Sonohysterography (SIS) and HSG: Clinical Tricks and Tips

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Disclosures

- Nothing to Disclose

Learning Objectives

At the end of this presentation, participants will be able to:

1. Describe the differences between HSG or SIS
2. Compare Uterine cavity assessments: HSG versus SIS
3. Describe Tubal Assessment and abnormalities: HSG vs SIS
4. List methods to improve each technique

Comparing HSG and SIS:

Question:

In an initial infertility evaluation, which technique do you use to assess the uterine cavity and tubal patency?

- Hysterosalpingogram (HSG)?
- Saline Infusion Sonohysterogram (SIS)?
- Laparoscopy with chromopertubation and hysteroscopy?

Question:
Which test would you do if you were only interested in the uterine cavity?

- HSG?
- SIS?
- Hysteroscopy?
- MRI (MR HSG)?

Question:
Which test would you do if you really wanted to know about tubal patency? (i.e. single woman who wants to do Donor sperm)

- HSG?
- SIS?
- Either?

Question:
Other Factors involved in choosing one over another?

- Location? (Within the office vs 30 miles away)
- Cost?
- Iodine allergy?
- Specific Benefits?
  - Tubal assessment?
  - Uterine assessments?

HSG vs. SIS: What do I do?

HSG

- Single or same sex female
- Post-ectopic check
- Post myomectomy check
- History of PID
- Insurance required

SIS

- Plan for IVF
  - Known male factor
  - Known tubal factor
  - PGT
- Low suspicion for tubal factor
  - PCOS
  - Previous spontaneous conception

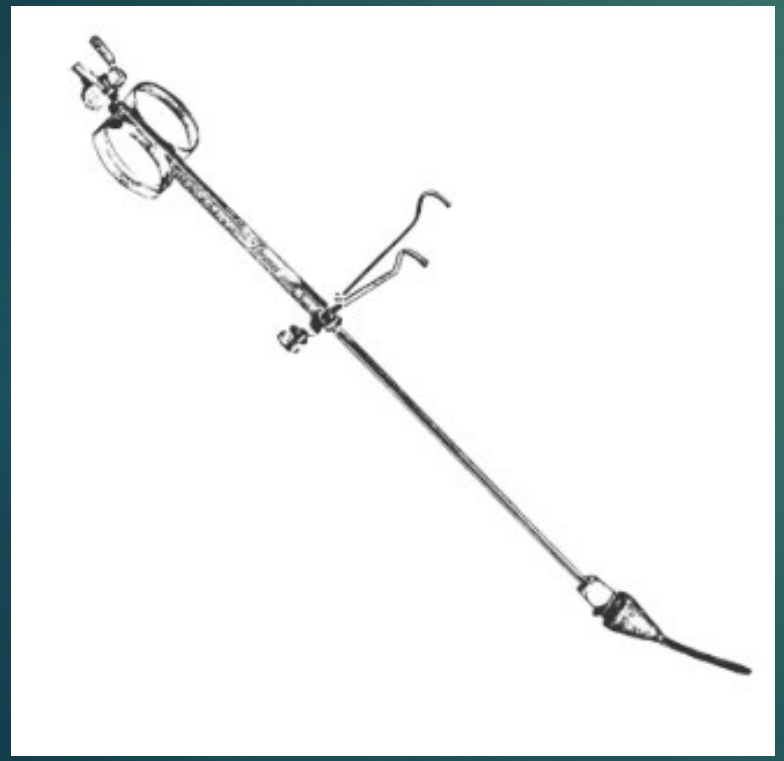
Hysterosalpingogram

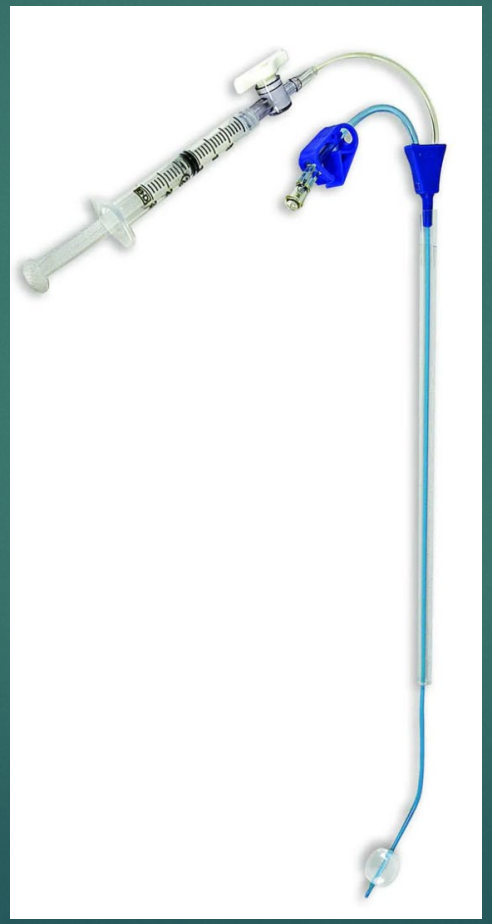
- Prepare the patient: Often they are fearful
  - Empathetic, patience, take time and
  - Vocal Local: talking through it
- Potential Clinical Issues:
  - Vaginismus —
    - Change Speculum size,
    - Pelvic Floor Physical Therapy
    - Anesthesia with HSC?
  - Vaginal discharge: Infection? Cancel and treat
  - Bleeding: OK if spotting but heavy---concern for clot artifact

Cervical problems: TIPS

- Cervix stenosis (External or Internal)
  - External– Plastic "Os Finder" or gentle sound
    - Not working---pre-treat with Estrace or Misoprostal and reschedule HSG or Hysteroscopy with cervical dilation
  - Internal ---Can't place the catheter
    - Os Finder or use Balloon catheter in cervix
- Trouble finding the cervix:
  - Retro? Adjust position of speculum or add fists under the hips or Bimanual exam
  - Flush with vagina: Probe folds with plastic "os finder" Convert to Ultrasound or HSC

Pain Associated with Type of Catheter: Balloon vs Metal Cannula



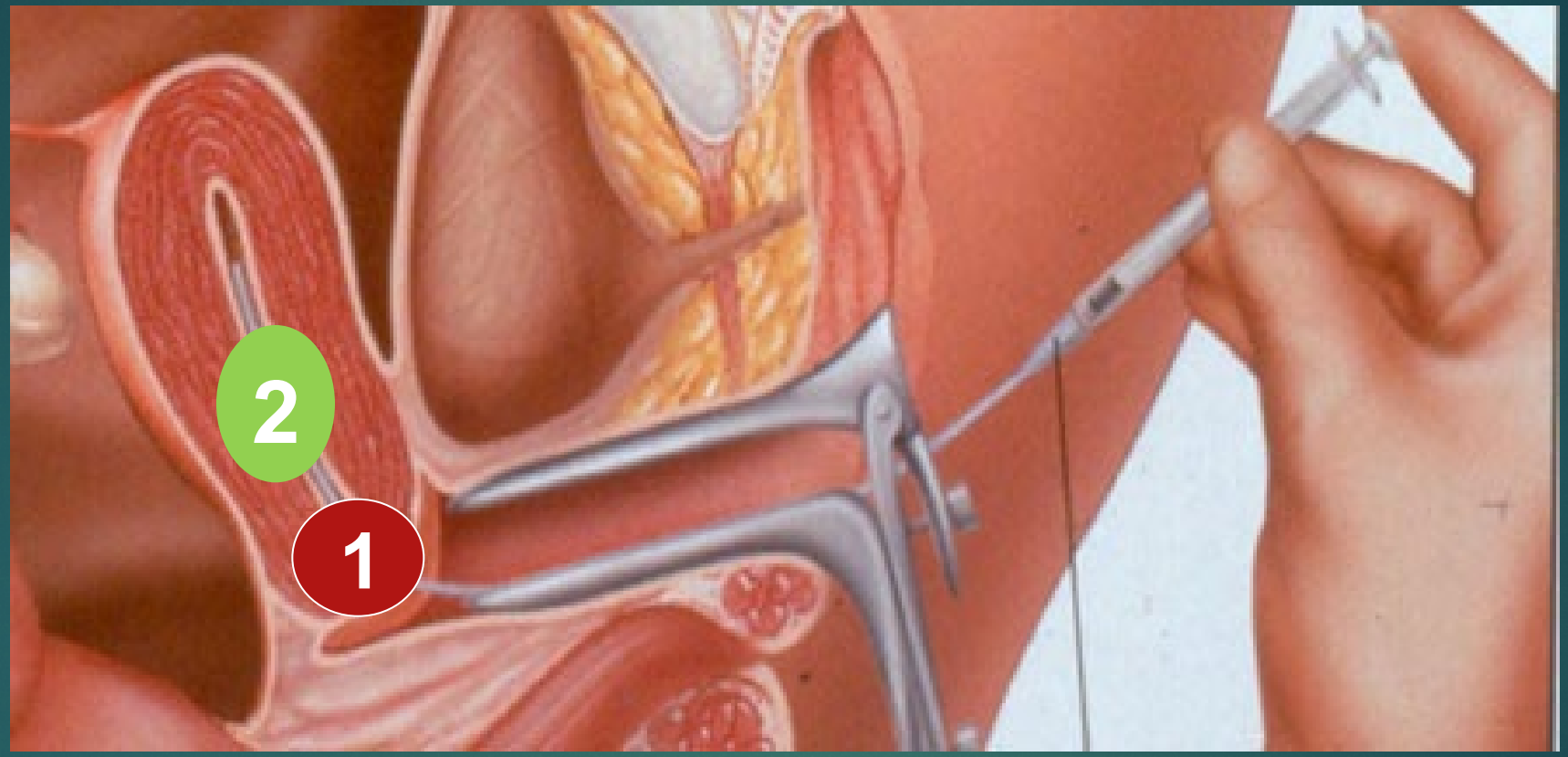


PAIN DURING THE PROCEDURE.

STUDY	MOMENT OF PAIN	BALLOON CATHETER	METAL CANNULA	MD (95%CI)	p
Kiykac Altinbas S[2], 2015	During device placement	*2.11 ± 0.87 (VAS)	*2.51 ± 1.07 (VAS)	−0.4 (−0.69 to -0.10	0.008
	During contrast injection	*2.63 ± 0.93	*3.74 ± 0.91	-1.11 (-1.39 a -0.82)	<0.00001
	1 hour after	*2.13 ± 1.18	*3.07 ± 1.02	−0.94 (−1.27 to −0.60	<0.00001
de Mello JF Sr[3], 2006	Pain during the procedure	4.3 ± ? (VAS)	6.8 ± ? (VAS)	-2.25	<0.05
Tur-Kaspa I[4], 1998	Pain during the procedure	3.8 ± 2 (VAS)	5.6 ± 2 (VAS)	−1.8 (−2.8 to -0.77)	0.0008

*The Wong-Baker Faces Pain Rating Scale (WBS) goes from 0 to 5 - there is an agreement between the facial pain assessment scale and the visual analog score (VAS); ? = not reported; MD = mean difference; CI = confidence interval.

Pain & Catheter Placement



Less pain with intra-cervical than intrauterine w/initial placement. p=0.02
Time was same duration. Volume of distending media less in IC approach

RCT: Pain with SIS Catheter

- 69 subjects SIS with Balloon: 35 w/Intracervical and 34- IU
- Pain: VAS: higher for G0 than multiparous
  - Initial Cervical (1+/-1) lower than IU (2+/-3) ***P=0.02***
  - End Cervical (1+/-3) same as IU (1+/-2) P=0.66
- Volume: Cx 19 +/- 16, Ut 40 +/- 32 ***P=0.001***
- Touching fundus increases pain and vasovagal

Spieldoch et Obstet Gynecol 2008;111:15-21

Comparing HSG Contrasts:

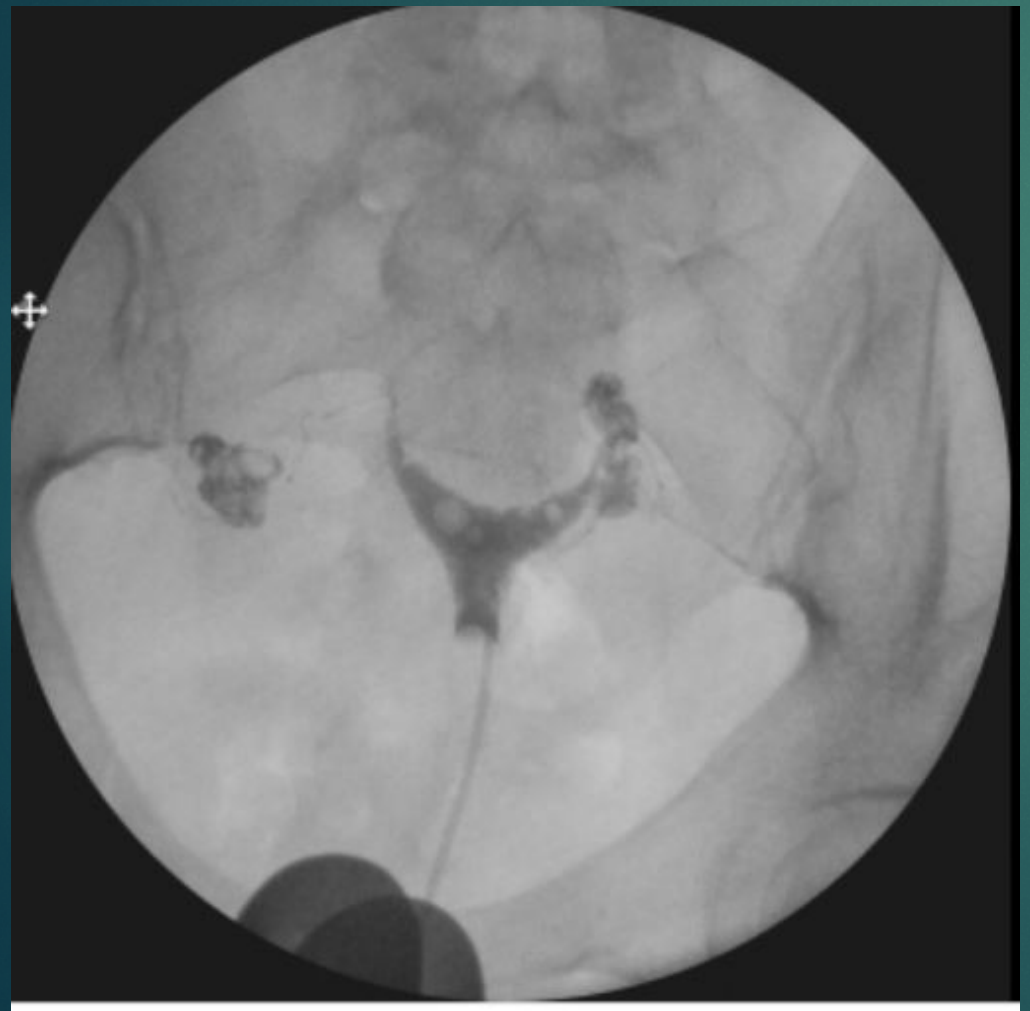
- Oil based contrast
  - Thicker
  - Higher iodine concentration
- Water Based contrast
  - Thinner
  - Absorbed faster

