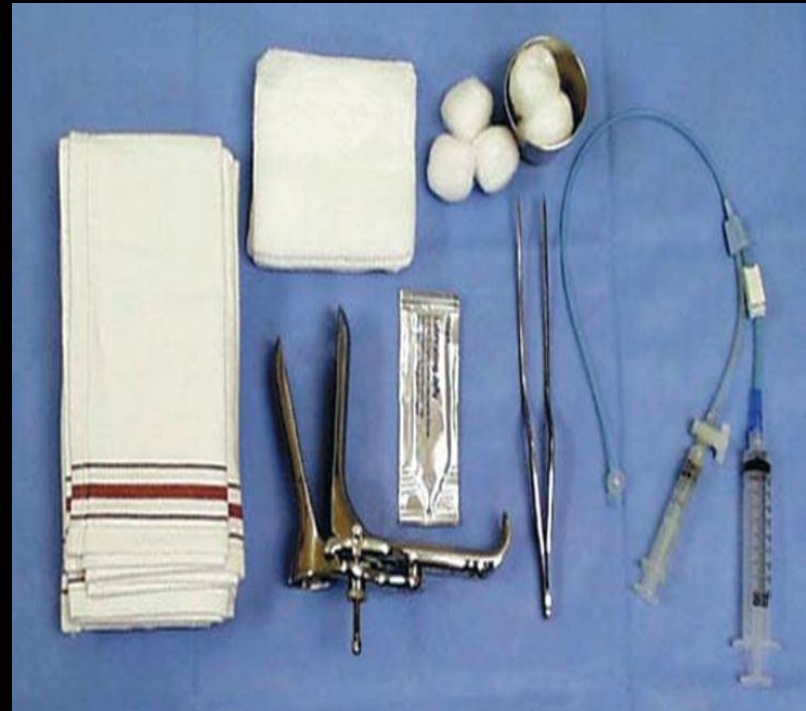


- **Position:** Gynecologic examination
the patient bends her knees and places her feet at the end of the table.

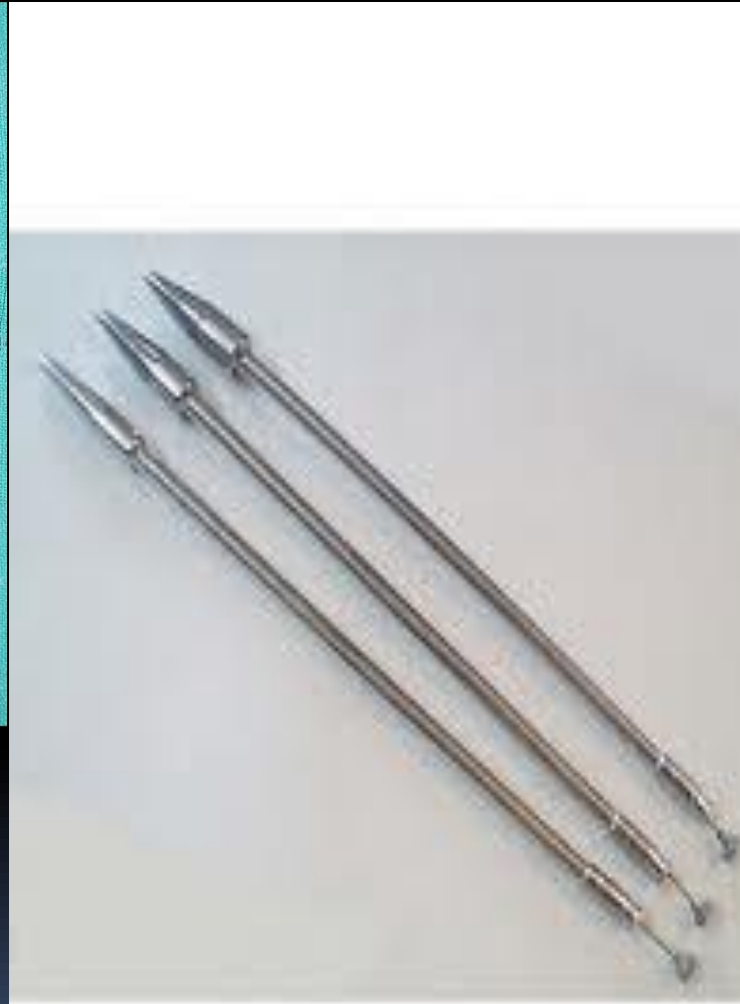


- 
- 
- Cleaning the external genital area with antiseptic solution,
 - Casco speculum : The vagina is dilated by a gynecologic dilator.
 - The cervix is localized and cleansed with iodine solution.

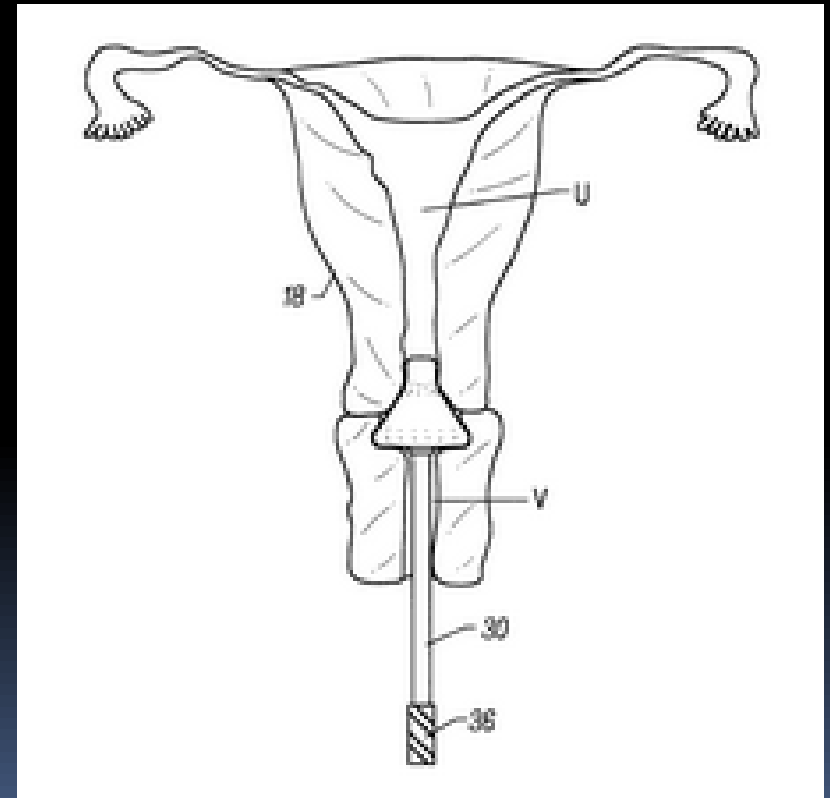
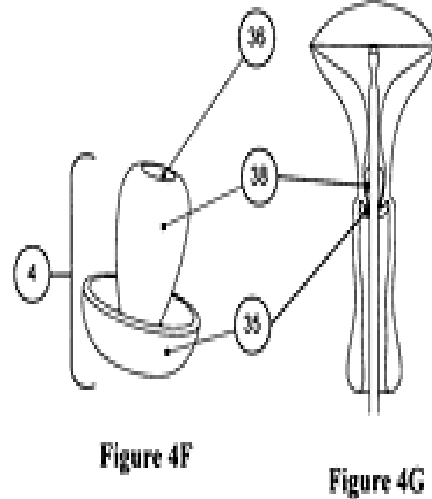
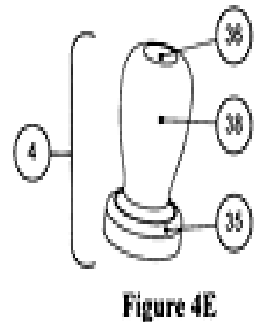
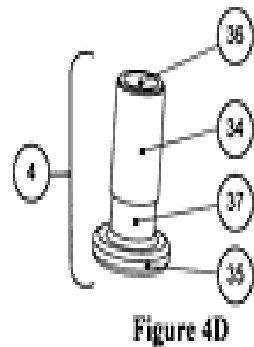
Equipments

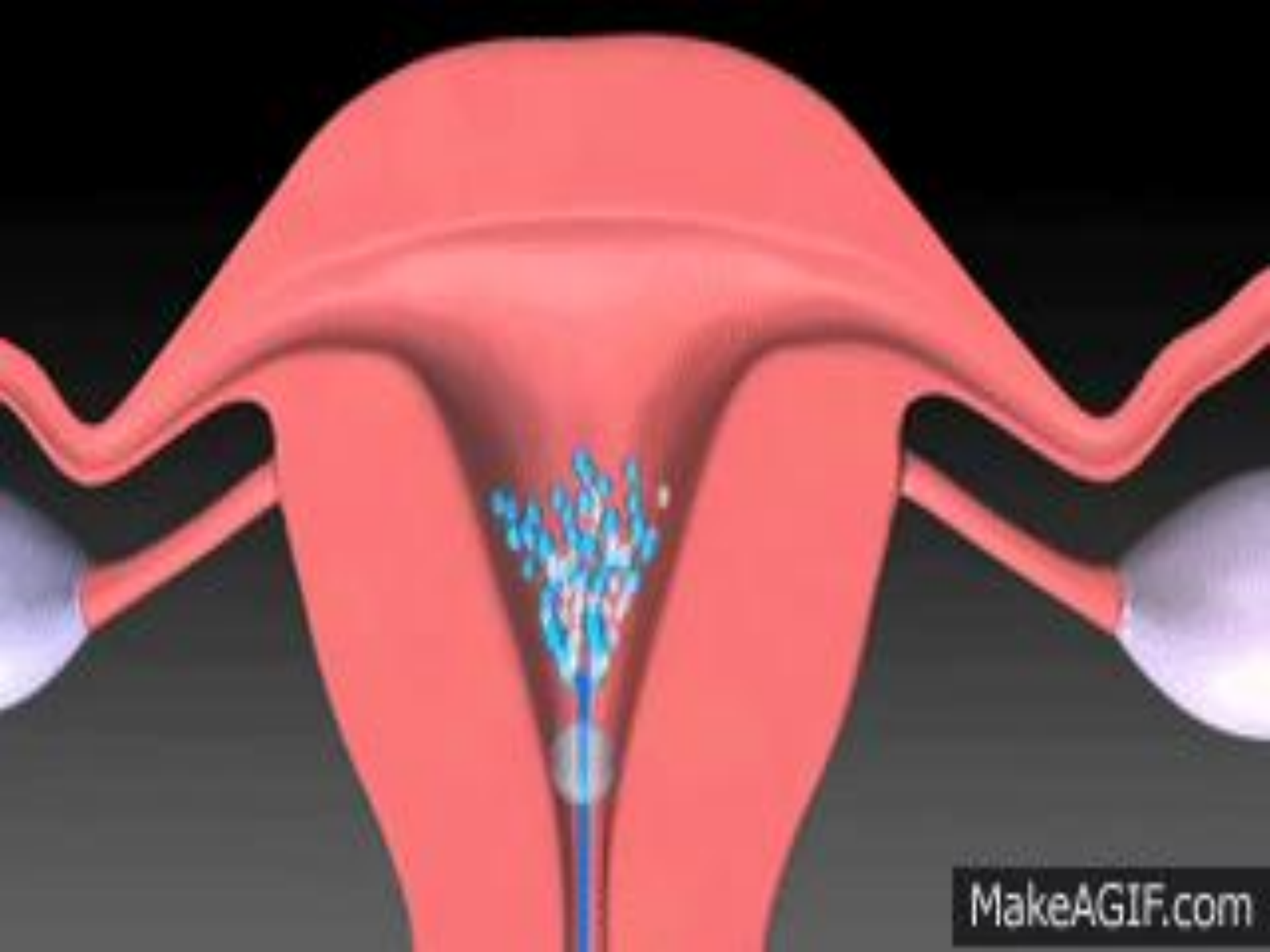


Some Forms of Catheters



In both techniques, there is a syringe with iodinated hydrosoluble contrast medium at the other end of the salpingographer.





Contrast Media

→ **Two categories** of iodinated contrast media have been used in HSG.

→ I - Water-soluble iodinated contrast media, such as Omnipaque 300, is preferred.

- It is absorbed easily by the patient,
- Does not leave a residue within the reproductive tract, and provides adequate visualization.
- This medium does, however, cause pain when injected within the uterine cavity, and the pain may persist for several hours after the procedure.

II- oil-based contrast media

Allow maximal visualization of uterine structures.

However, it has a very slow absorption rate and persists in the body cavities for an extended time.

Risk of oil embolus that could reach the lungs.

- ➔ The amount of contrast : is variable, “About 5 : 15 ml”
- ➔ On average, *approximately 5 ml* is necessary to fill the uterine cavity,
 - An additional 5 ml is needed to demonstrate uterine tube patency.





© Julio Herrero

Complications

- The two most common complications of HSG are pain and infection.
- SimplyComplications are related to
→ technique → Contrast & → Radiation
- Complications may be : General or Local

1-Uterine contractions and discomfort:

- due to the introduction of contrast medium into the uterine cavity → Dilating it.
- more diffuse pain, caused by irritation of the peritoneum due to the contrast.
- *Pain can be minimized* by :
 - slowly injecting the contrast medium
 - using isosmolar contrast agents.

2- Postprocedural infection:

Spreading and generalization of inflammation may happen in cases of chronic inflammation.

3- Vasovagal reaction:

A possible reaction to manipulation of the cervix or inflation of a conclusion balloon in the cervical canal.

4- Traumatic elevation of endometrium by the inserted cannula:

A complication which does not cause significant consequences.

5- Uterine perforation and tubal rupture: are very rare.

- 6- Intra-vasation of contrast media:
 - Venous or lymphatic
 - With a water-based contrast medium there is no adverse effect on the patient,
 - But it can make interpretation of the image difficult. It occurs more commonly in the presence of fibroids or tubal obstruction.
- It could occur if :
 - Rapid injection,
 - If the endometrium is injured during the catheterization, or
 - if the examination is performed during menstruation.

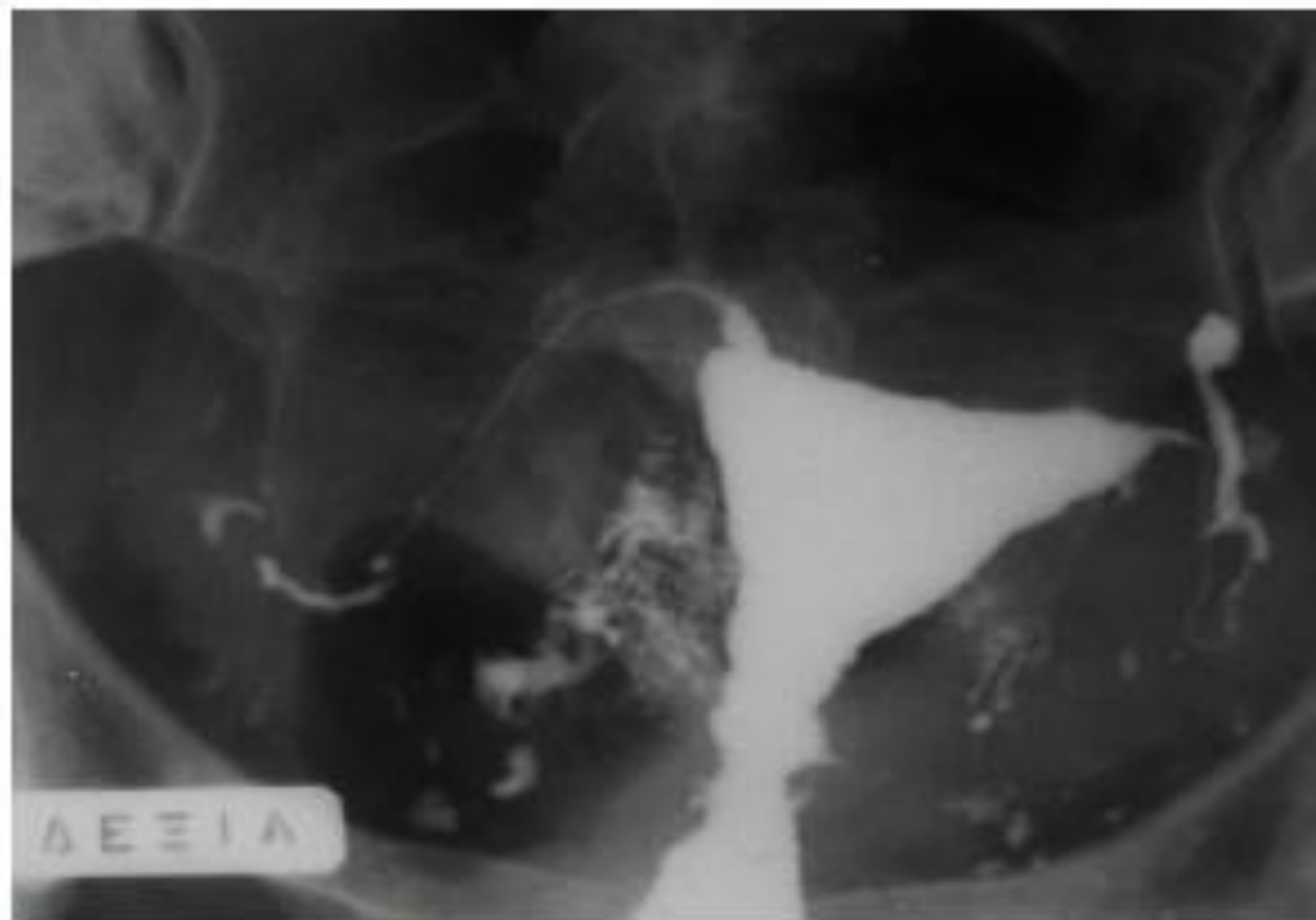


FIG 1. Extravasations of the contrast medium. Presence of contrast medium in the peritoneum.

7- Allergic reaction to contrast media:

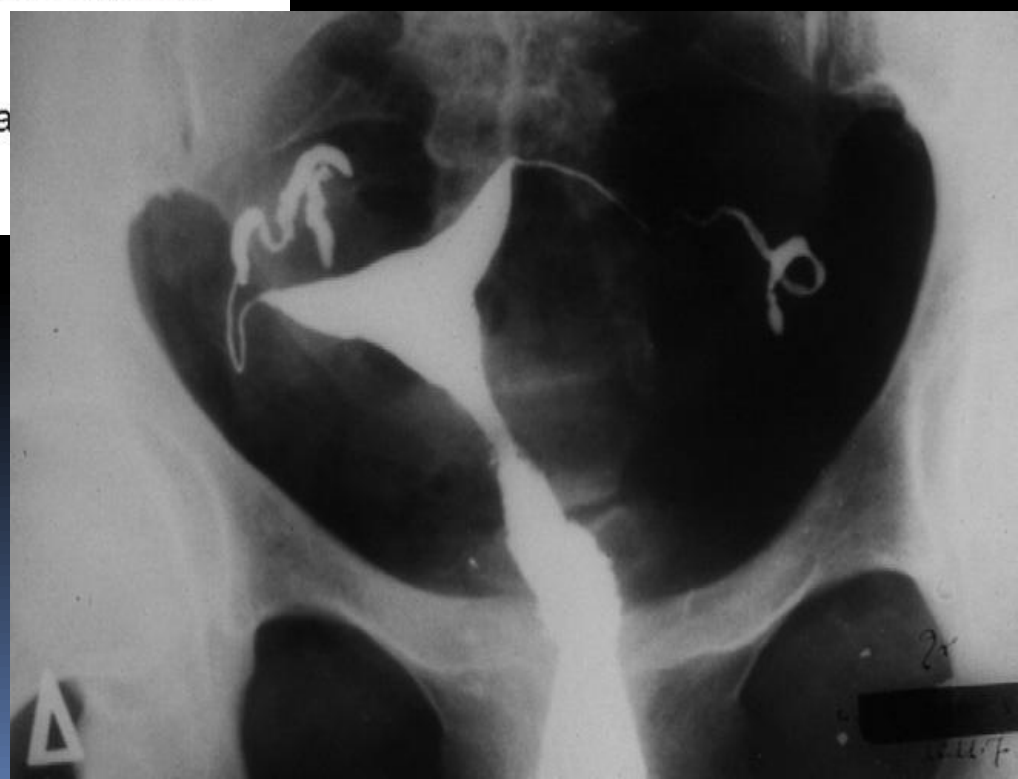
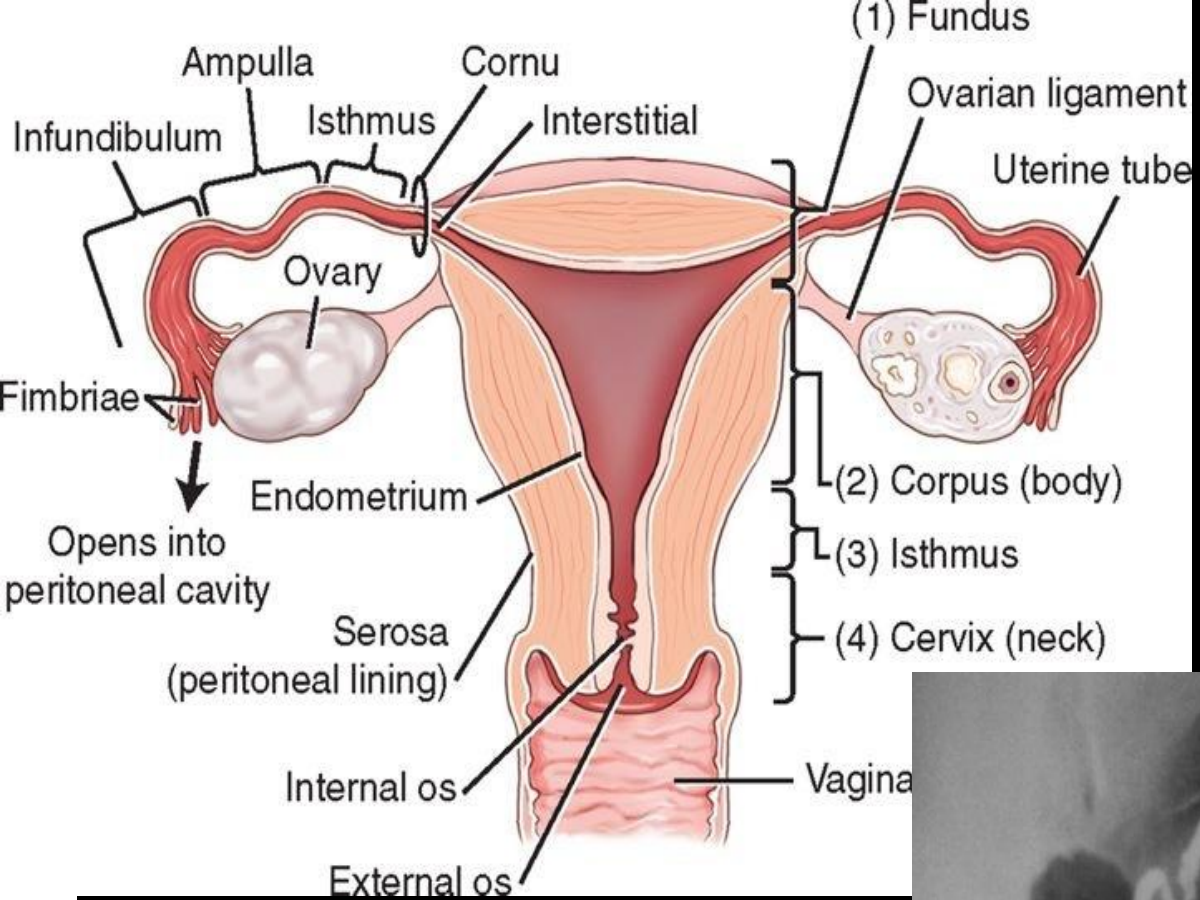
- very uncommon with low-osmolar nonionic contrast agents currently available.

8- Radiation exposure to the ovaries:

Exposure is minimal and can be reduced if the proper technique is utilized.



Normal Findings



■ *Uterine cavity :*

- has a normal trigonal shape .
- The apex of the triangle is the isthmus, → nearly 3.7 mm wide.
- Is pointed downwards
- connected to the internal ostium of the cervix uteri,
- The base of triangle is the fundus, which can be concave, flattened, or slightly convex.
- On both sides of its base, in the area of the lateral horns,

■ *Cervix:*

- is 2.5 cm in total length.

- *The fallopian tubes :*

- separated into three segments:

- 1- Isthmus (attached to the uterus, not imaged in several cases),

- 2- Ampullary :

- in the middle,

- the longest and widest segment,

- 3- Infundibulum : bell-shaped (to the distal end).

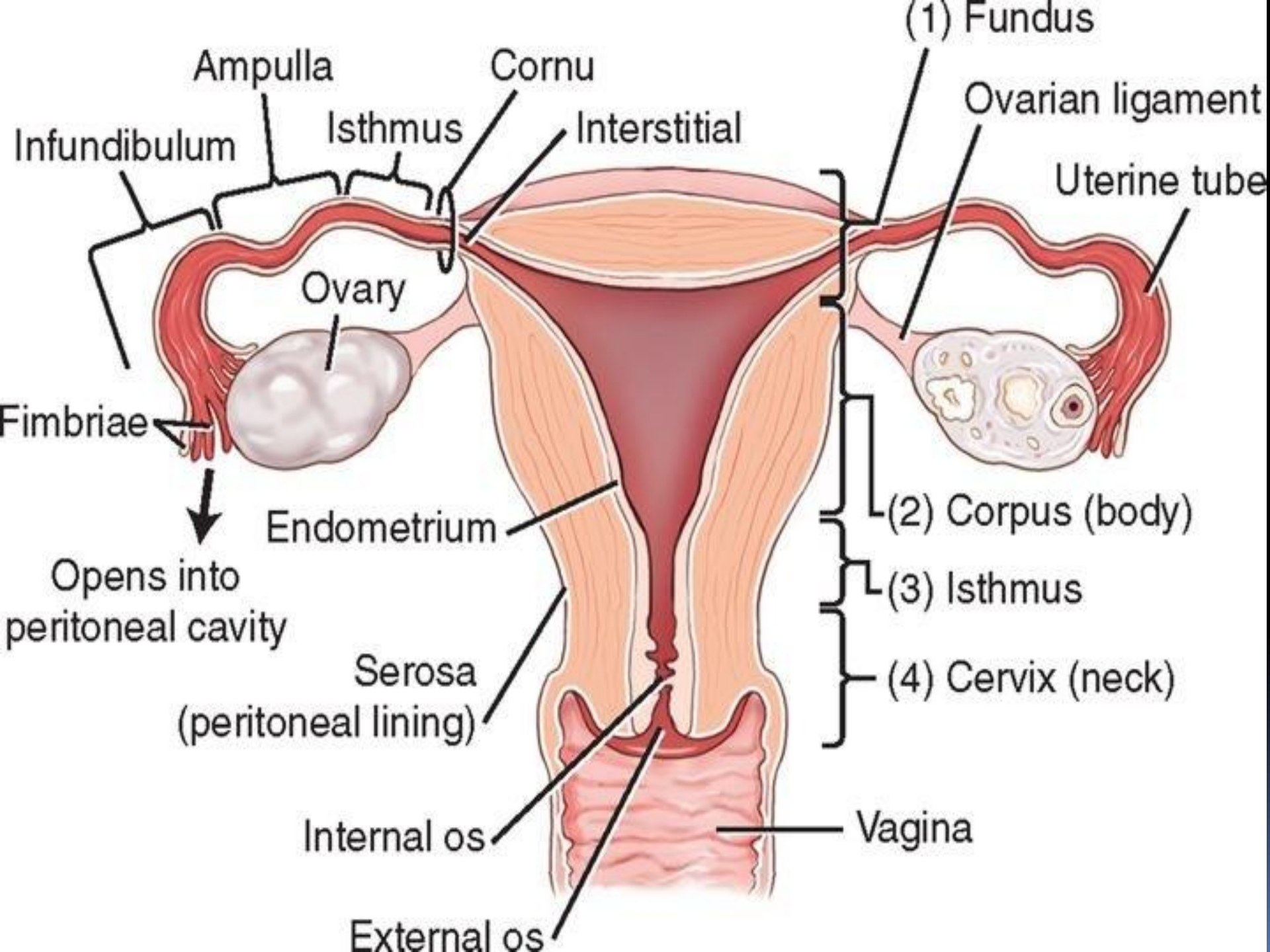
- There are two ostiums:

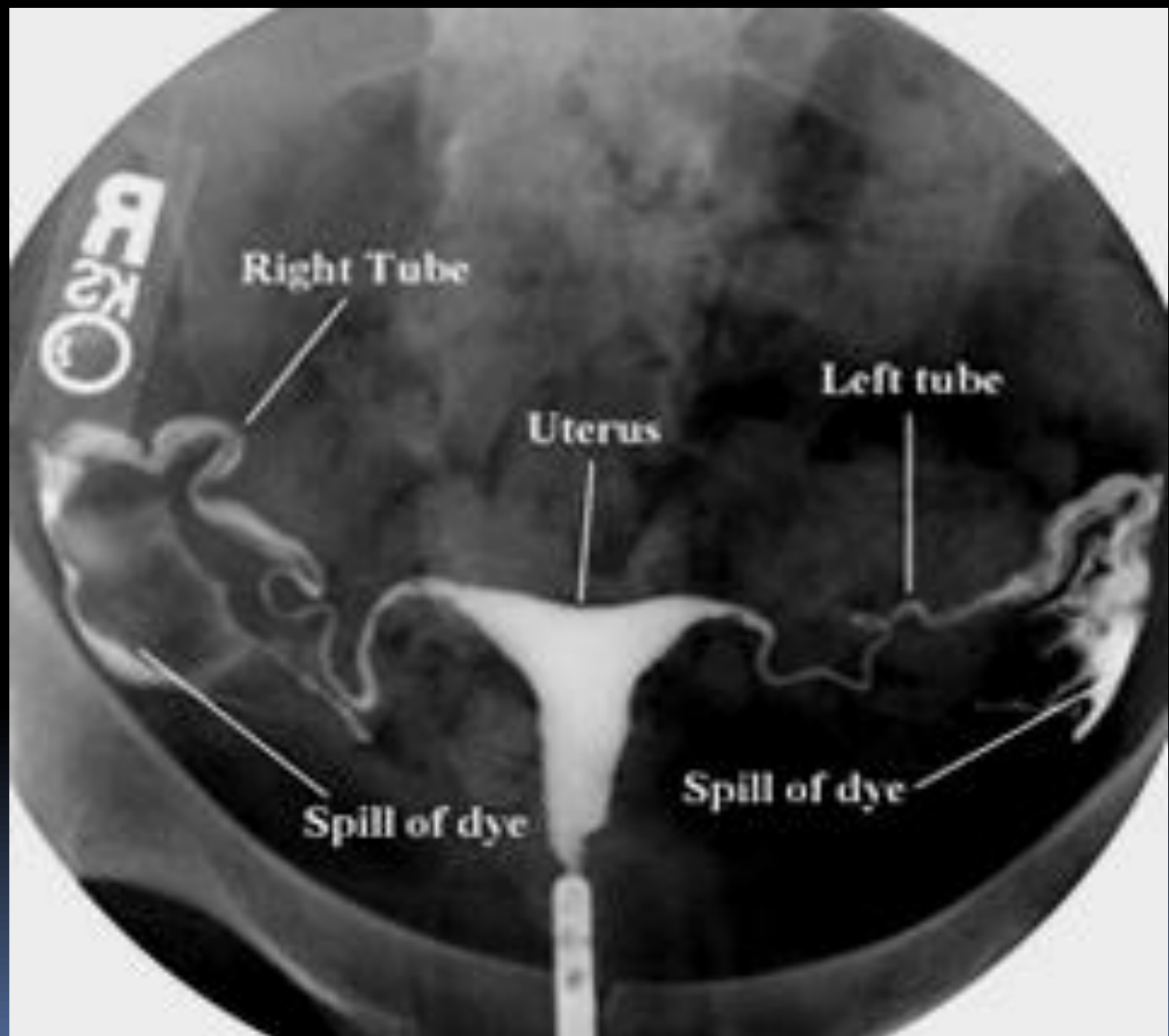
- Internal or uterine, and

- External or abdominal → through it contrast diffuses into the peritoneal cavity



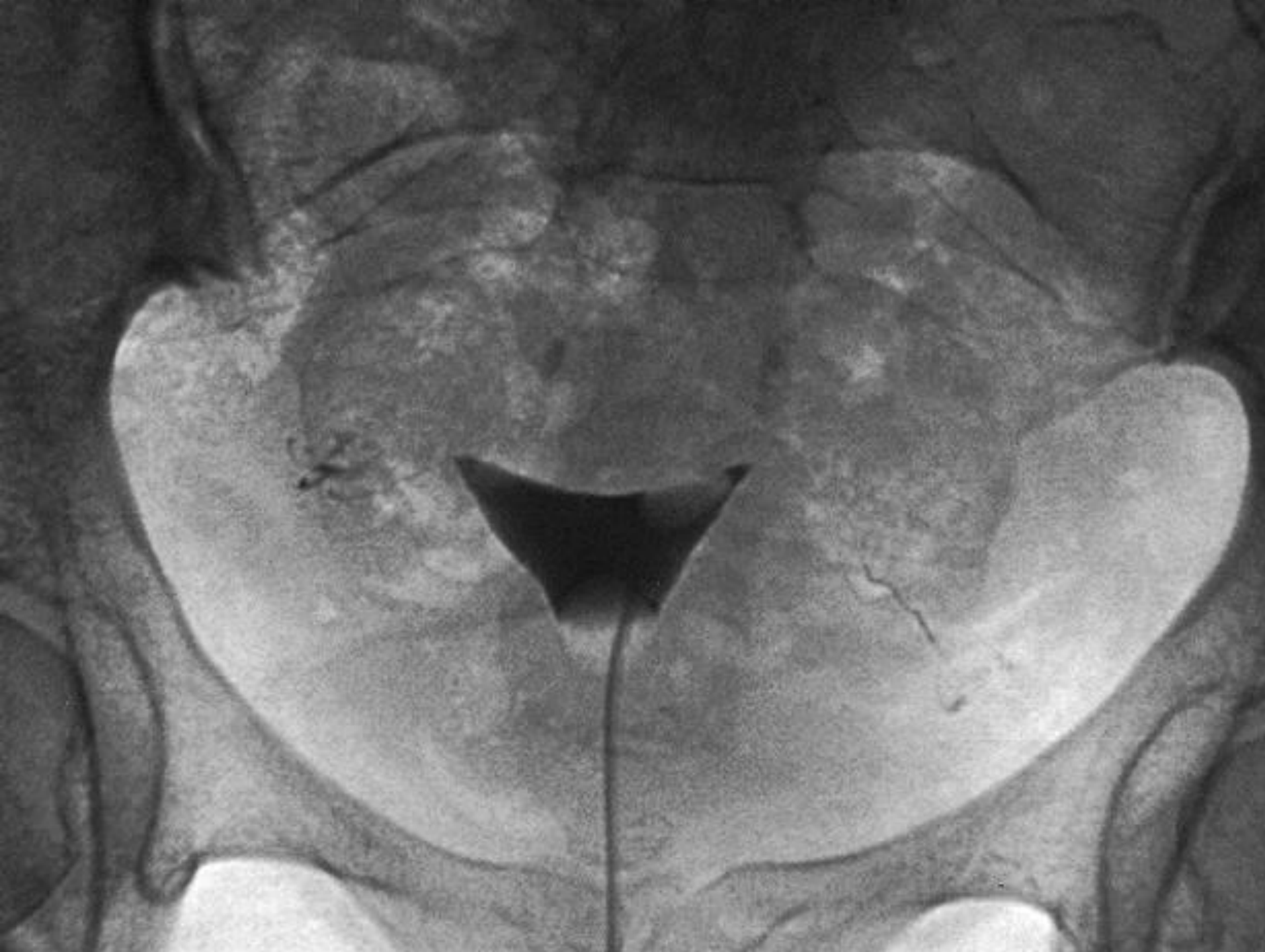
- 
- Remaining contrast medium in the furrows of the peritoneum can be observed up to **3 hours** after administration.