International RCT: H2Oil HSG Study (Oil vs Water based Contrast) on OPR and LBR

- Total 930 infertile women: 465 randomized per group
- Inclusion: >39 years old, Ovulation disorders, or high risk of infection
- Excluded: Iodine allergy, Diabetes, Prolactin or Thyroid disorders, and male factor
- Primary endpoint: On-going pregnancy rate (OPR) and Live Birth Rate (LBR)
- OPR: RR 1.37 with 95% CI (1.16-1.61) $P<0.001$ for Oil
- LBR: RR 1.38 with 95% CI (1.17-1.64) $P<0.001$ for Oil
- 5 year follow up Cumulative PR 80% with oil and 70% with water. RR 1.07 with 95% CI (1.00-1.14)

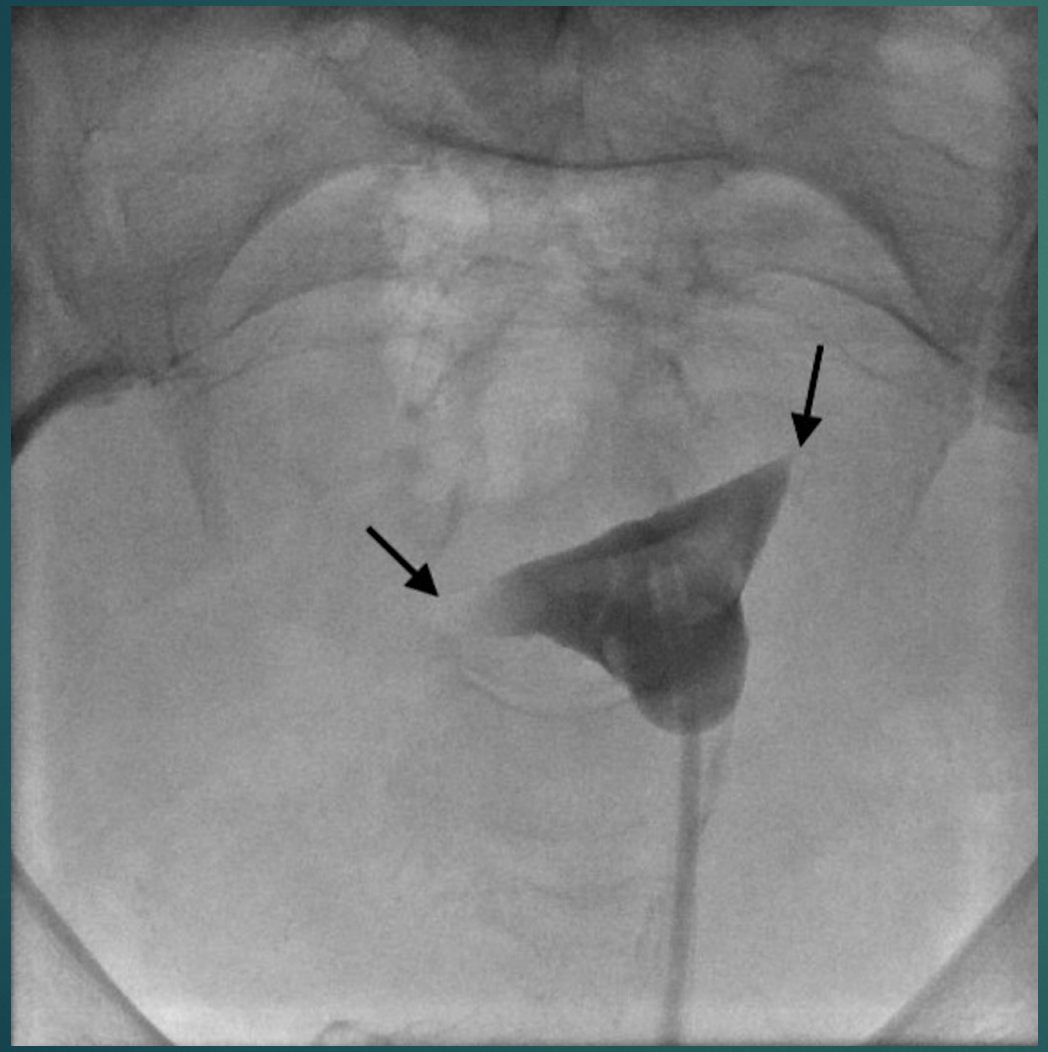
32 yo G0 obese with initial HSG:

Was the catheter Pre-Loaded?



Move the patient, defect moved -Bubbles

27 yo with 2 years infertility:



Proximal Occlusion or False Positive?

HSG Accuracy

- Sensitivity 65%
- Specificity 83%

- False positive rate 60%
- False negative rate 5%

- False positive:
  - Spasm most common
  - Plugging by amorphous material

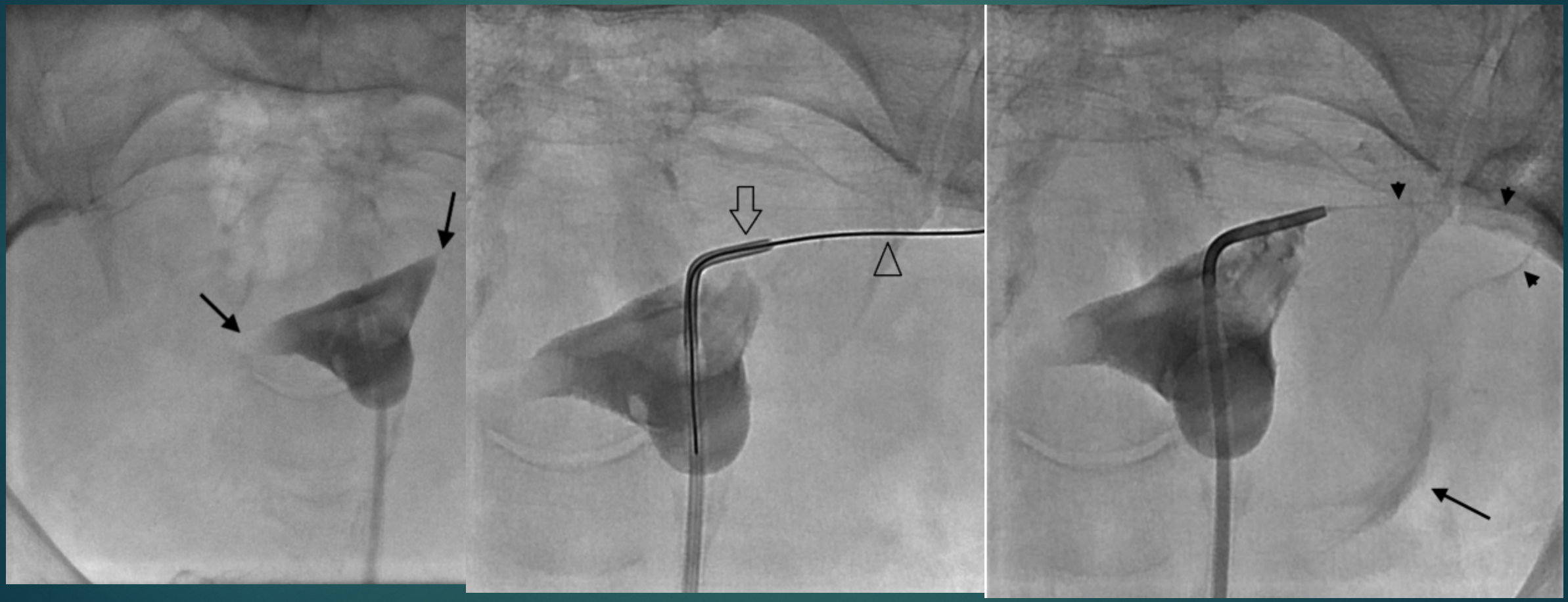
- What to do?

RCT: Double blind Control Trial of pretreatment vs placebo for HSG

- 146 subjects with Infertility
- Treatment: 20 mg HBB (Hycosine-N-Butylbromide; aka Scopolamine butylbromide)—an anticholinergic blocking transmission of neural impulse in parasympathetic ganglia
- Identify proximal occlusion then repeat HSG or do LSC
- Results:
  - HBB 6/70 (8.6%) proximal occlusion
  - Placebo 16/71 (22.5%) proximal occlusion
  - Repeat HSG and number remaining occluded:
    - HBB still had 1/6 and Placebo had 9 of 16 remain occluded

CONCLUSION: Pretreatment may be helpful to reduce false positive Proximal tubal occlusion

Special HSG Technique: Re-canulation of tubes if Proximal Tube Obstruction



Mody P, Salazar G and Kohi MP. Seminars in Interventional Radiology 2023; 40(2):379-383

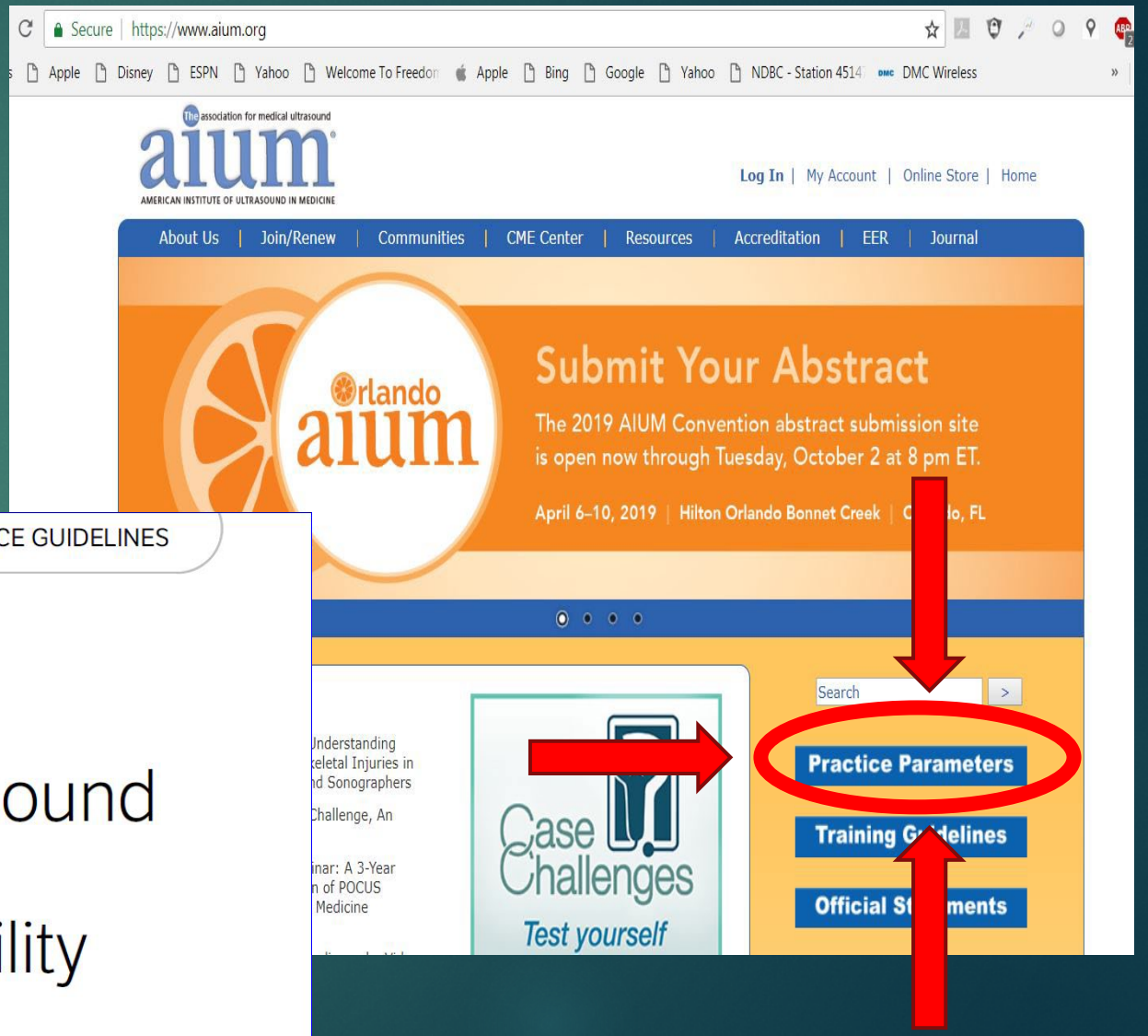
Saline Infusion Sonohysterogram

Baseline ultrasound

- Start with a baseline ultrasound is important:
  - Evaluate the anatomy
  - Use ultrasound as DYNAMIC test
  - Any contra-indications?
  - Any thing that could be done to make the procedure more comfortable?