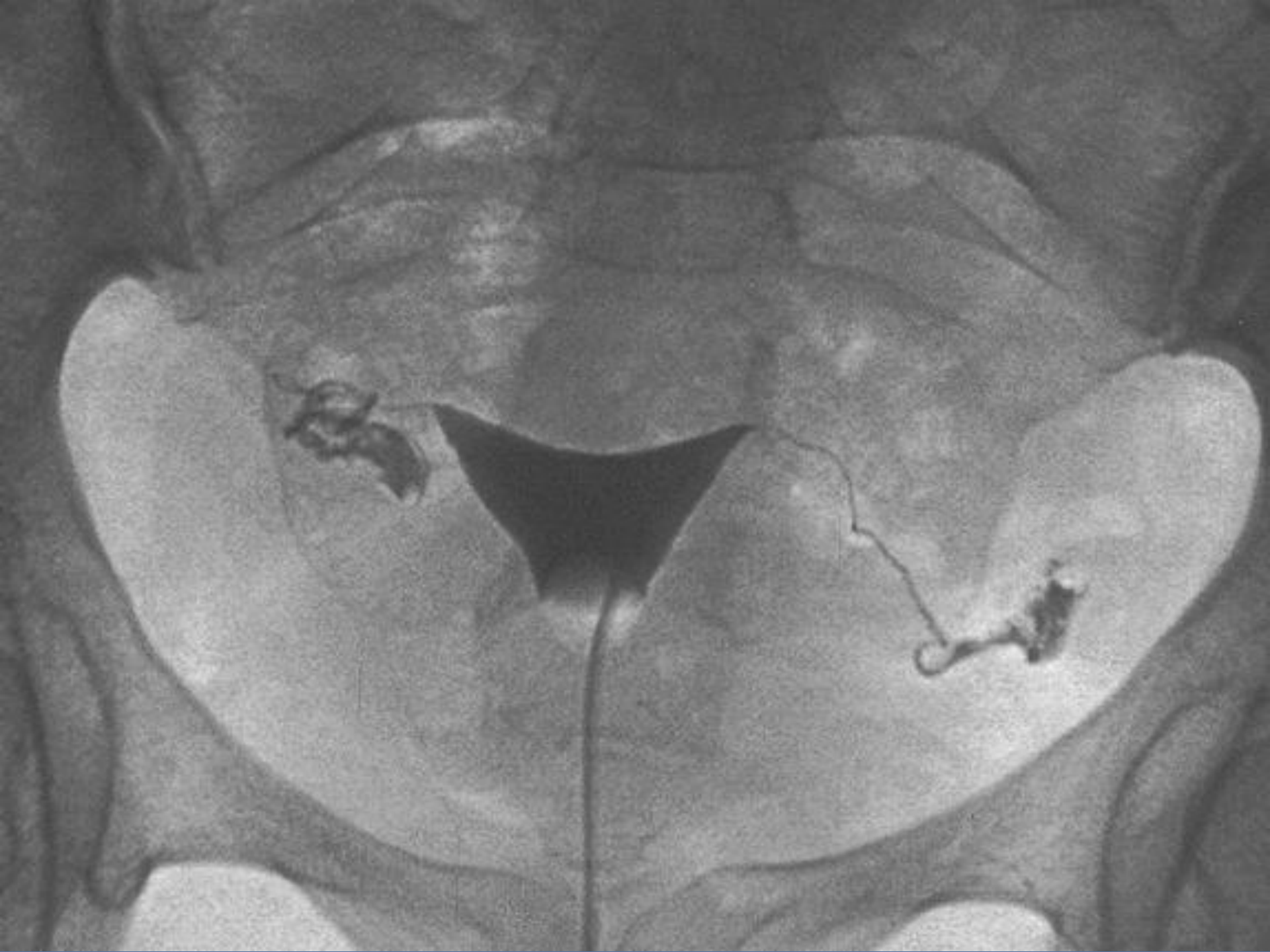




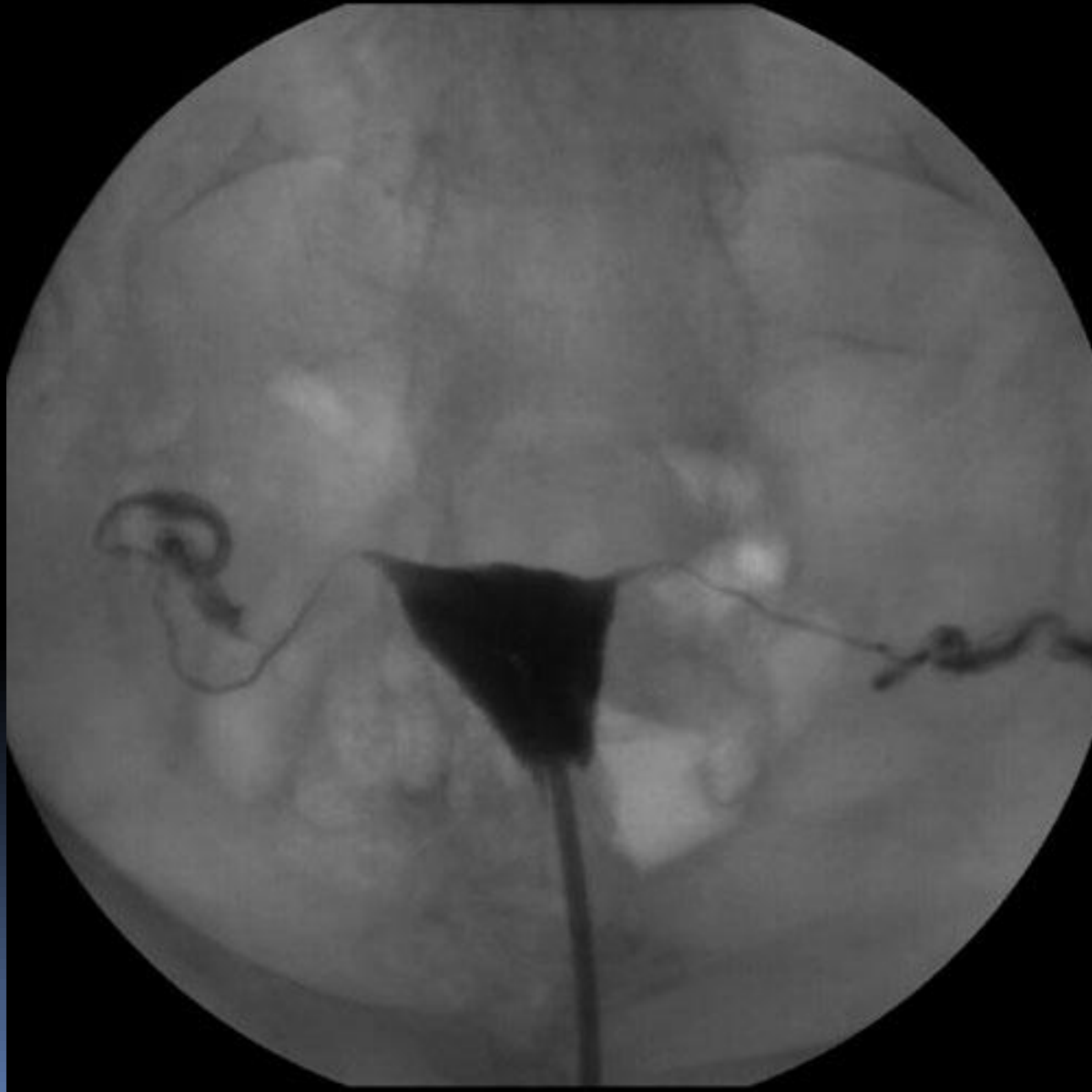
Scout

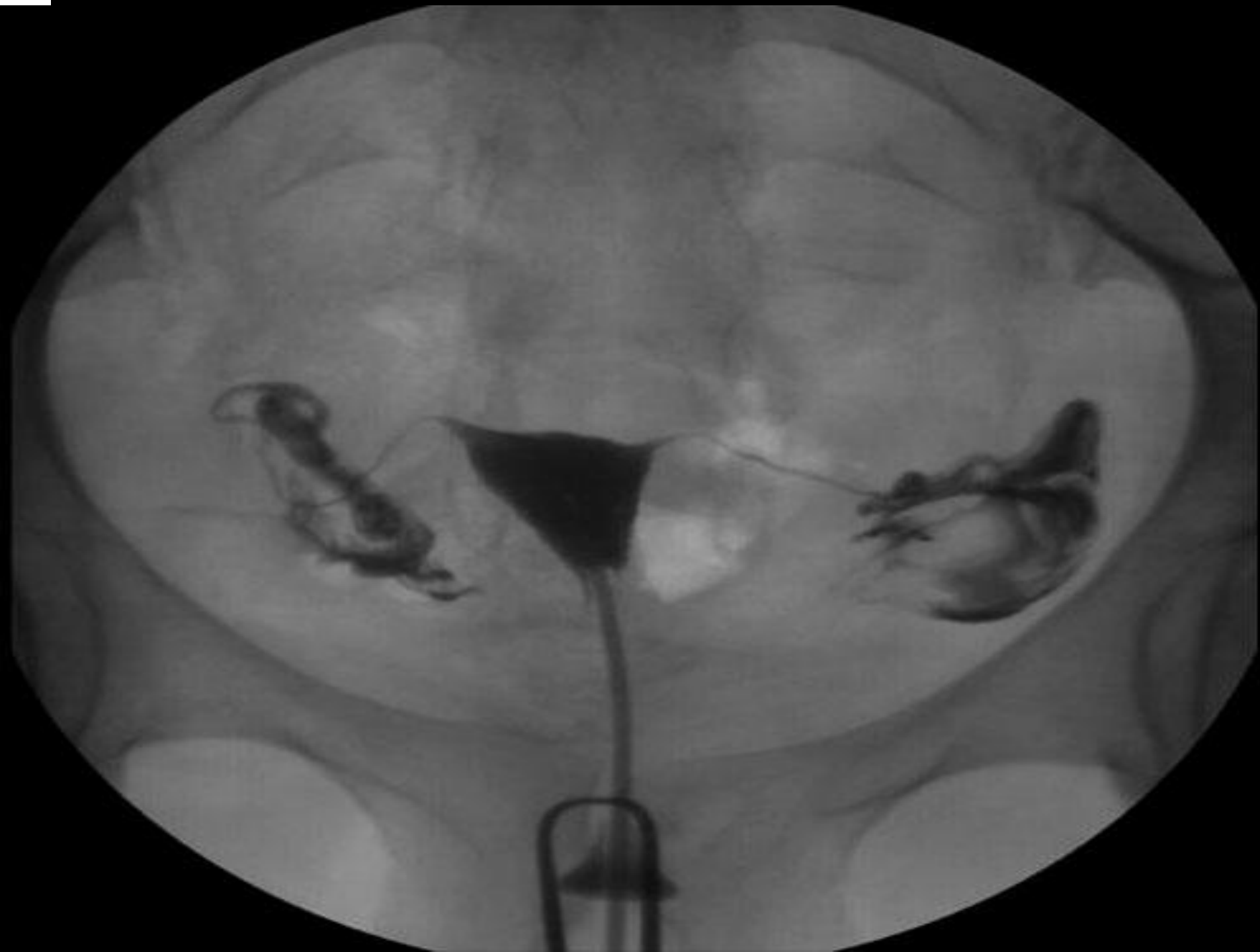






Normal Hysterosalpingograms







NORMAL

Comment on:

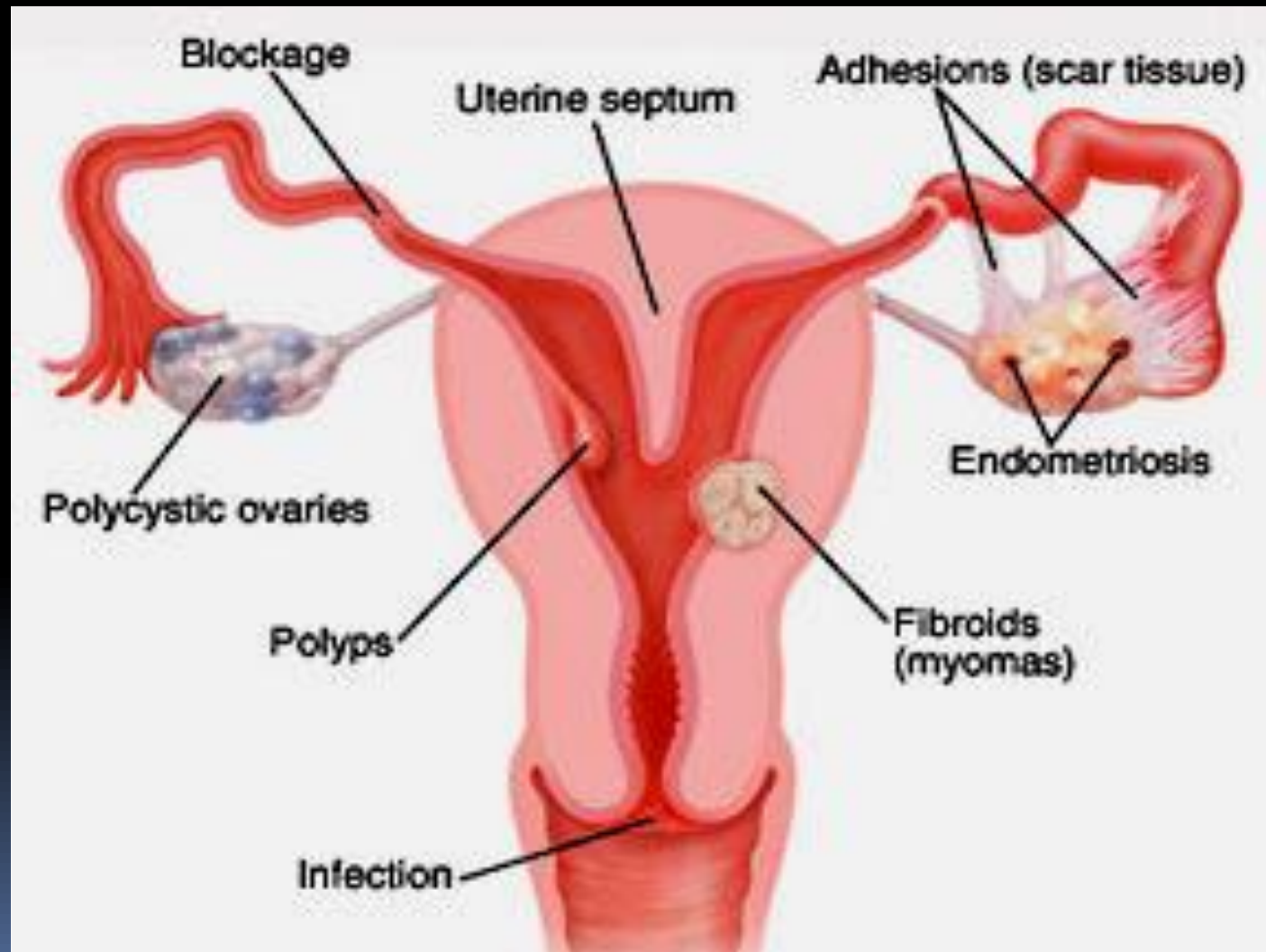
Uterine cavity: size & shape

Fallopian tubes: calibre, mucosa, patency

Free spill

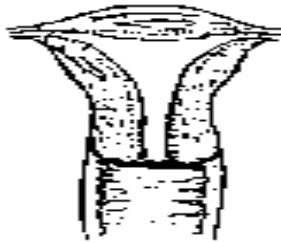
Homogenous smearing

Abnormal Hysterosalpingogram

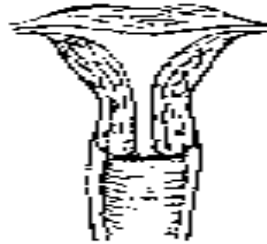


Congenital Uterus Anomalies

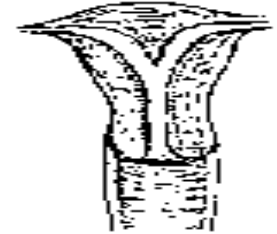
Classification of Uterine Anomalies



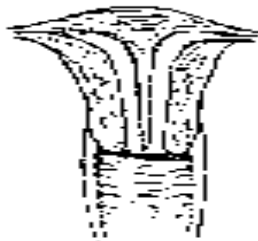
Normal



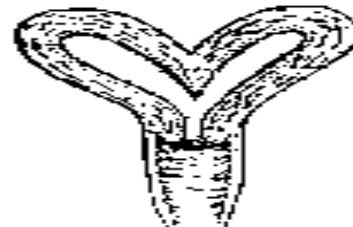
Arcuate



Subseptate



Septate



Bicornuate
(unicollis)



Bicornuate
(bicollis)



Didelphys



Unicornuate



Hypoplastic

- 
- 
- Caused by *incomplete junction* of the paramesonephric ducts (Muller ducts),
 - Majority of women with mullerian duct anomalies have *reproductive problems* :
 - little chance of conceiving,
 - higher rates of *spontaneous abortion*,
 - higher rates of *premature delivery*
 - Abnormal fetal position

- *Primary infertility*

In such cases has an extra uterine cause and is not generally attributable to mullerian duct anomalies alone.

- *Cervical incompetence :*

Has been reported to be associated with these anomalies.



- ***Unicornous uterus.***
 - Hysterosalpingography shows opacification of a single right uterine horn.
 - A single fallopian tube is also visualized.



- Didelphys uterus.
 - Hysterosalpingography shows two uterine cavities, two cervices, and one single vagina.

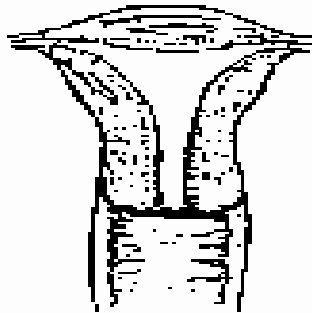


- Bicornate uterus.
 - Spot radiograph shows two uterine horns.
 - The fallopian tubes are also visualized at this imaging stage.

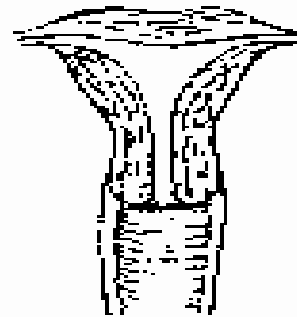


- Arcuate uterus. Hysterosalpingography demonstrates
 - a depression of the uterine fundus, compatible with an arcuate uterus.