REI Ultrasound Parameters: (www.aium.org)

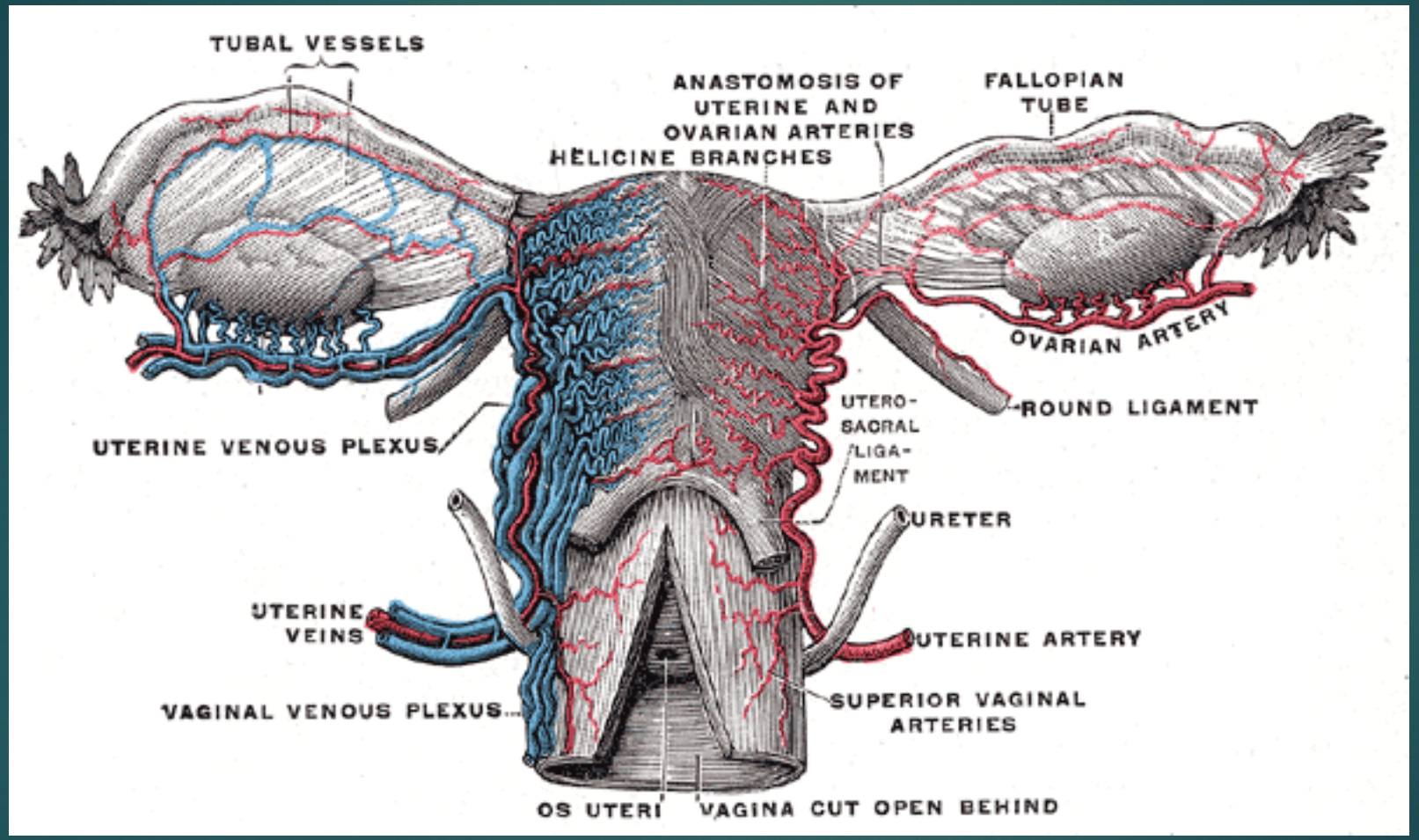
- "Focused REI"—In Revision
- Best place is to look at AIUM website for the resources: free!
- Residents/Fellows $30/year membership



PRACTICE GUIDELINES

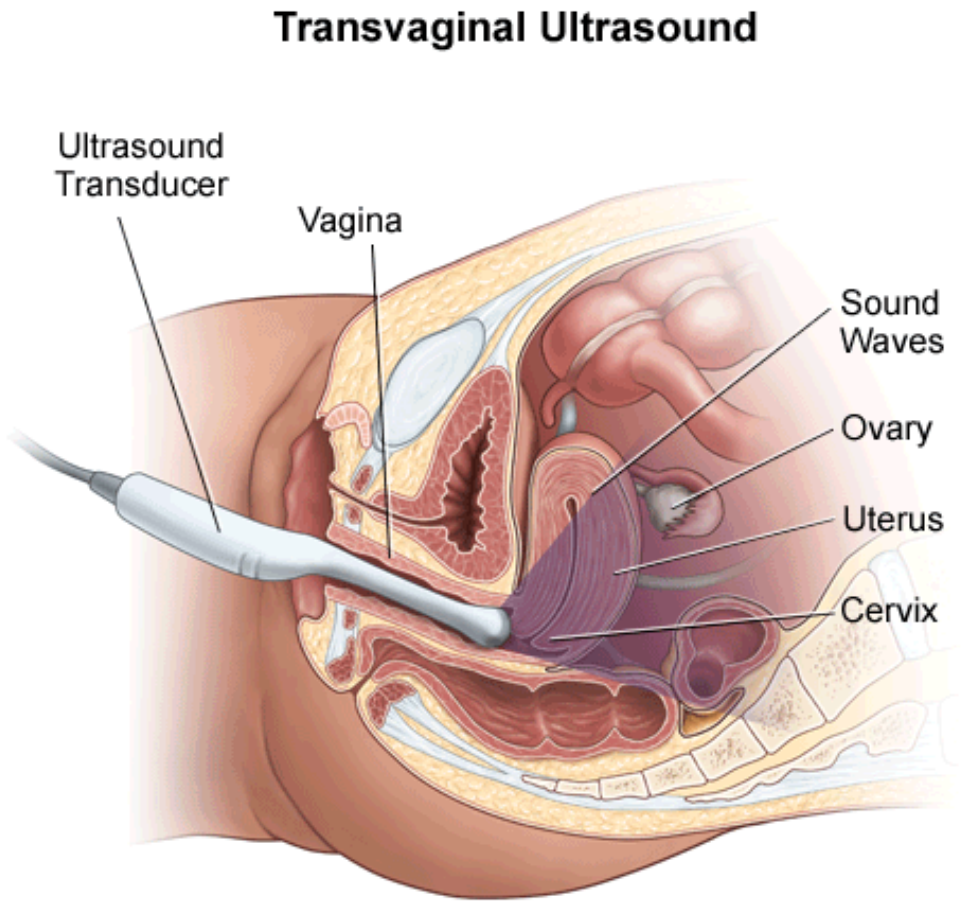
AIUM Practice Parameter for the Performance of a Focused Ultrasound Examination in Reproductive Endocrinology and Female Infertility

Think Anatomy and Look with Ultrasound



- Ludwin A, Ludwin I, Martins W. Venous intravasation during evaluation of tubal patency by ultrasound contrast imaging. . Ultrasound Obstet Gynecol 2018;51:143-45

Pelvic ultrasound:
Start w/ Transvaginal Sonography (TVS)

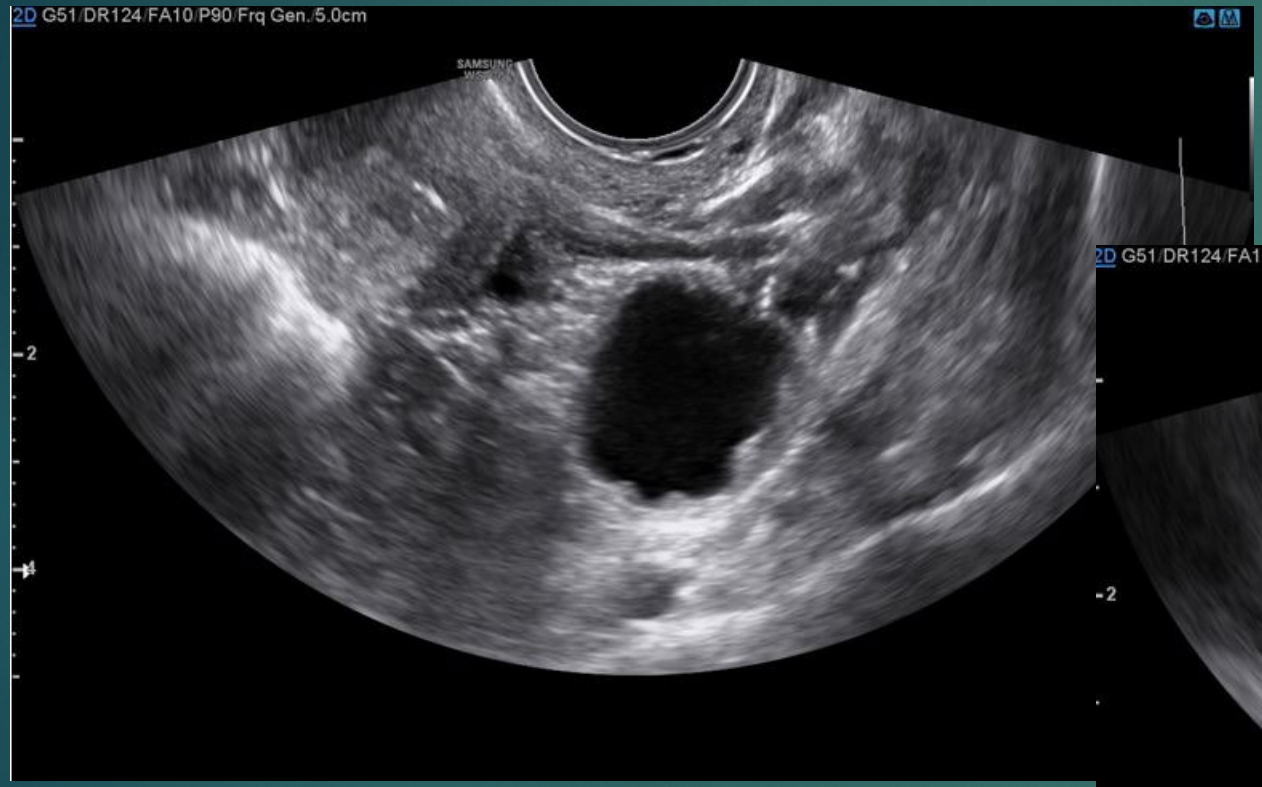


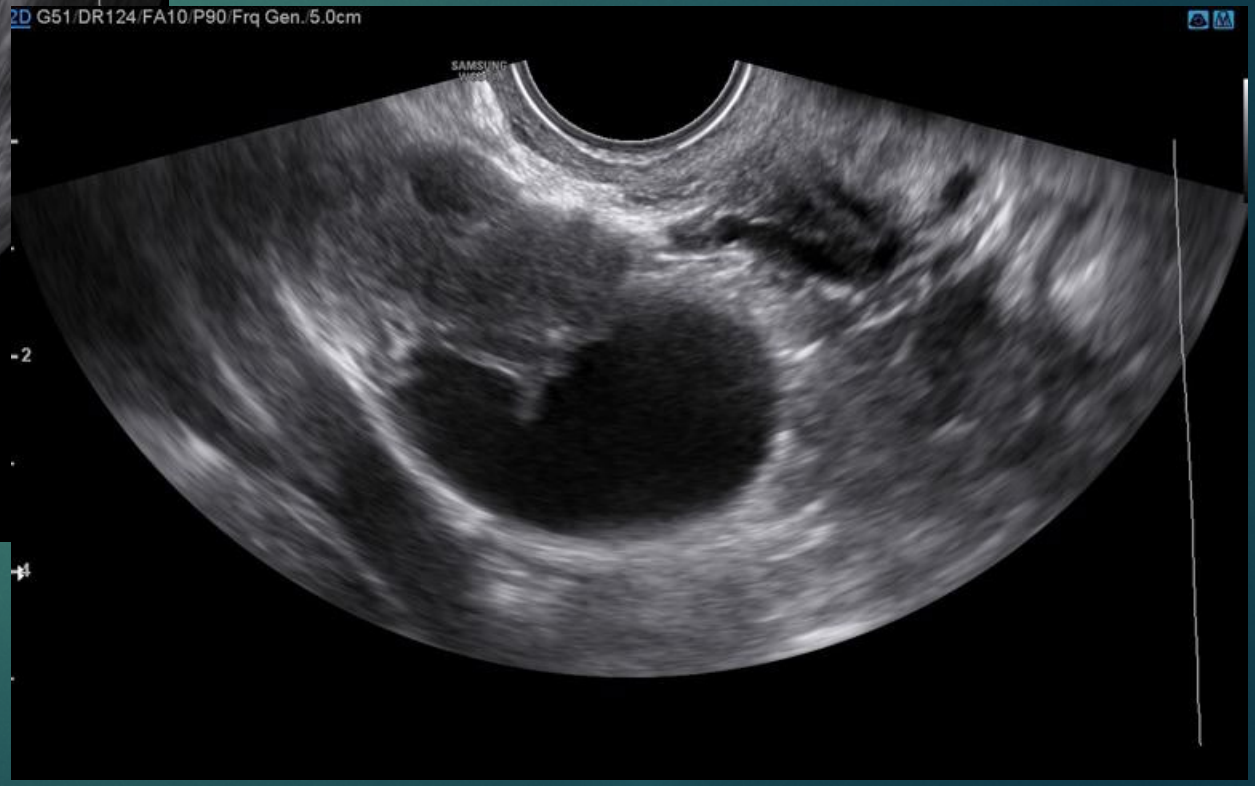
www.hopkinsmedicine.org/health/treatment-tests-and-therapies/pelvic-ultrasound

Key Points:

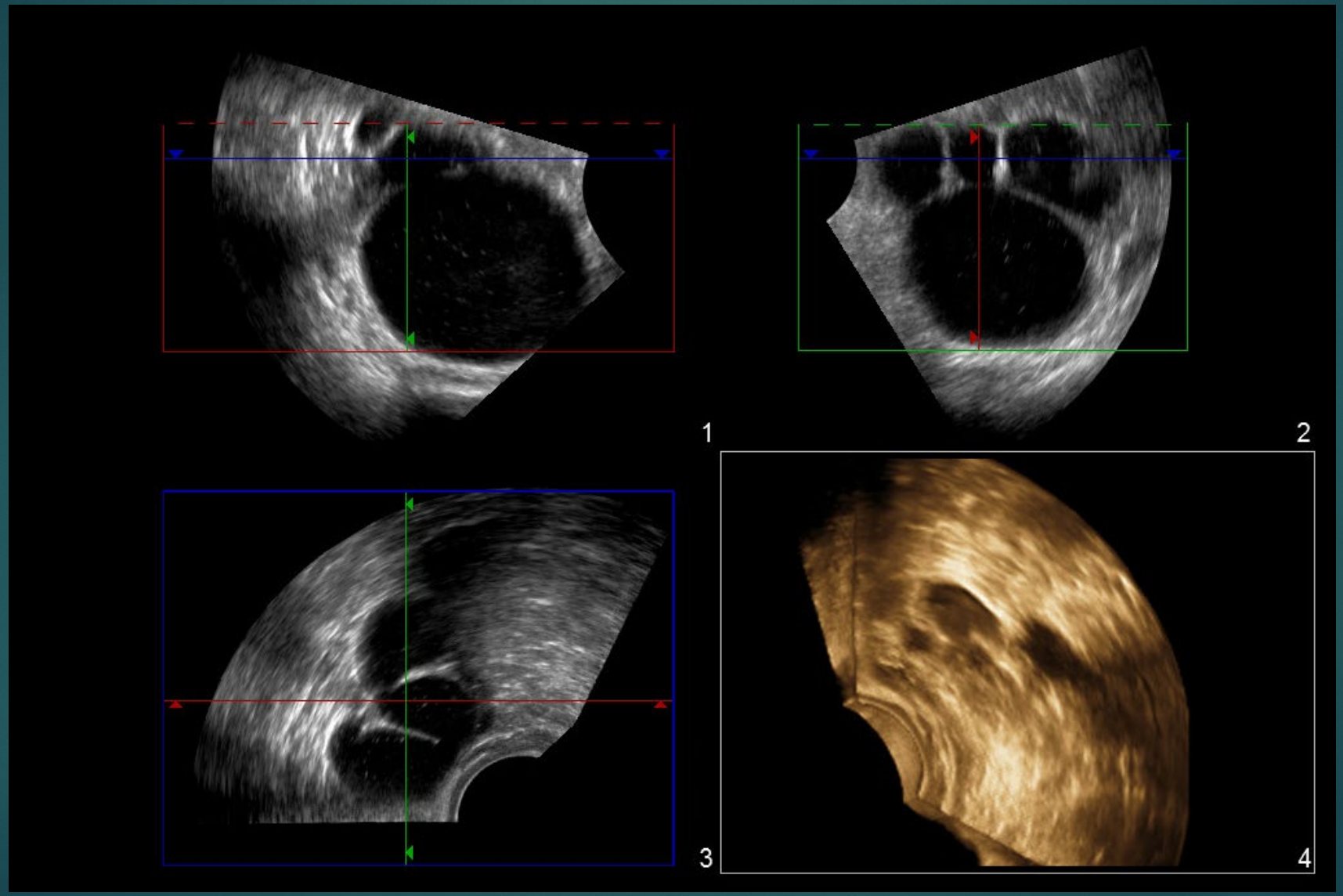
- Uterine
  - Orientation: Look at cervix and uterus
    - Right or left
    - Anteverted or Retroverted
  - Masses: distortions of myometrium or endometrium (and EM thickness)
- Adnexa: Tender? Mass: Ovarian or tubal?
- Prep: antibiotic, NSAID, or change speculum size or type

28 yo G0 with 5 years of Infertility and baseline ultrasound:





Multiple cysts or stacked—think tube



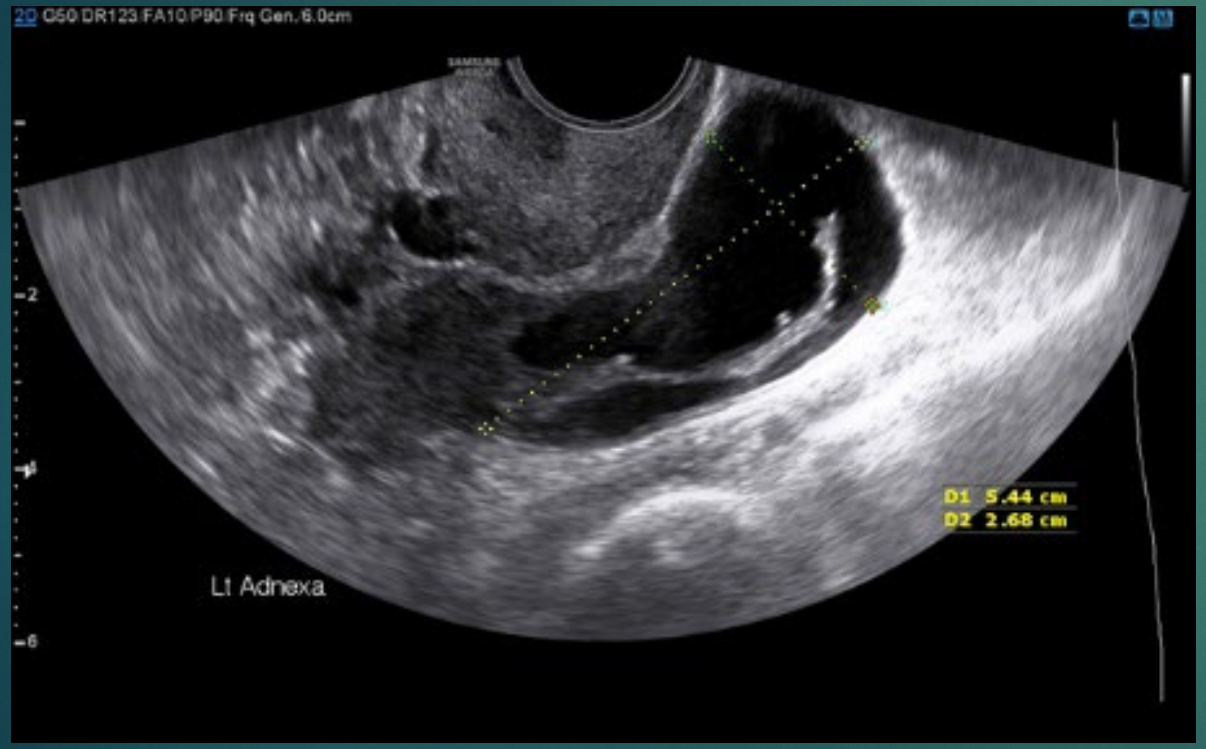
Antibiotics?

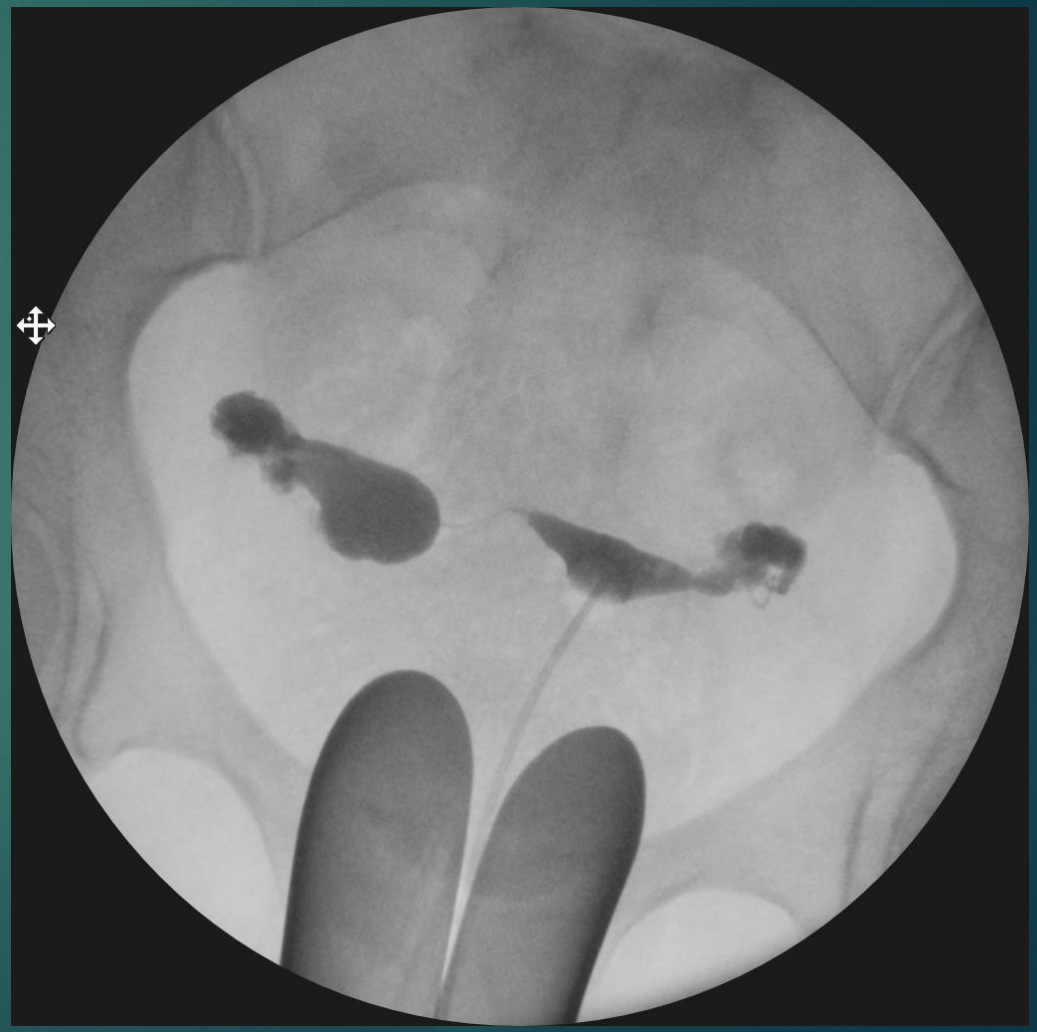
- HSG or SIS in general no Antibiotic indicated
- Infection rate <0.5%-2%
- Infectious complications reported for both HSG and SIS:
  - PID: 50% if active Chlamydia; 11 % if dilated tubes on HSG
  - One study showed 9/1100 endometritis for SIS
  - Post procedure report of TOA for both SIS and HSG--rare
- However: ANTIBIOTIC Prophylactic recommended:
  - History of PID
  - Hydrosalpinx suspected
  - ?Endometriosis?
  - Re-schedule if active infection

Pereira N et al. J Pathogens 2016; 1-8. doi: 10.1155/2016/4698314

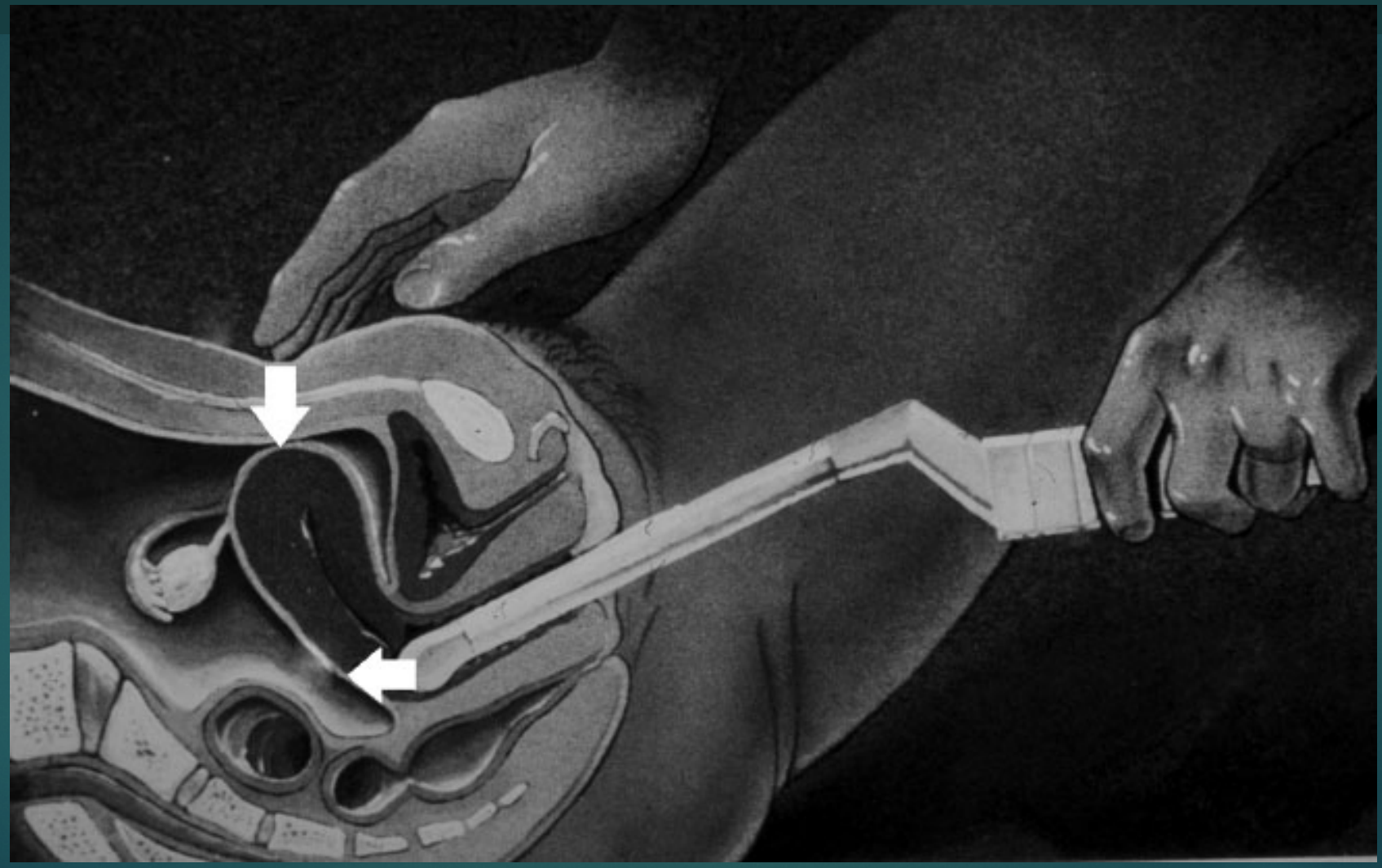
Kishkovich TP et al. Minerva Obstet Gynecol 2023;75(1):80-84

Identify During procedure, treat with an antibiotic





Sliding Organ Sign: Bimanual exam



Uterine Sliding Sign

Courtesy of Jim Shwayder, M.D.

Sliding Organ Sign: Abnormal (=Negative)

Courtesy of Jim Shwayder, M.D.

Sliding Organ:

Sliding Organ Sign: Ovary (Normal, Positive sliding)

Courtesy of Jim Shwayder, M.D.

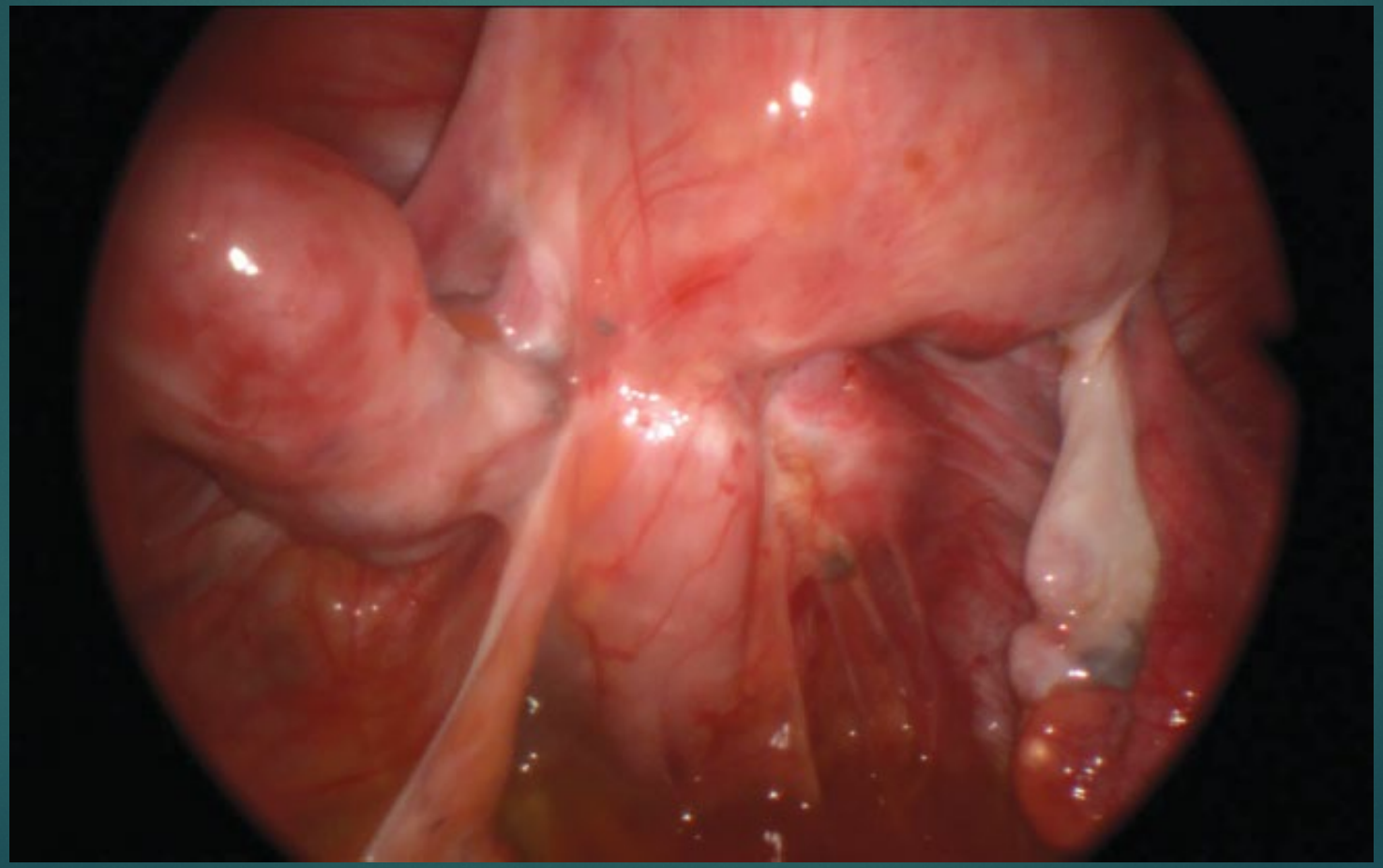
Sliding Organ Sign: Negative (no sliding)

Uterine sliding sign: Negative (no sliding) is Associated with Obliteration of POD

Author	#	Sensitivity %	Specificity %	PPV %	NPV %	Accuracy %
Hudelist et al.	117	85	96	91	94	93.1
Reid et al.	100	83.3	97.1	92.6	93.2	93.0

Hudelist et al. Ultrasound Obstet Gynecol 2013;41:692-695.
Reid et al. Ultrasound Obstet Gynecol 2013;41:685-691.