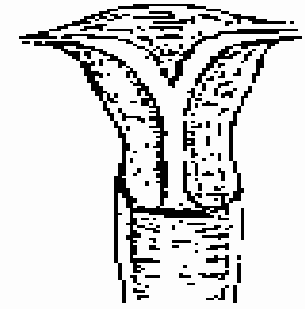
Classification of Uterine Anomalies



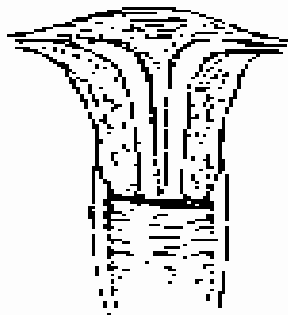
Normal



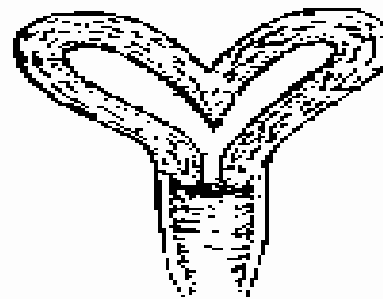
Arcuate



Subseptate



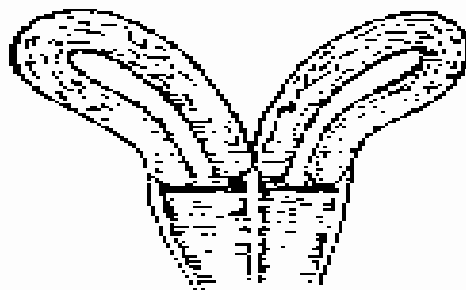
Septate



Bicornuate
(unicollis)



Bicornuate
(bicollis)



Didelphys



Unicornuate



Hypoplastic

- 
- 
- ➔ ***Small sized Uterus "Hypoplastic" :***
 - *Another congenital anomaly,*
 - caused by *inadequate hormonal stimulation* as a fetus,
 - Small uterine cavity size with normal vaginal length
 - A common finding in cases of female infertility.



- *Small size* of the uterus cavity with normal length of the vagina



Non congenital Abnormal Findings



Fibromyomas

- Submucosa fibromyomas → are imaged as smooth filling defects in the uterine cavity.
- DD:
 - endometrial polyps
 - possible pregnancy.
- Small intramural fibromyomas :
 - Do not distort the endometrial cavity
 - Not visualized on HSG.
- Subserous fibromyomas :
 - only if they are located in the lateral walls of the uterus. → smooth filling defects or smooth repression of the fallopian tubes



- *Submucosa fibromyoma.*

Contrast deficiency “filling defect” with smooth border at the fundus of the uterus.



Endometrial Polyps

- are focal overgrowths of the endometrium.
 - usually manifest as well-defined filling defects and
 - Best seen during the early filling stage.
 - Small polyps may be obscured by contrast filling.
- 

Internal Endometriosis (Adenomyosis)

- presence of ectopic islets of active endometrium in the muscularis wall of the uterus.
- It is usually imaged as a pointed projection of 2 to 3 mm length, perpendicular to the uterine wall
- Rarely, this is imaged as a sack-shaped projection filled by contrast medium, 4 mm to 1 cm in length.

→ Differential diagnosis :

- hyperplasia of the endometrium and the entrance of the contrast medium in the myometrium or
- in the nutrient arteriole of submucosa fibromyomas.



- Endometriosis.
Sack-shaped projection full of contrast medium

Uterine Cancer

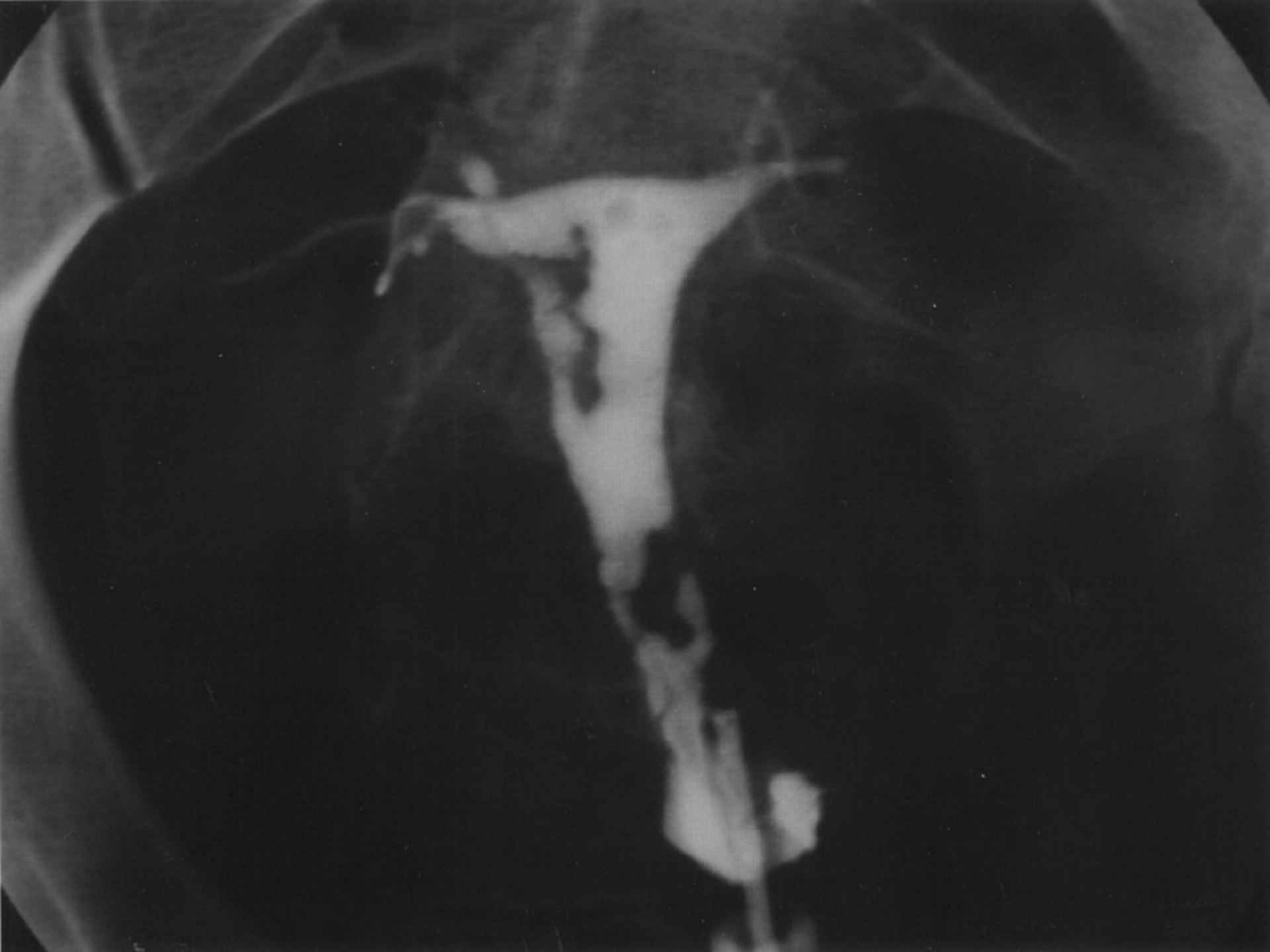
- manifests as an *irregular filling defect*,
- rarely diagnosed by the HSG method.



Uterine cancer.
Large contrast deficiency “Filling defect” with abnormal border at the left lateral uterus wall, which is indicated.

Intrauterine Adhesions

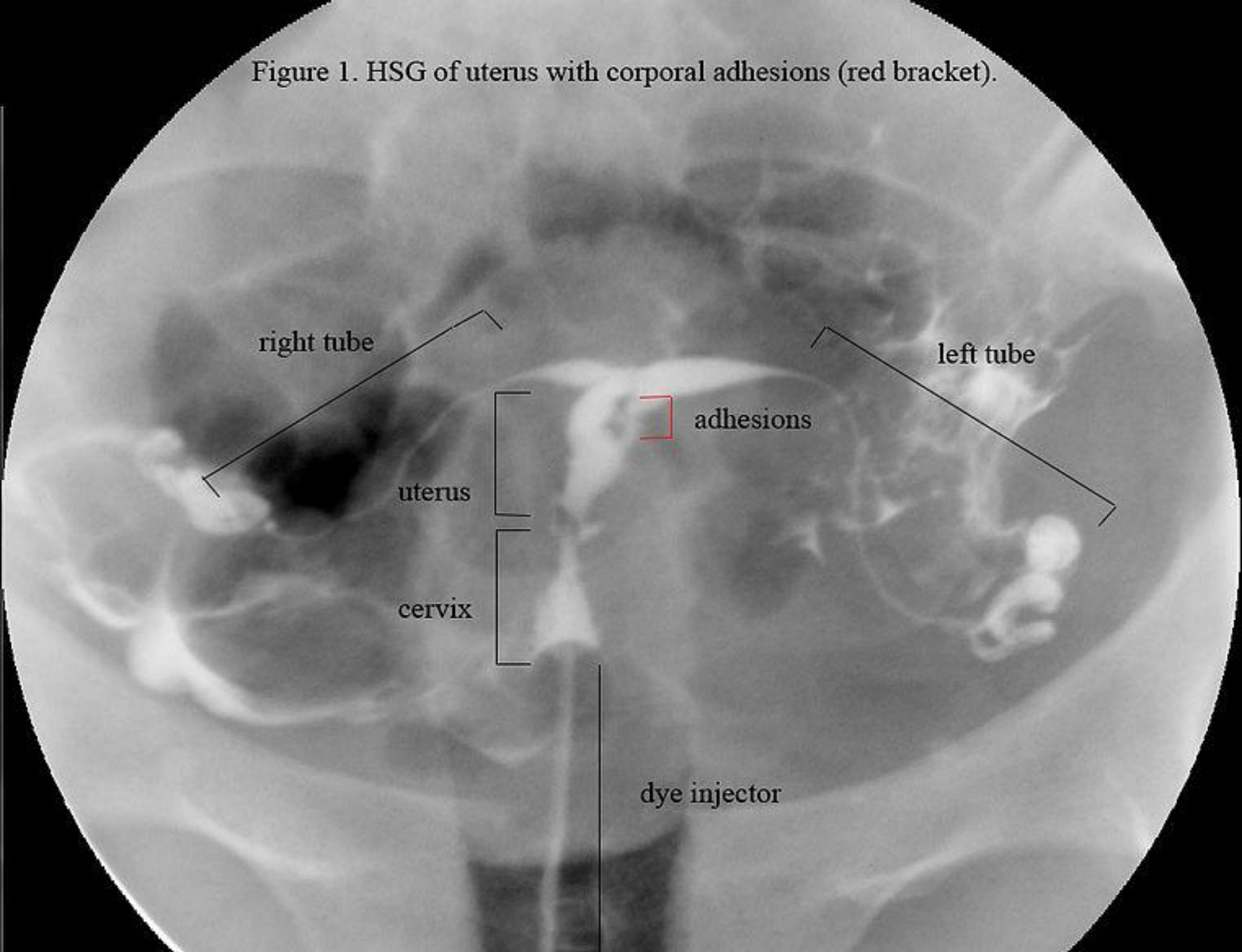
- most commonly caused by endometrial trauma of curettage.
- They are also seen in patients with chronic endometriosis due to tuberculosis.
- Intrauterine adhesions manifest as irregular filling defects, → most commonly as linear filling defects arising from one of the uterine walls.



Asherman's syndrome

- is a condition characterized by:
adhesions and/or fibrosis of the endometrium most often associated with dilation and curettage of the intrauterine cavity.
- was first described in 1894 by Heinrich Fritsch (Fritsch, 1894)
& further characterized by Israeli gynecologist Joseph Asherman in 1948.

Figure 1. HSG of uterus with corporal adhesions (red bracket).



ALFALAH



08-09-22
23-Apr-2009
75 kV, 320 mA, 30 ms

S-7
SBAN KHALFALAH



08-09-22
23-Apr-2009
75 kV, 320 mA, 30 ms

ALFALAH



08-07-48
23-Apr-2009
75 kV, 320 mA, 30 ms

S-8
SBAN KHALFALAH



08-07-48
23-Apr-2009
75 kV, 320 mA, 30 ms

ALFALAH



08-07-48
23-Apr-2009
75 kV, 320 mA, 30 ms

S-9
SBAN KHALFALAH



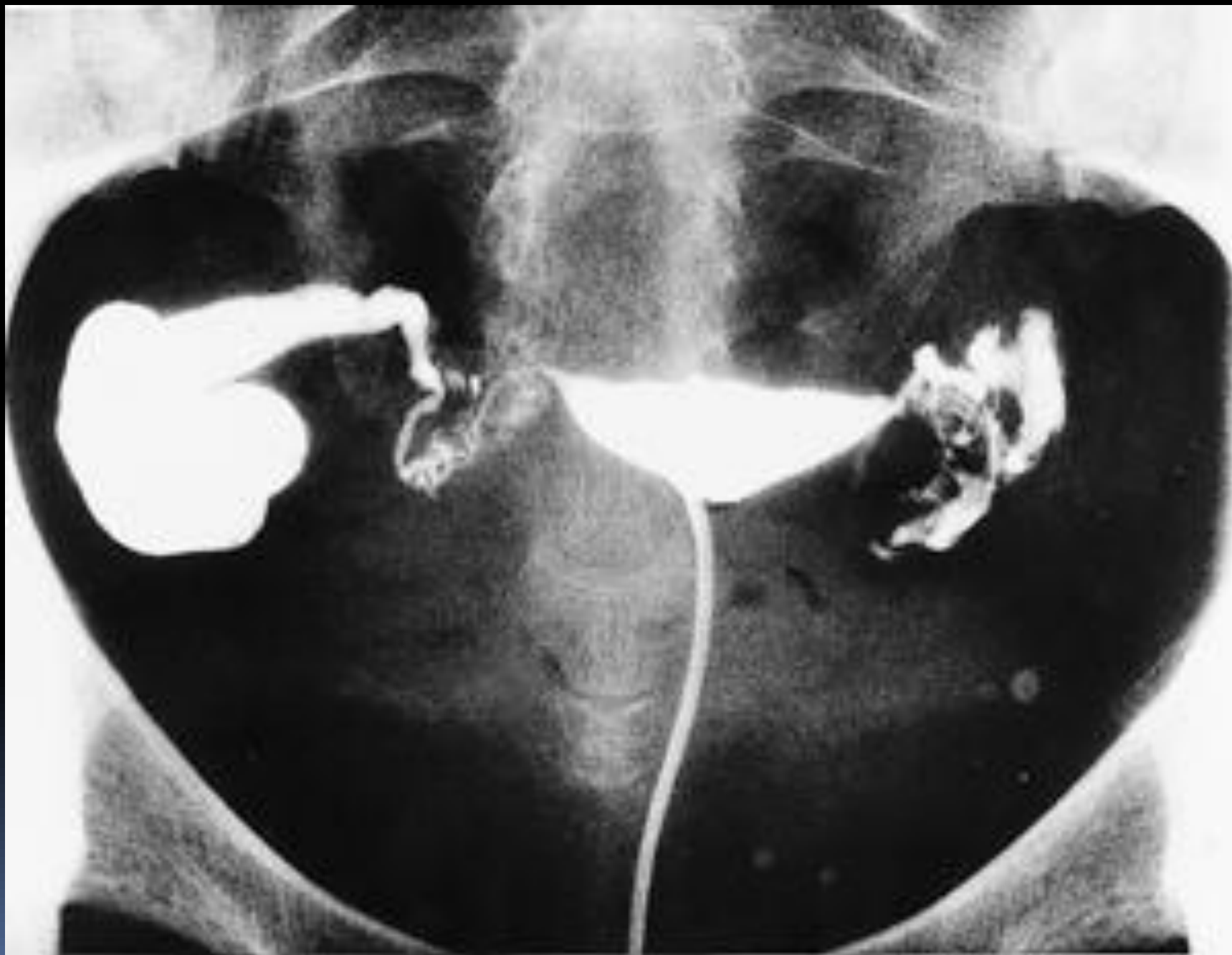
08-07-48
23-Apr-2009
75 kV, 320 mA, 30 ms