Negative Sliding Organ Sign with Laparoscopy: Obliteration of Pouch of Douglas



Reid et al. Ultrasound Obstet Gynecol 2013;41:685-691

Sliding organ sign

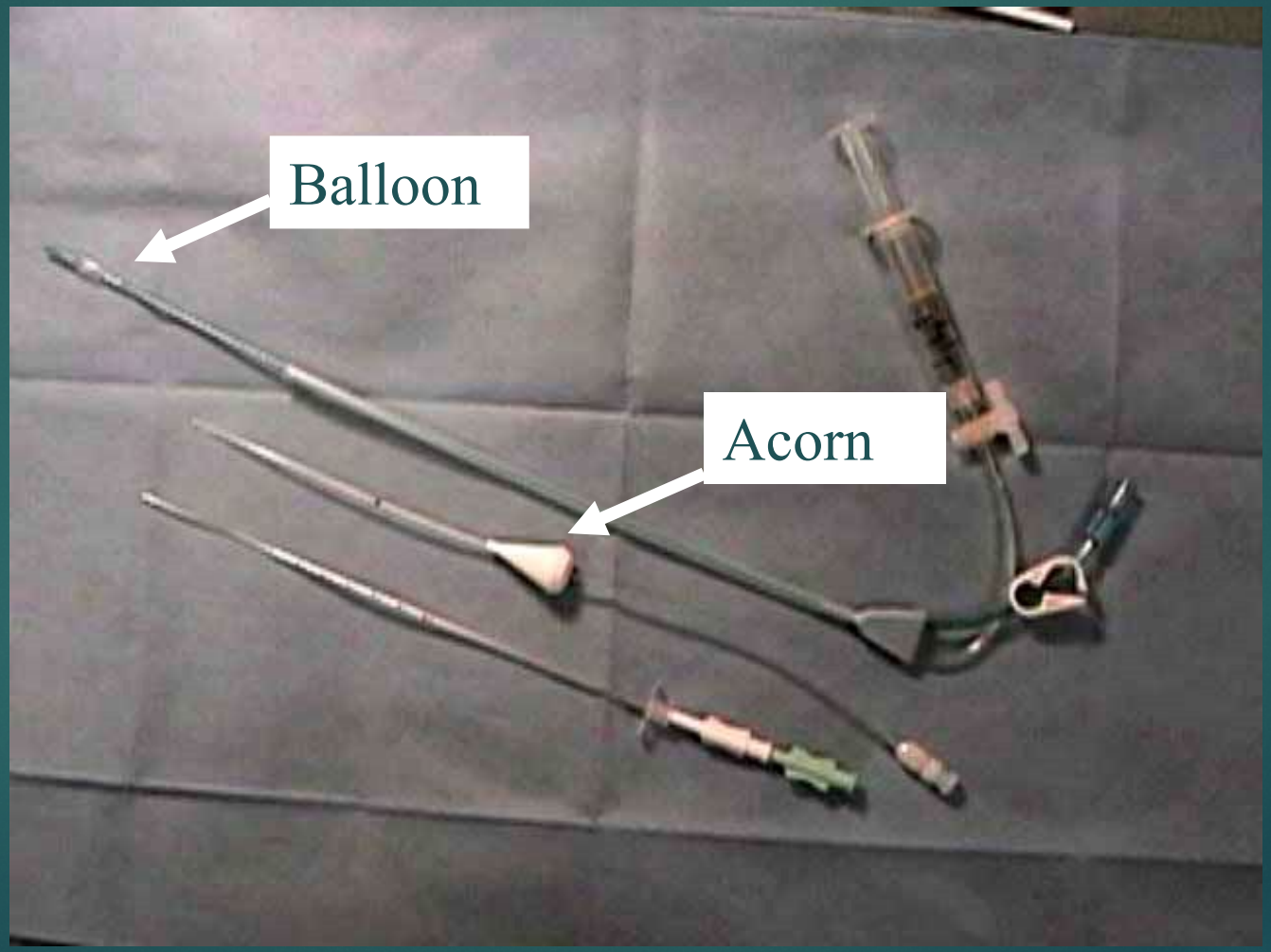
- Easy to do
- Lack of “sliding” is associated with adhesions and obliteration of POD
- Tenderness is also often associated with “no sliding” (NEGATIVE sliding sign)
- This technique is also great to see if an adnexal mass is part of the ovary or in the tube (i.e. ectopic pregnancy)

Saline Infusion Sonohysterogram (SIS):

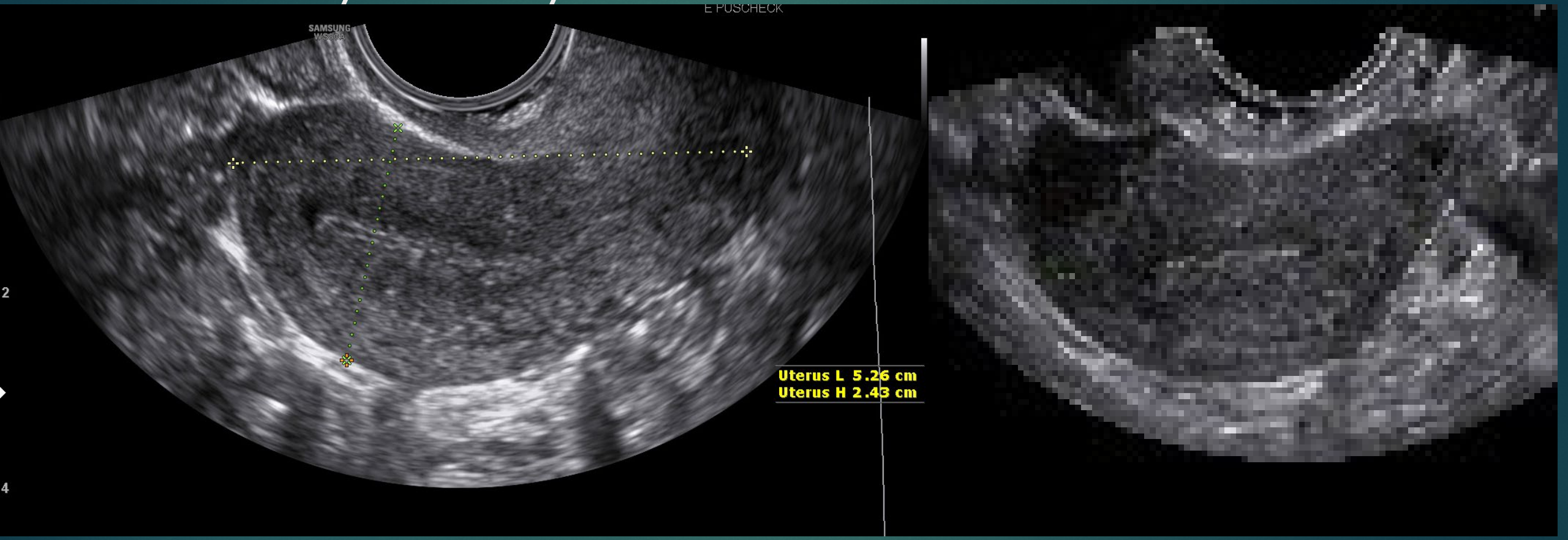
- Baseline Ultrasound:
  - Screen for congenital anomalies
  - Screen for fibroids and adenomyosis
  - Screen for adnexal masses
  - Evaluate the endometrium
  - Evaluate for cornual **tenderness**
  - Screen for uterine positioning

- Time in the early in the cycle (CD 5-12)

SIS Catheters



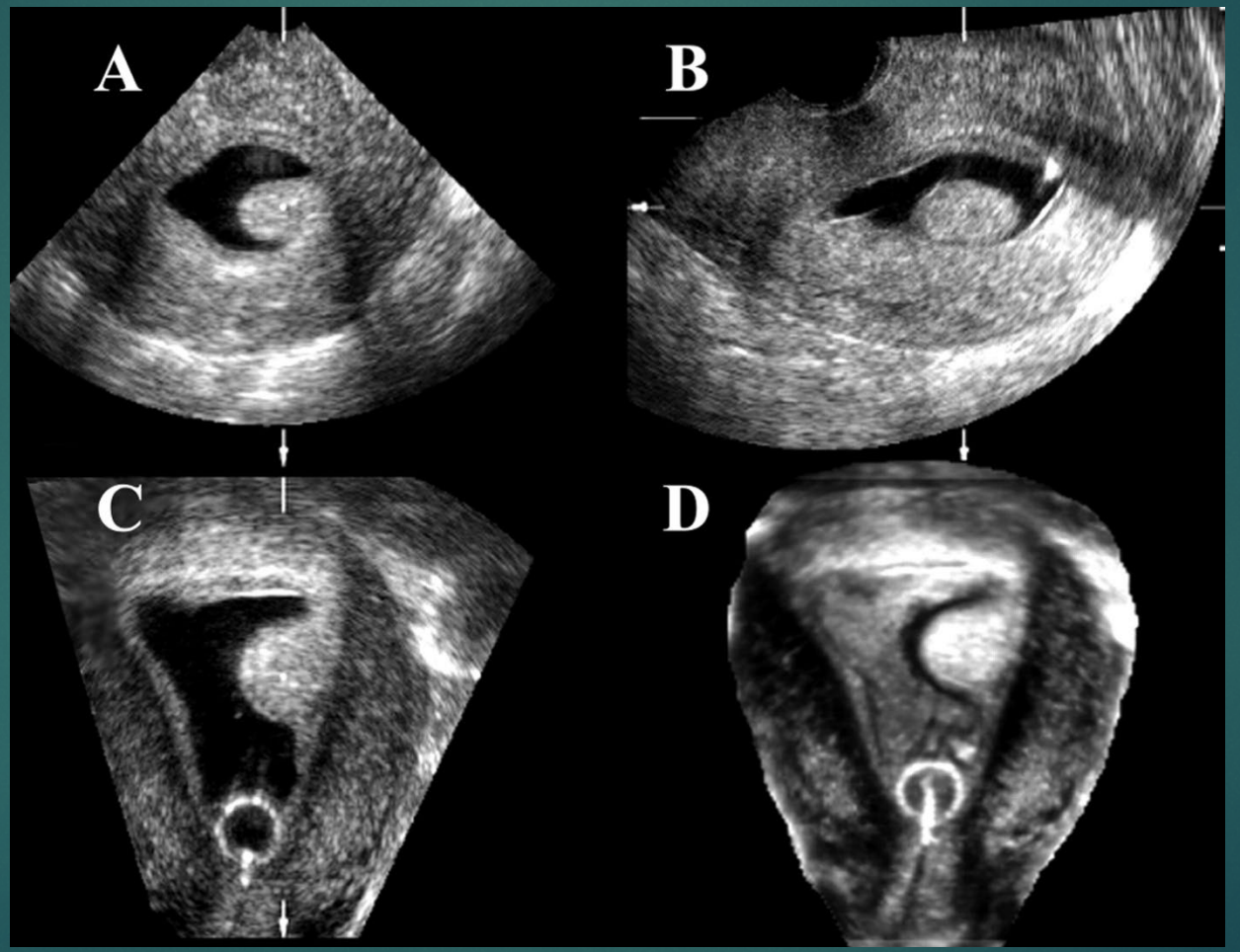
35 yo G3P0030 presenting with infertility for 3 years



Baseline Ultrasound on cycle day 3

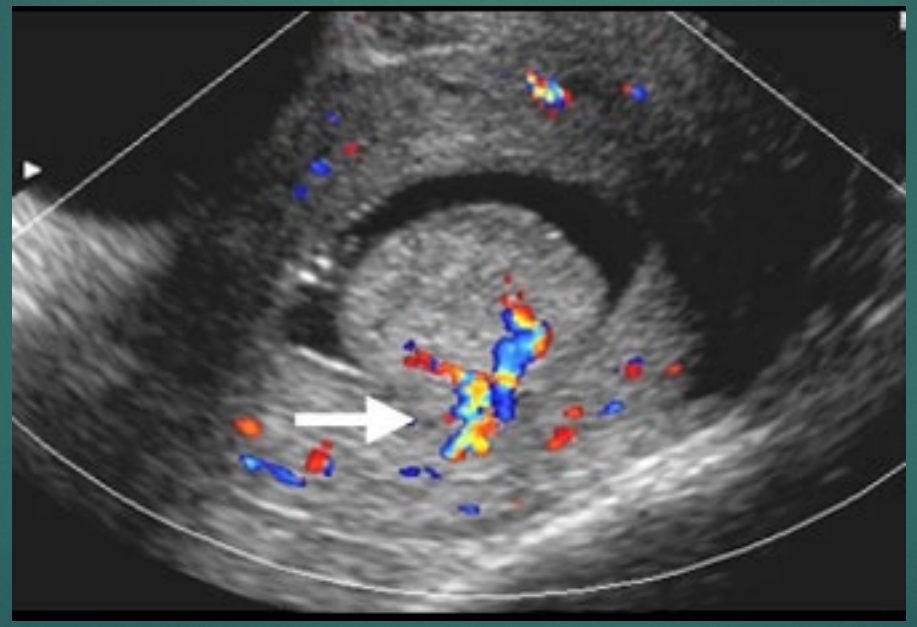

51487
Gyn EV
3D9-3v
50 Hz
9.0cm
2D
Gen
Gn 50
56
1/2/4
51487
Invia Fertility
10:14:25 AM
3D9-3v
Review
10.0cm
13:27 AM

SIS with 3D

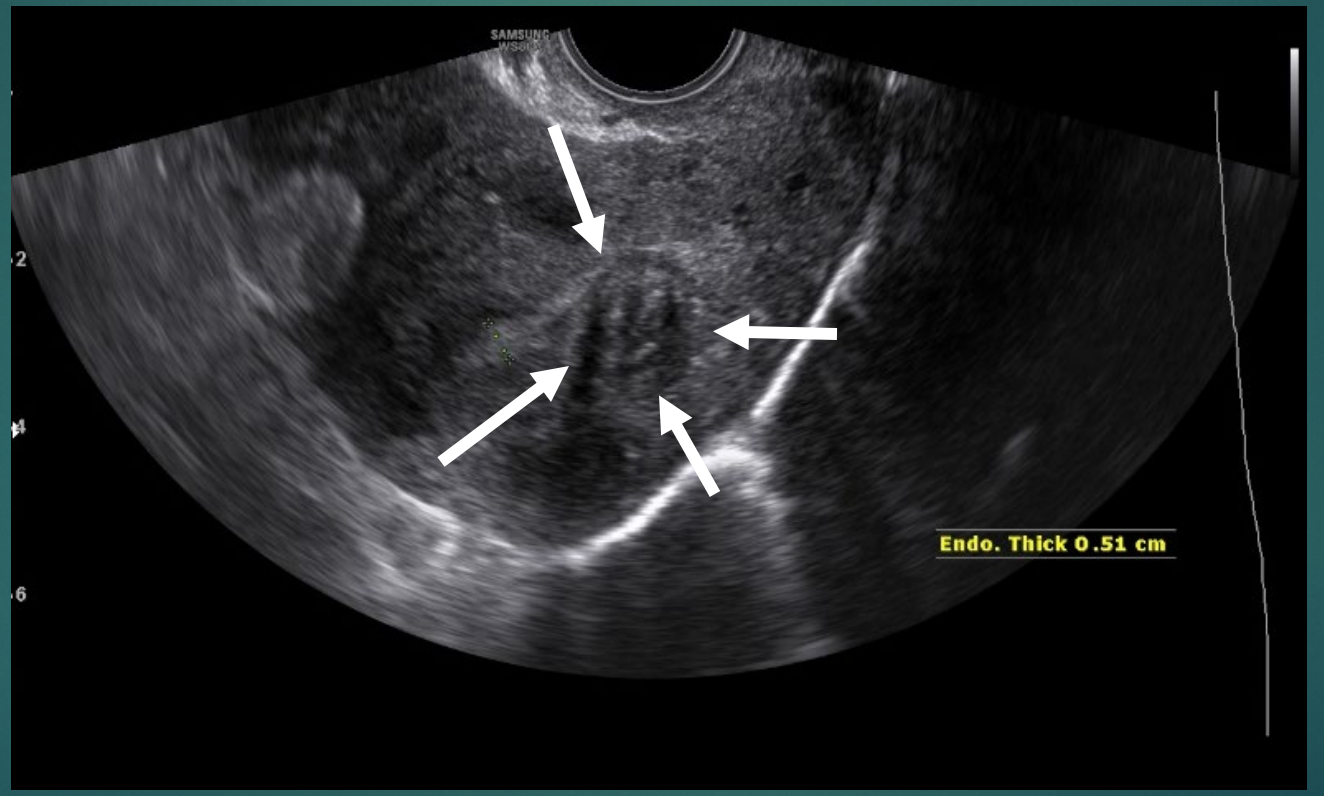


Bega et al JUM 22(11):1249

SIS with Doppler



Baseline US: Uterus



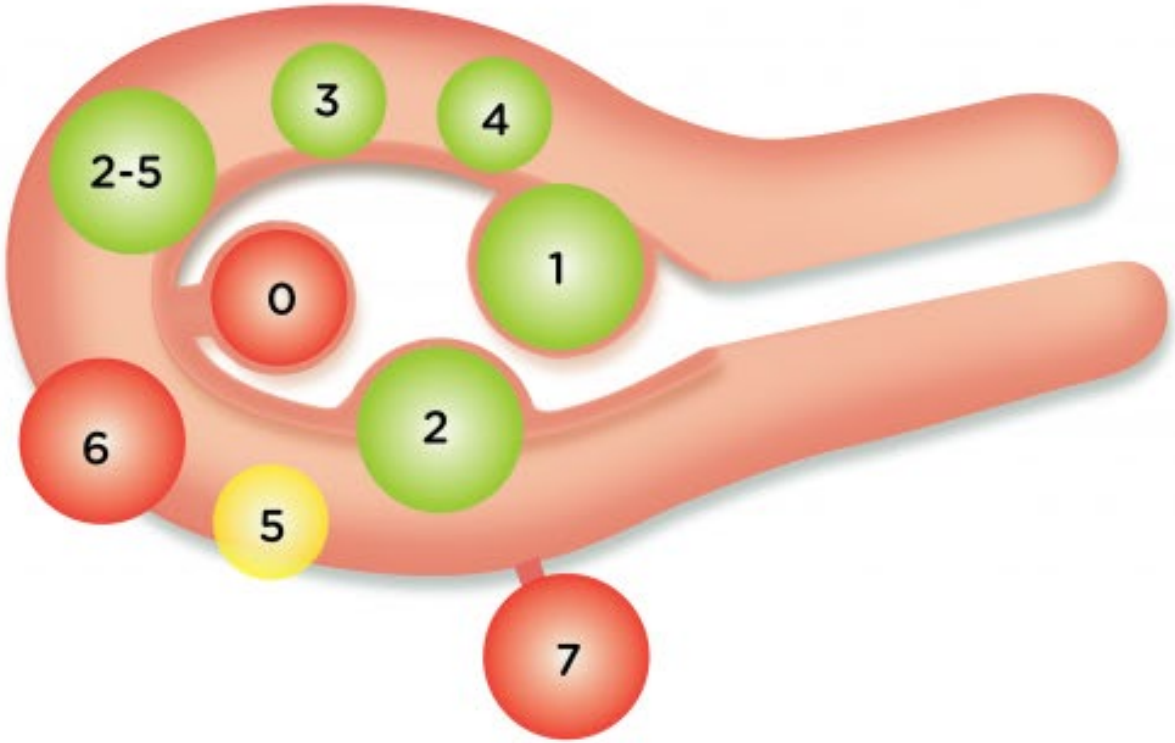
Fibroid impacting the endometrium

Fibroid Subclassification System

Submucosal	0	Pedunculated intracavity
	1	<50% Intramural
Intramural	2	≥50% Intramural
	3	Contacts endometrium; 100% intramural
	4	Intramural
	5	Subserosal ≥50% Intramural
Subserosal	6	Subserosal <50% Intramural
	7	Subserosal Pedunculated
	8	Other (specify eg. cervical, parasitic

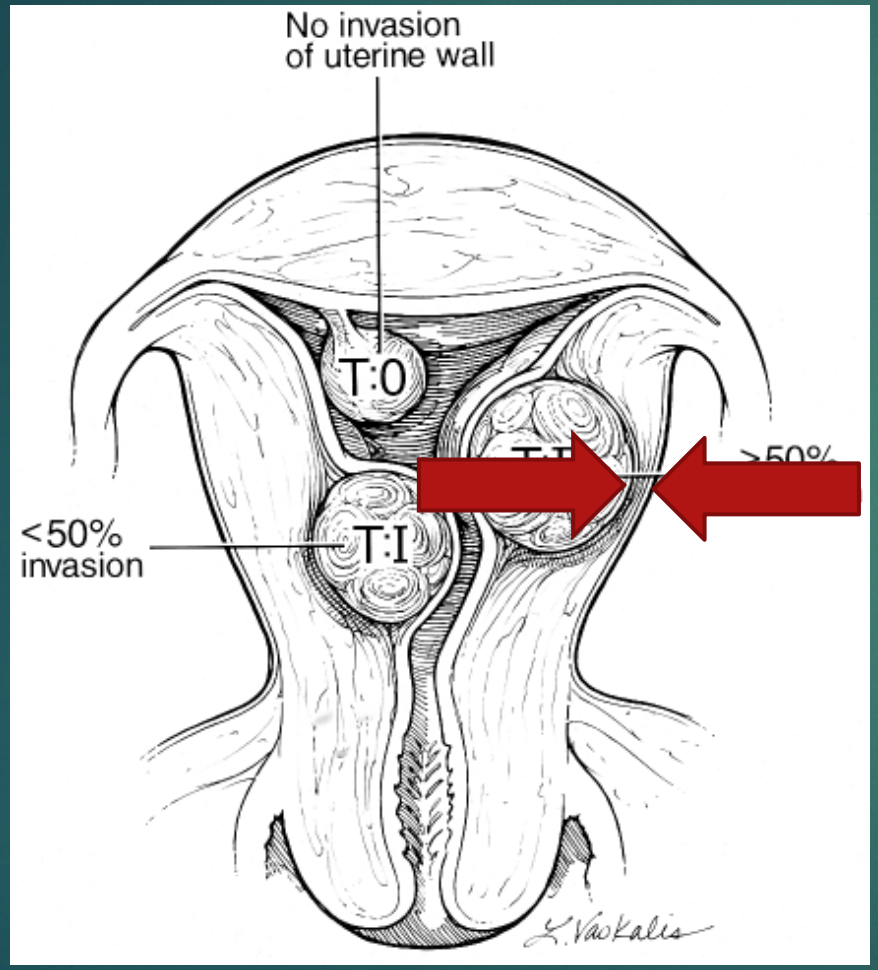
Two numbers are listed separated by a dash. By convention, the first refers to the relationship with the endrometrium while the second refers to the relationship to the serosa. One example is below.

2-5	Submucosal and subserosal, each with less than half the diameter in the endometrial and peritoneal cavities respectively.



Source: Munro, M et al. Int Gynaecol Obstet. 2011 Apr; 113 (1):3-13

Fibroid Location & Fertility



Cohen L, Valle R. Fertil Steril 2000;73; 197-204

Consider:
Measure the outer fibroid surface to the serosal borders for type I and II submucosal fibroids.


65617
Invia Fertility
TIS 0.2
2:10:50 A
P
4
G
P
R
3.0 9.0
Invia Fertility
TIS 0.2
2:10:26 AM
P
+ Length 2.23 cm
× Length 1.57 cm
Length 0.543 cm
8.0

SIS: Determine Tubal Patency?

- No initial fluid and then Positive Post-procedure Fluid in Pouch of Douglas
- Color Doppler or Power Doppler (2D vs 3D)
- Contrast material
  - Agitated Saline
  - Optison (off label use)
  - Echovist (off label use)

Spalding et al Hum Reprod 1997;12:306-9;

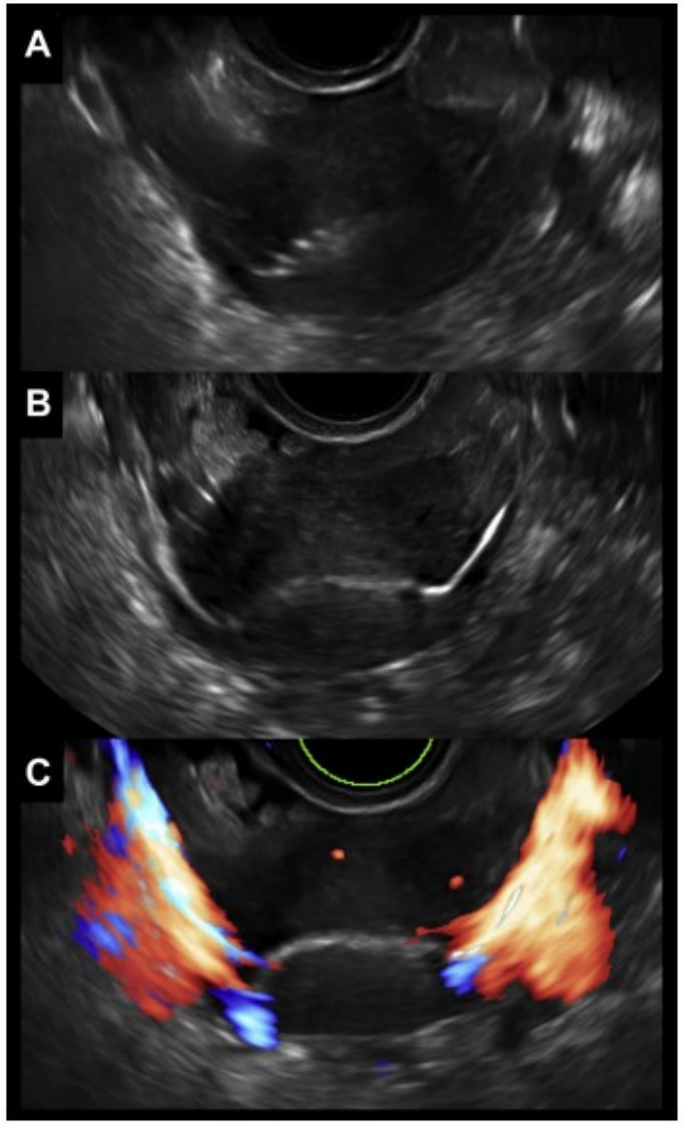
Fleischer et al J Ultrasound Med 1997;16:381-4

- HyCoSy: Hysterosalpingo-contrast
- Off FDA label contrast: Optison and Echovist—Expensive and short acting so not used

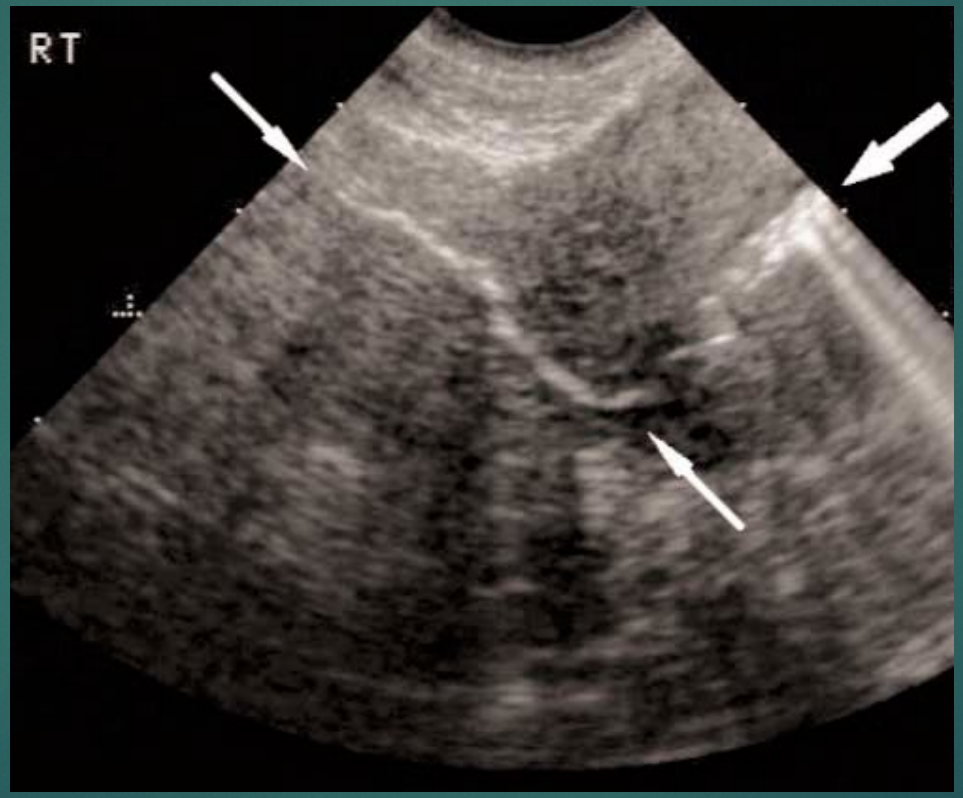
- A. Agitated Saline
- B. Foam (FDA Approved 2019)
- C. Doppler
- D. MR-HSG

Fig. 2

(A) Hysterosalpingo-contrast sonography, **(B)** hysterosalpingo-foam sonography, and **(C)** Doppler hysterosalpingo-foam sonography in 2-dimensional imaging (cross-section of uterus) in women with 2 patent tubes.