Hydrosalpinx

→ *HSG is the best method for visualizing and evaluating the fallopian tubes.*

- Commonly results from a previous inflammation of the fallopian tubes (salpingitis).
- Distal tubal occlusion, → dilation of the proximal segment.
- The radiologic image shows a dilated lumen in one or more spots, → contrast will not pass to the peritoneal cavity

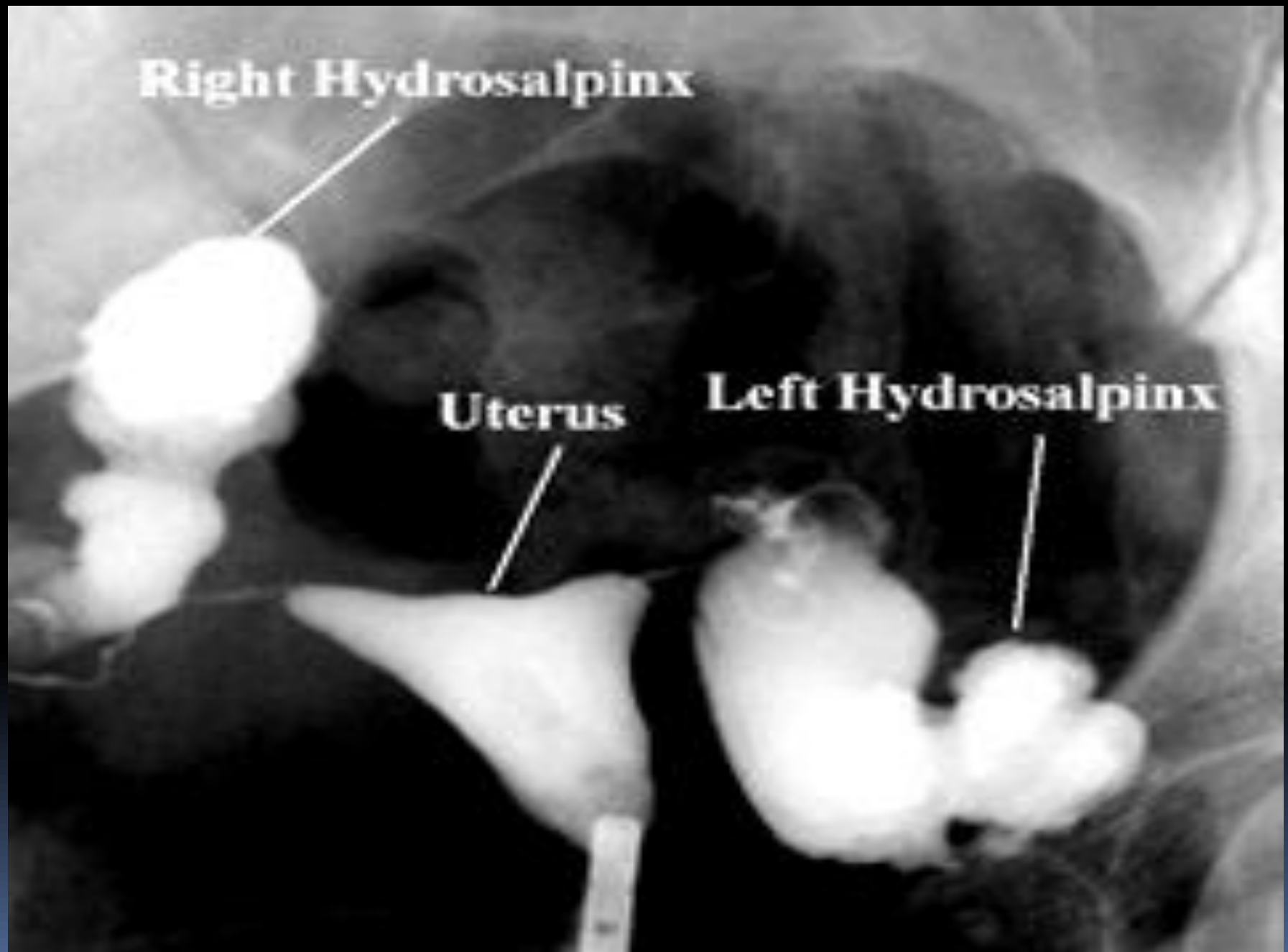




Right Hydrosalpinx

Uterus

Left Hydrosalpinx



Salpingitis Isthmica Nodosa

- a disease of unknown etiology,
- characterized by :
 - multiple small outpouchings or diverticula
 - Affecting one or both fallopian tubes.
- It is presumably caused by pelvic inflammatory disease or endometriosis .
- Is associated with ectopic pregnancy and infertility.9



- ***Nodosa isthmica salpingitis.***
Presence of small projected spots full of contrast medium, parallel to the fallopian tube.



©Behrang Amini, MD/PhD



Non Filling of the Fallopian Tubes

- *This is the most common finding during the examination .*
- Usually caused by:
 - poor technique,
 - spasm, or
 - obliteration of the fallopian tube.

➔ *Poor technique includes:*

- imperfect straightening of the external cervical ostium
- Inadequate amount of contrast medium in the uterine cavity.

→ Spasm Vs Obliteration :

- The cornual portion of the fallopian tube is encased by the smooth muscle of the uterus
- If there is a spasm of the muscle during HSG, one or both tubes may not fill.
- Tubal spasm cannot be distinguished from tubal occlusion.

→ This could be avoided by:

- progressive administration of the contrast medium
- Administration of a spasmolytic agent to relieve spasm, → helping differentiate cornual spasm from true occlusion.⁴

- 
- Obliteration is usually caused by previous inflammation or uterine surgery and manifests as :

nonopacification or abrupt cutoff of the fallopian tube with no free intraperitoneal spillage.



Fallopian tube

Uterine cavity

Ovary

Vagina

Cervix

*Spillage indicates
tube is open*

*No spillage indicates
tube is blocked*

Cannula through which dye is injected

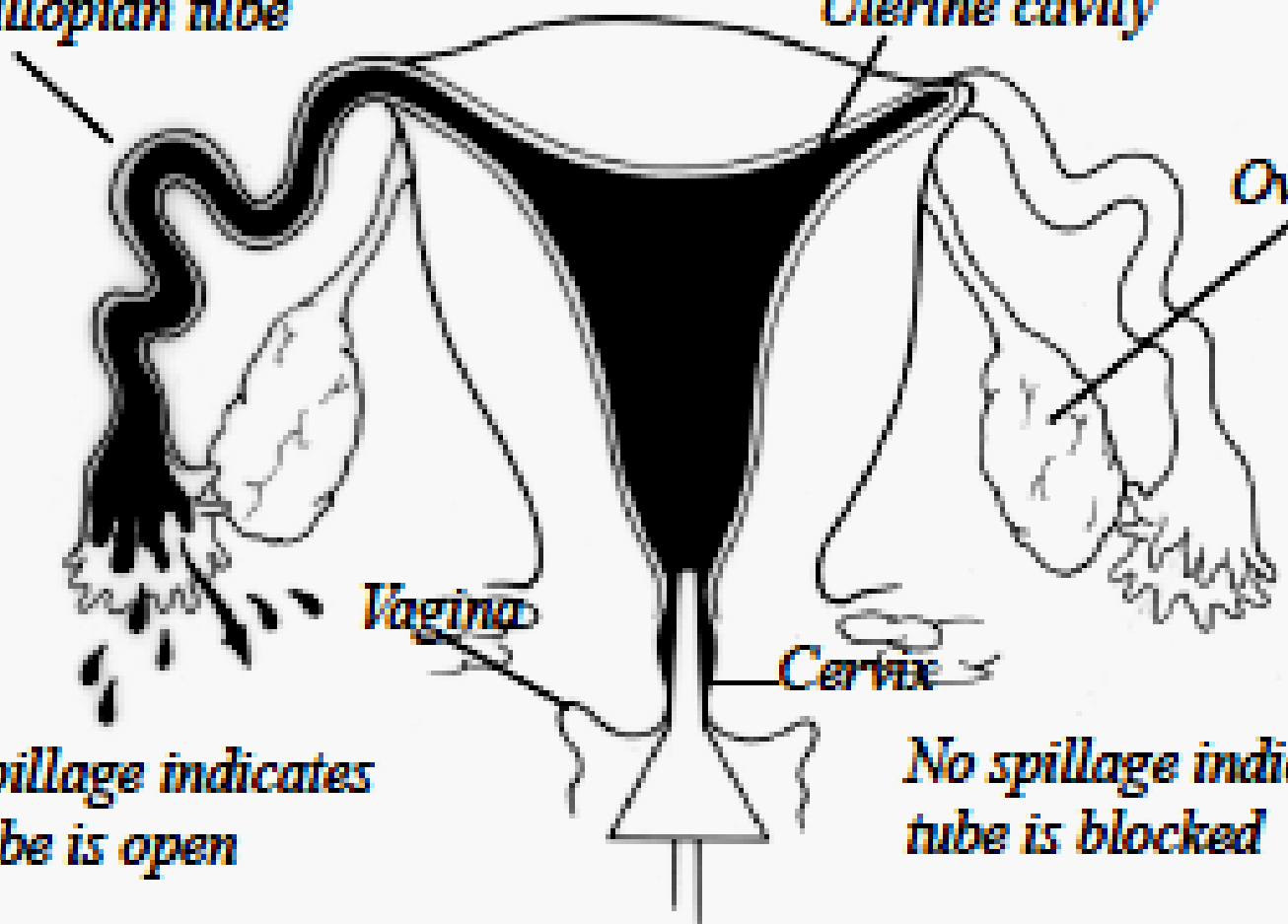




Figure 1

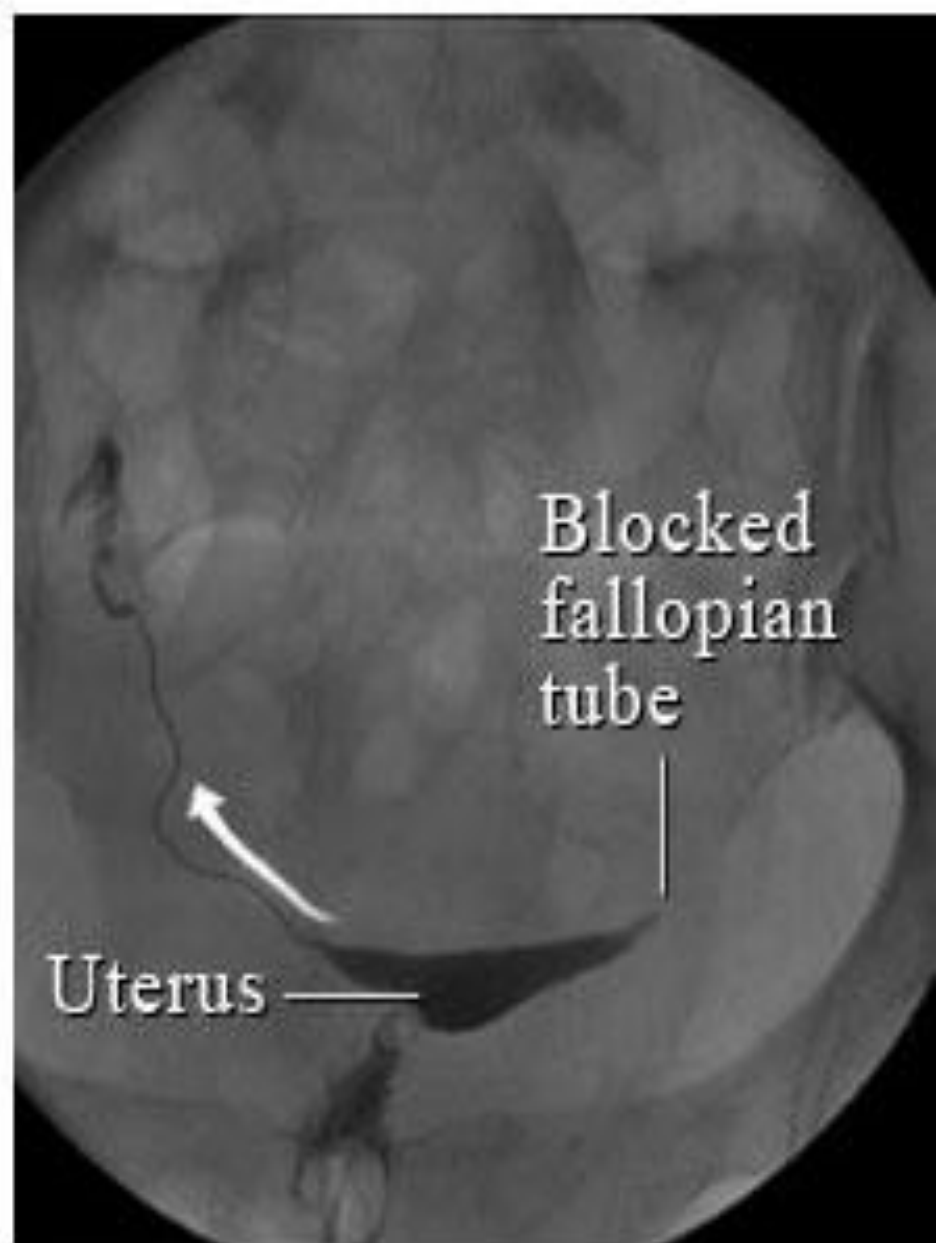


Figure 2

External Adhesions

- occur secondary to :
 - previous inflammation or
 - surgery,
similar to the causes of tubal occlusion.
- Peritubal adhesions → prevent contrast material from flowing freely around the bowel loops *“as seen in normal cases”,*
- Most commonly manifest as :
 - loculation of the contrast material around the ampullary portion of the tube.