Air Contrast for Tubal Patency

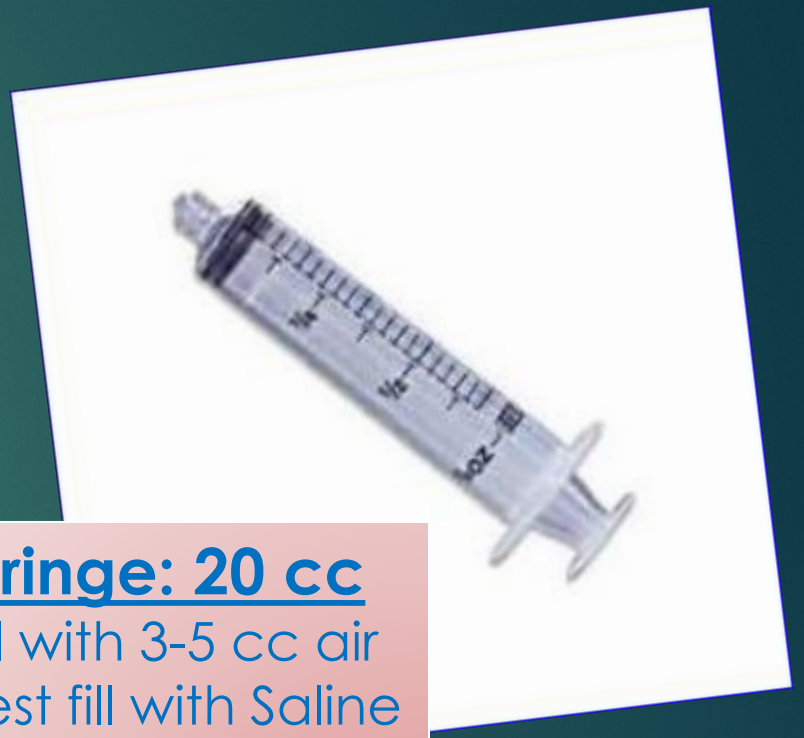


Jeanty et al JUM 2000;19:519-27

Femvue vs Agitated Saline Technique

Femvue Device

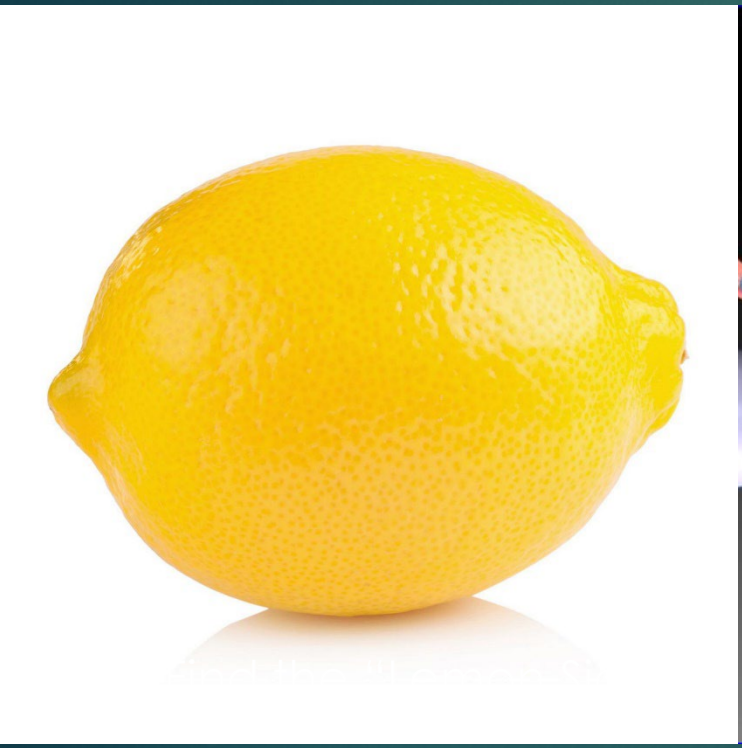
- 2 syringes:
  One with air
  One with saline
- Inject both concurrently

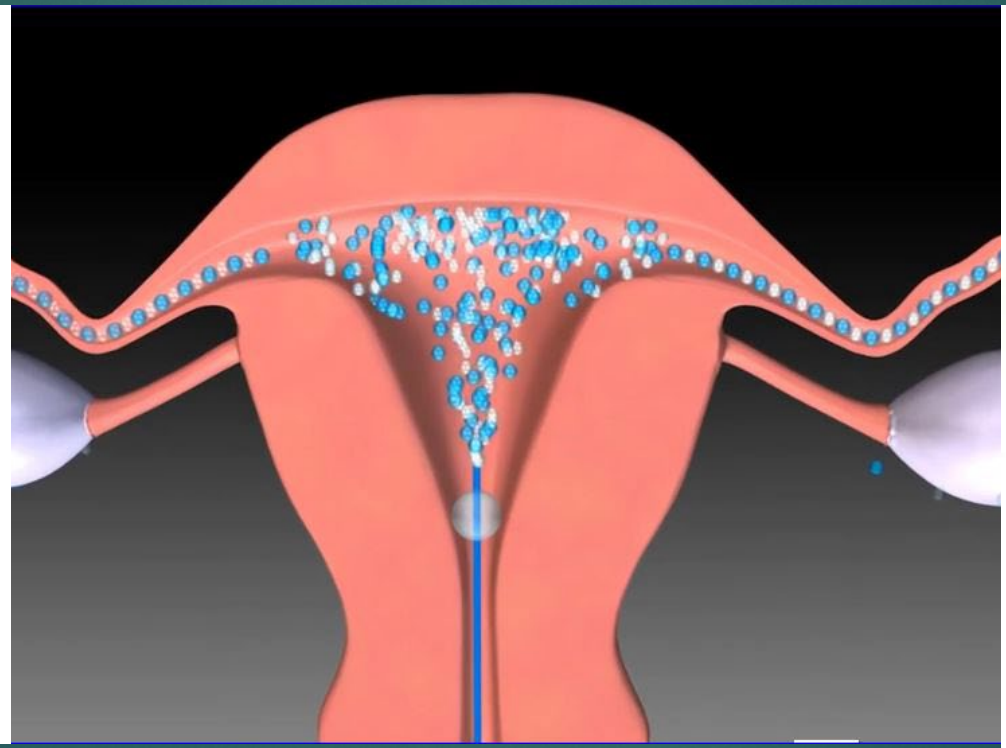


Syringe: 20 cc

- Fill with 3-5 cc air
- Rest fill with Saline
- Shake
- Inject fluid while scanning

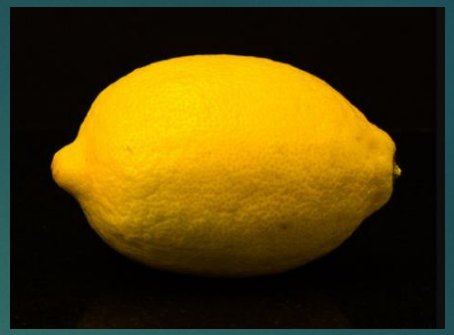
Key to Success in SIS Fluid and Bubbles:





Critical: Uterine orientation

Patent Tubes By SIS



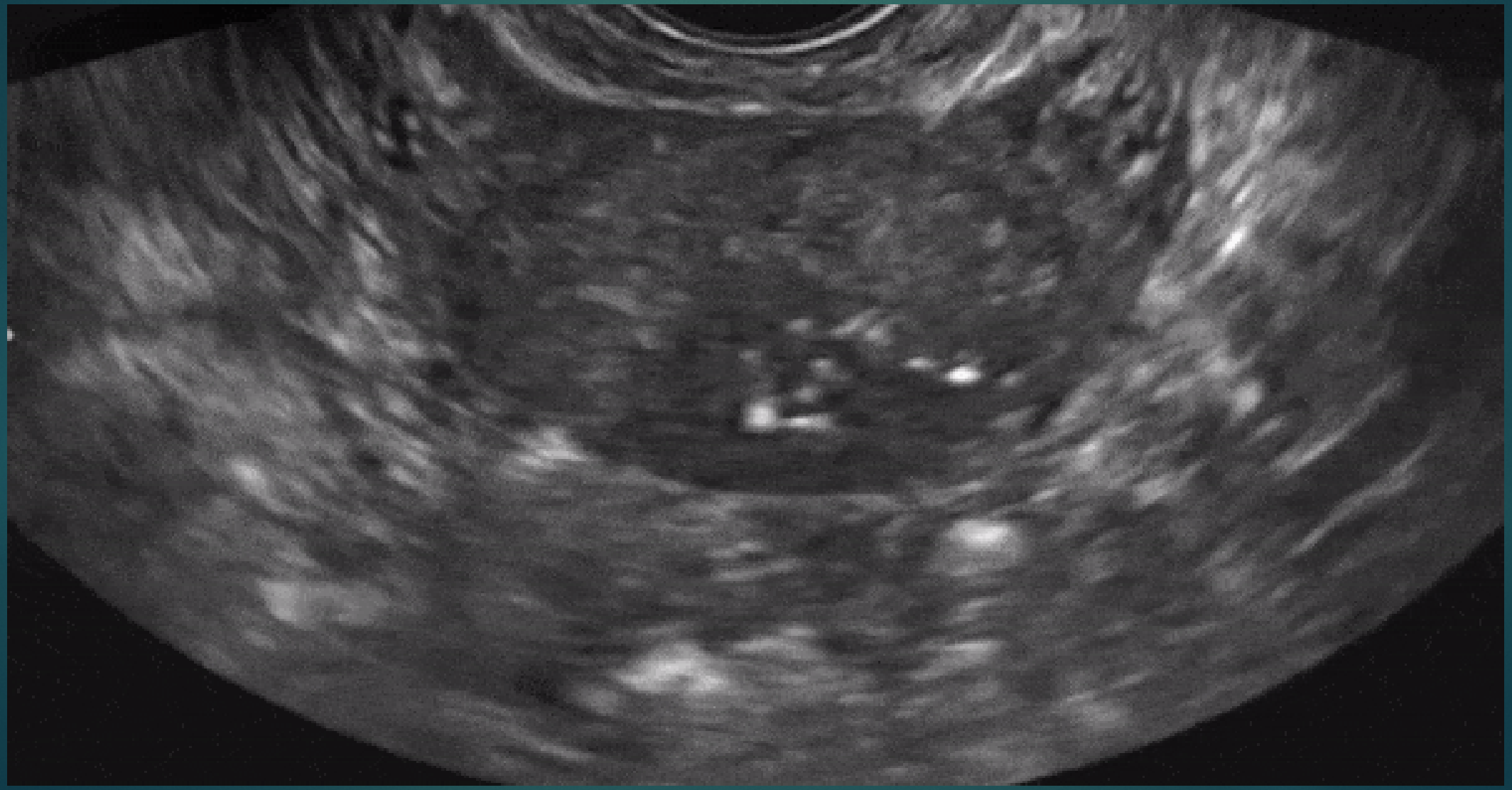
- The transducer needs to be in the right plane to see the cornua well. (Look for the "lemon" shape)
  - Transverse near the fundus and look for cornua
- Bubbles exit the proximal tube via the cornua.
- Free fluid accumulates around the ipsilateral ovary or in the cul de sac
- Only call it patent if you are sure.

  (Otherwise, indeterminant)

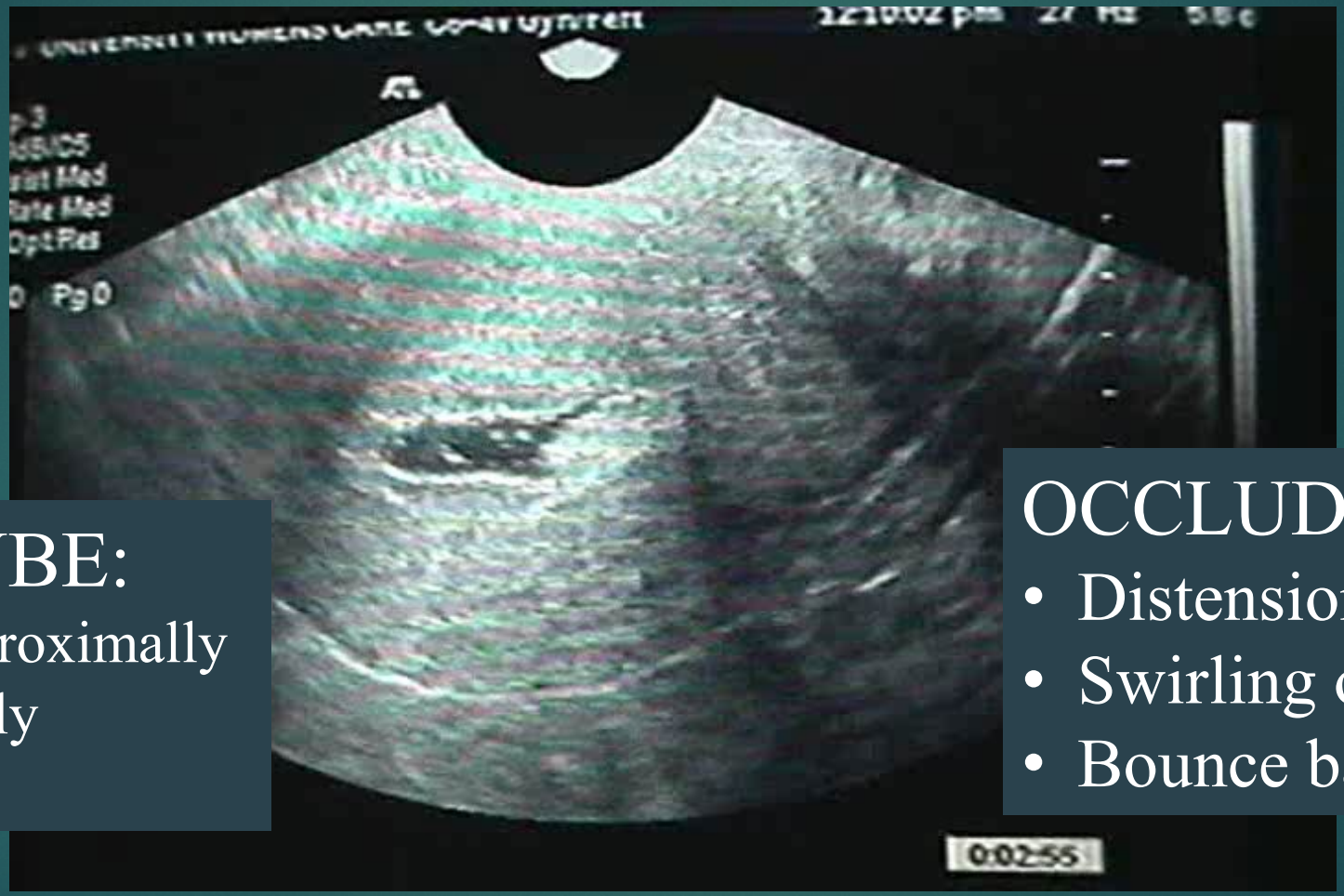
If blocked, one will see stretching of the cornua and/or swirling of the bubbles

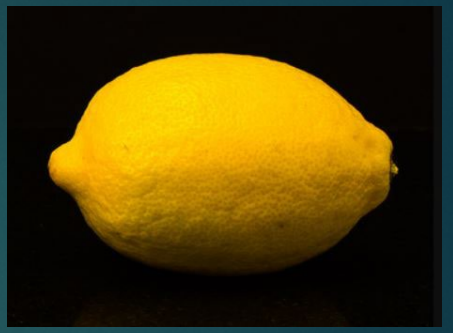
Training:

https://hcp.femvue.com/hcp/index



One Patent, One Not





PATENT TUBE:

- Bubbles exit proximally
- Bubbles distally
- Free fluid

OCCLUDED TUBE:

- Distension of the cornua
- Swirling of bubbles
- Bounce back

Tubes: Not Patent: Spasm, Occlusion, or Uncertain?