Enlarged Ovary ← ovarian
Cyst
Confirmed BY US
+ Adhesions.



CASES & Quiz



Double uterine
contour
← Improper
imaging time

“Secretory
Phase”



NORMAL HSG

Injected air bubbles

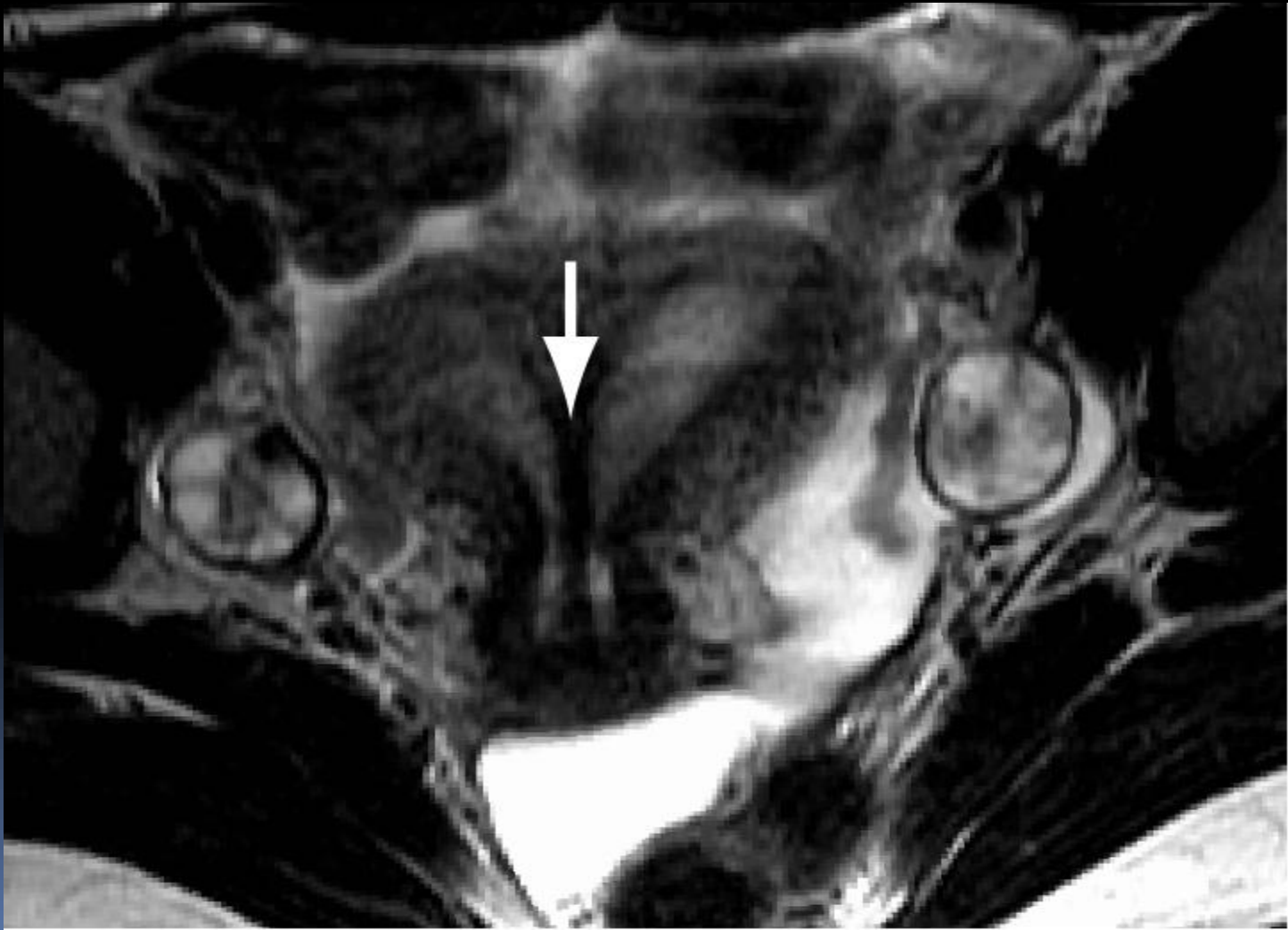


IMPROPER IMAGING

Inadequate cervical pulling
Uterus is markedly anti - flexed

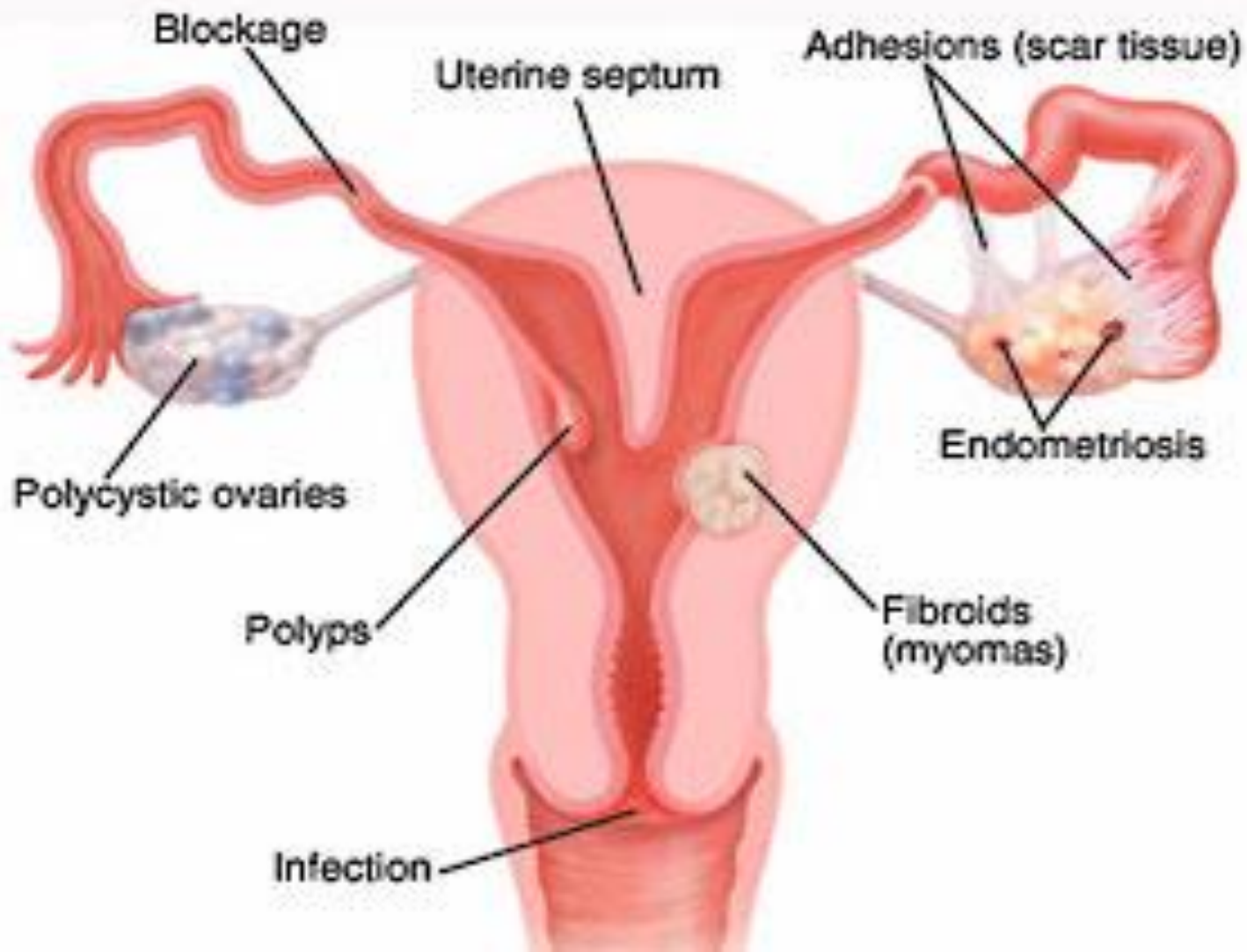


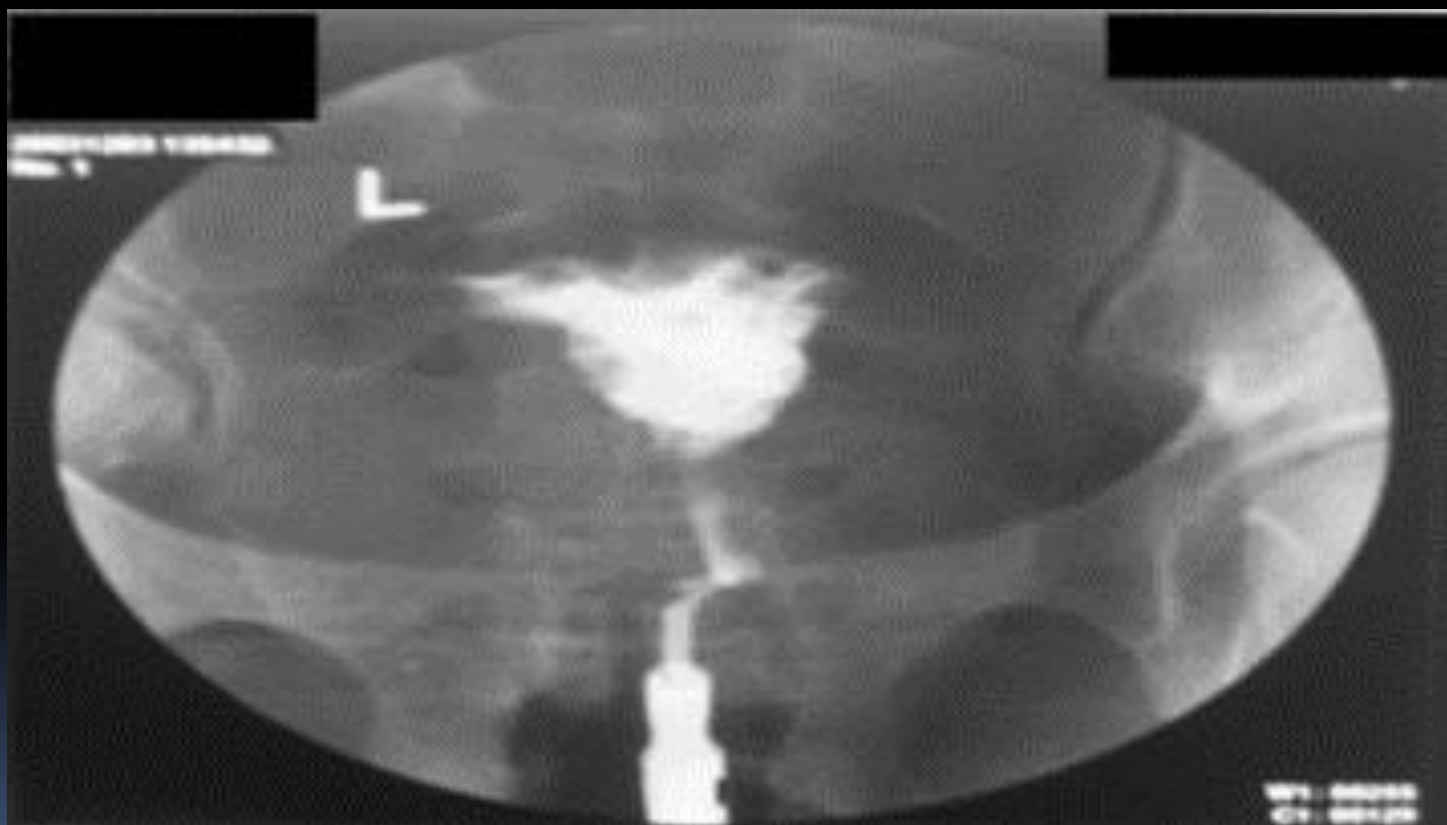
N.B. MRI is important for further assessment of many cases especially “Double cavity” categories.



Conclusion

- HSG remains the front-line imaging modality in the investigation of infertility.
- It is an accurate means of accessing the uterine cavity and tubal patency.
- but it has a low sensitivity for the diagnosis of pelvic adhesions, ←it cannot replace laparoscopy.
- It requires knowledge of the female anatomy as well as skillful technique in order to avoid pitfalls and misinterpretations.









CHOCOMACPORTSMITH DEPT DIGITAL IMAGE

Se 001
Im 007
M1



W 00M / L 00M / M 00
W 255 / L 134

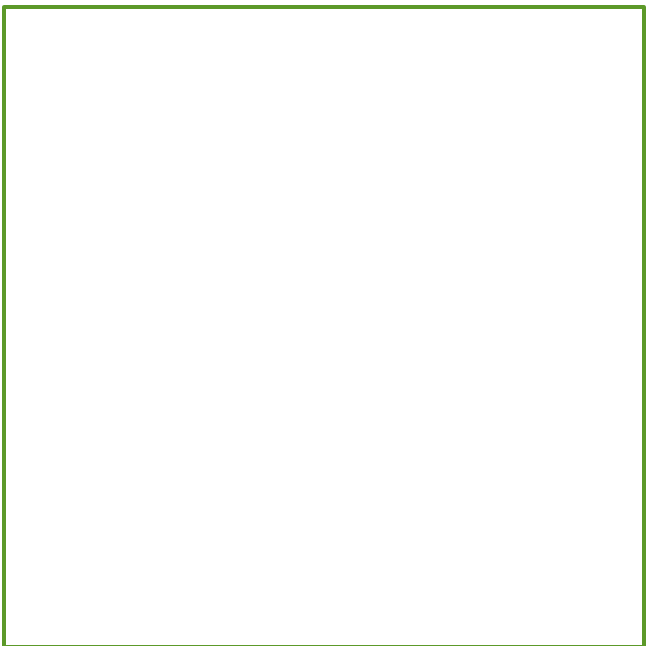
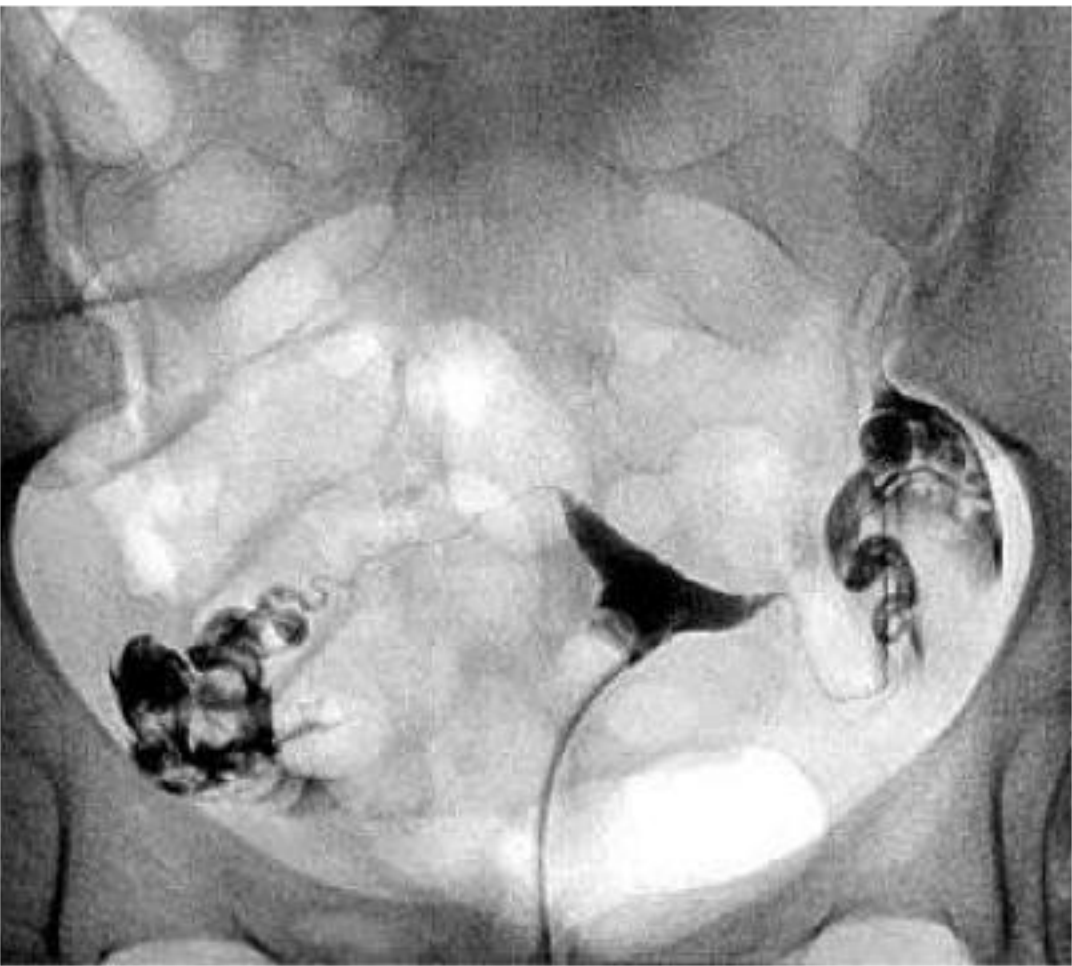






R

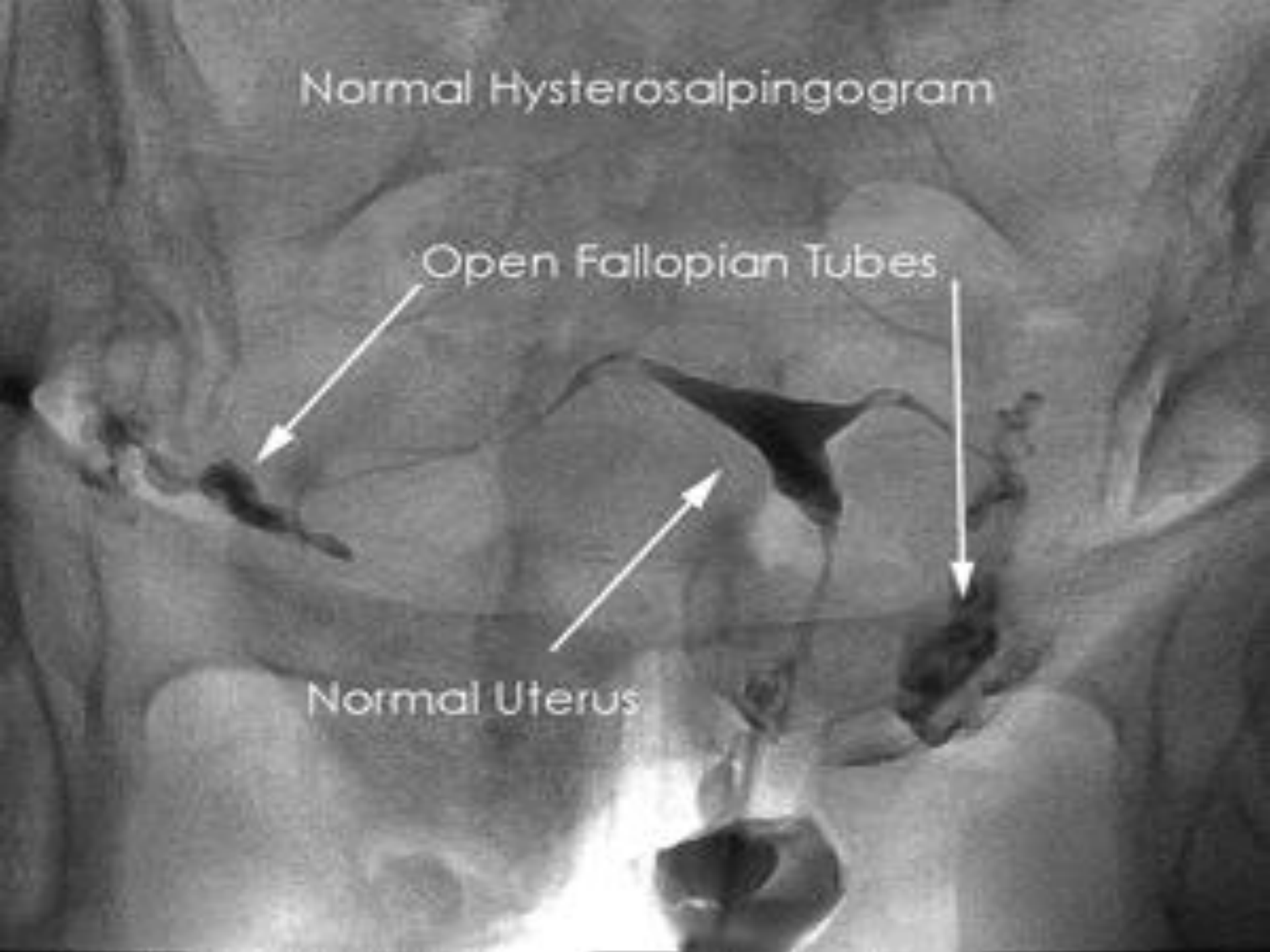


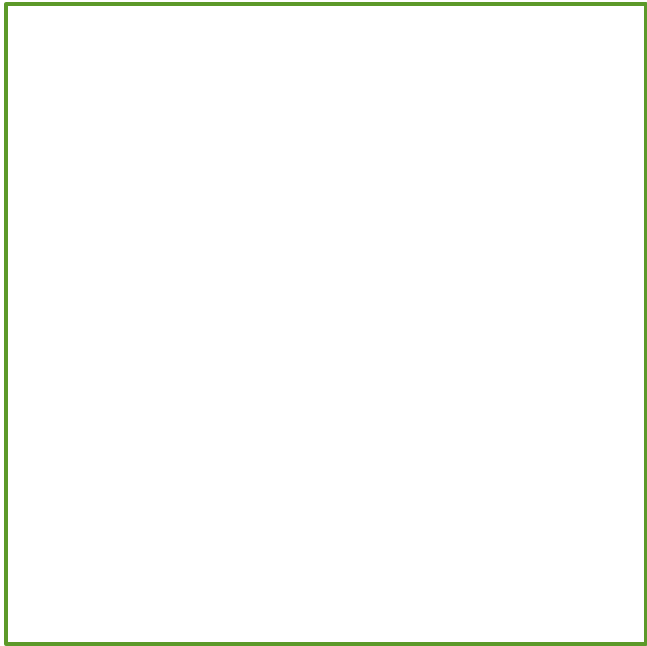


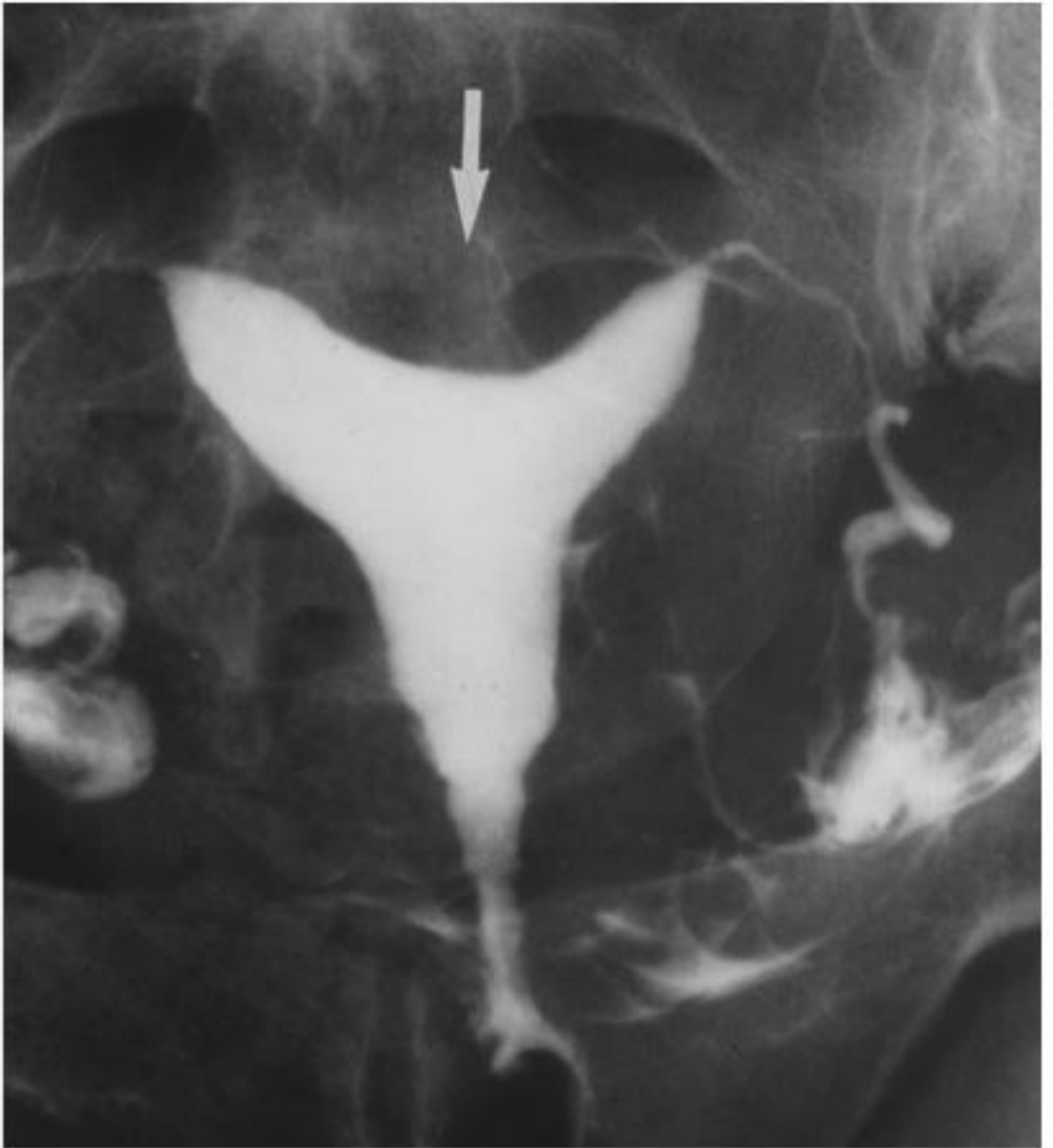
Normal Hysterosalpingogram

Open Fallopian Tubes

Normal Uterus













References:

- Hysterosalpingography: Technique and Applications ., Athanasios Chalazonitis, MD., et al , Curr Probl Diagn Radiol, September/October 2009.
- The WHO manual of diagnostic imaging, Radiographic Technique and Projections. Editors Harald Ostensen M.D.
- HSG film reading_Dr Rasha Kamal

For More Lectures visit our web pages:

- [*http://students-of-prof-mamdouh-mahfouz.blogspot.com*](http://students-of-prof-mamdouh-mahfouz.blogspot.com)
- [*http://Radiology-sohag.blogspot.com*](http://Radiology-sohag.blogspot.com)



THANK YOU

Ahmad Mokhtar Abodahab
Ass. Lecturer of Radiology
Sohag University

& 25 Dec 2016