- Cornua distends, stretches and contracts
- Bubbles have erratic flow or swirl
- "Bounce back" of bubbles
- There is increased discomfort
- Bubbles do not exit proximally or
- Bubbles may exit proximally but No free fluid in the cul de sac at the end of the procedure.
- ***If you do not see it, do not call it patent! ***

Accuracy: Causes of Misdiagnosis

- Not enough bubbles
- Poor orientation of the uterus or the cornua
- Uterine spasm
- Abnormal uterine shape or position of the oviduct
- Adhesions
- Infertility patients SIS vs Laparoscopy gold standard.:
  - 83 Women with 162 oviducts: 88.9% accuracy rate and 11.1% Misdiagnosis
  - Liang et al Rev Assoc Med Bras 2019;65(8):1055-60

  - Another study: 739 women with 88.7% accuracy.

  Chen S et al Biomed Res Int 2019. PMID 31275995

Patent tubes by SIS

- **KEY:** The transducer needs to be in the right plane to see the cornua
- Preview the Cul De Sac and ovaries for any fluid
- Patent tubes
  - Bubbles exit the uterine cornua to proximal tube
  - Follow bubbles through mid-tube
  - Free fluid accumulates around the ipsilateral ovary or in the cul de sac
- If you are unable to see the bubbles exit proximally
  - No cul de sac fluid PRIOR to this test,
  - And fluid found in the cul de sac at the end.
  - One can state that at least one tube is patent.

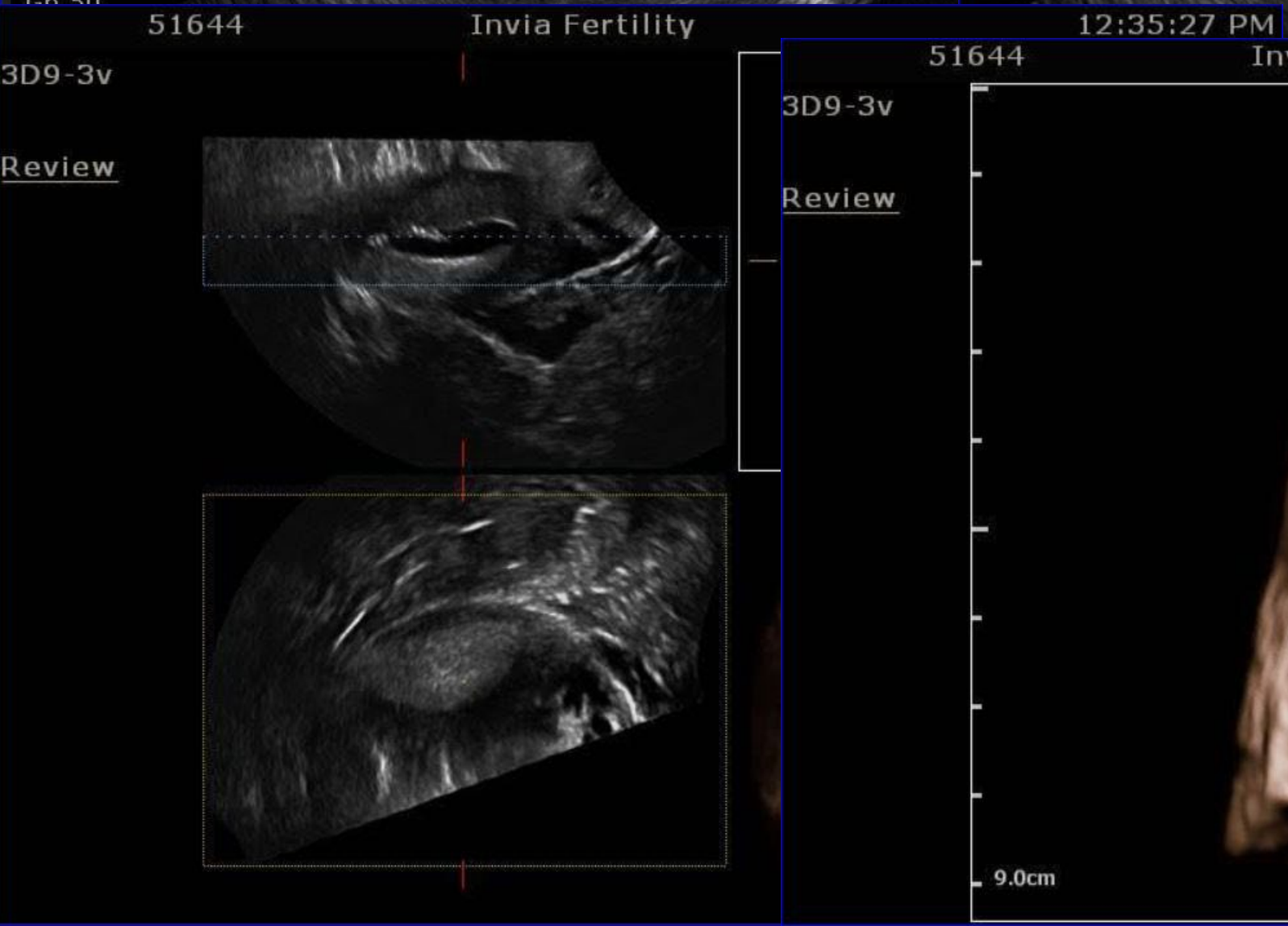
Compare: HSG vs SIS

- HSG- PRO
  - Tubal patency verified
  - Dx: Covered by most insurances
  - Standard 1st line
  - See tubal architecture
- HSG – Con
  - Radiation exposure
  - Higher vasovagal response
  - Uterine Filling defect is not diagnosed
- SIS PRO
  - Easy access in office
  - No radiation exposure
  - Increased comfort
  - Diagnosis uterine filling defect
  - Cheaper?
- SIS– Con
  - Tubal factor may be missed

Cases


51644
Invia Fertility
TIS 0.2
Gyn EV
3D9-3v
58 Hz
7.0cm
2D
Gen
+ Endometrium
0.375


P


51644
Invia Fertility
12:35:27 PM
3D9-3v
Review


51644
Invia Fertility
12:36:45 PM
3D9-3v
Review
9.0cm

3D Ultrasound in Luteal Phase or HSG Early Phase

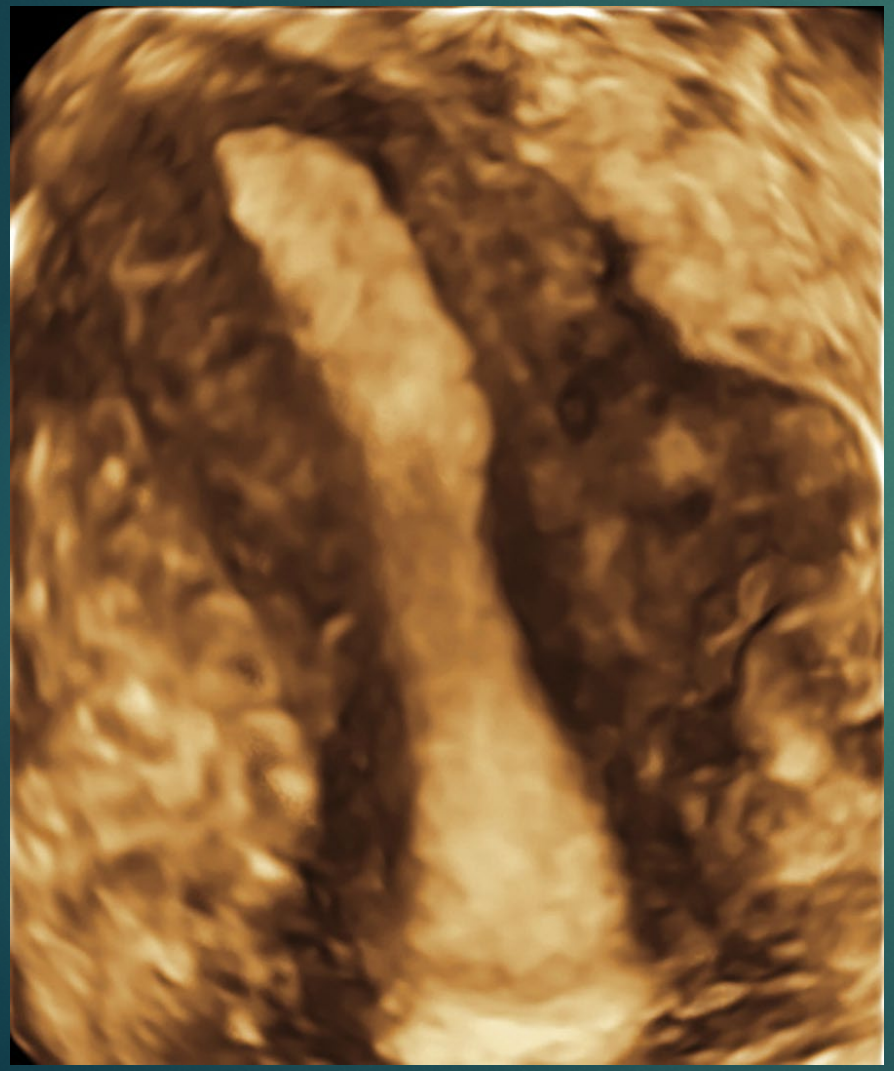
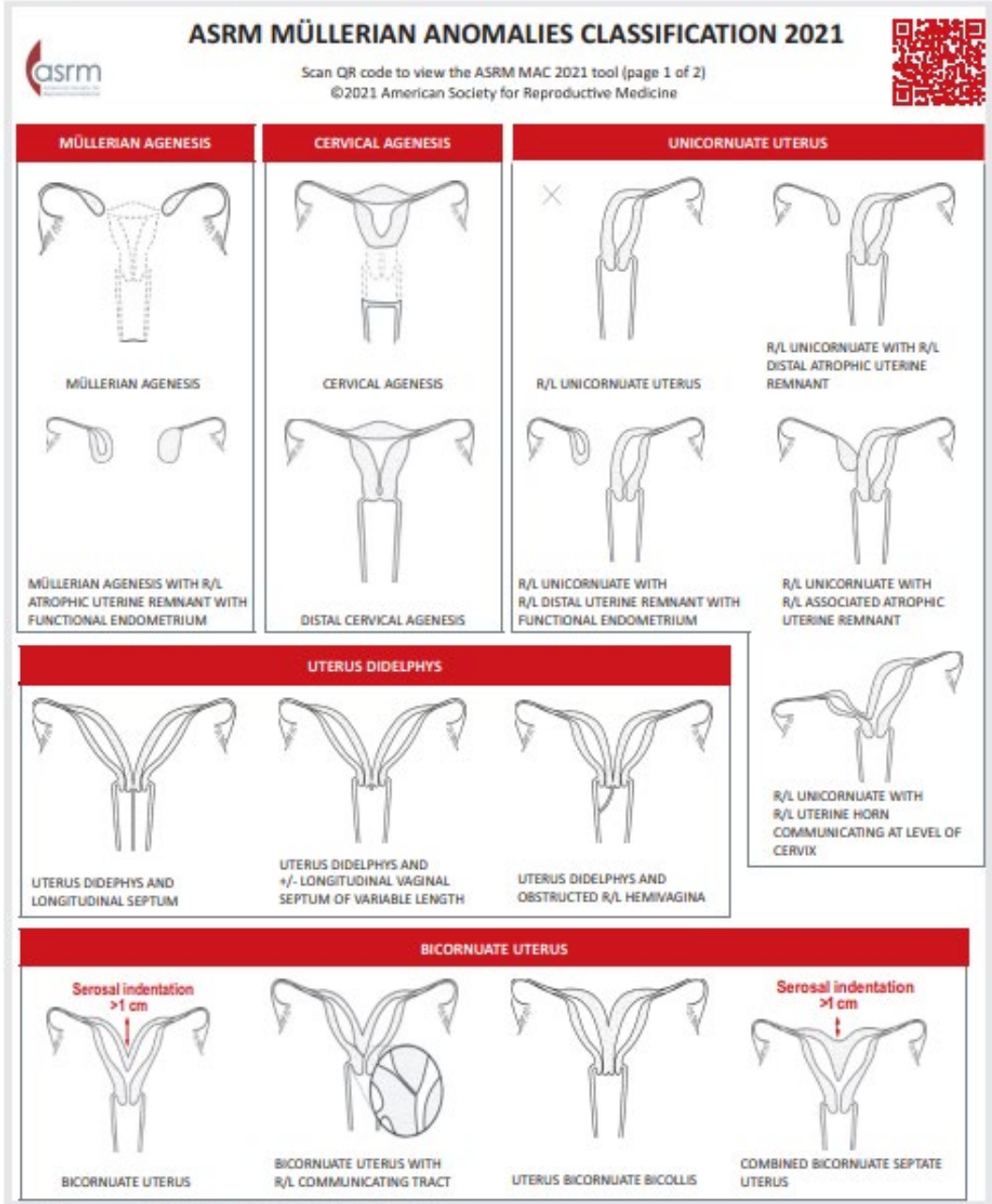


FIGURE 1



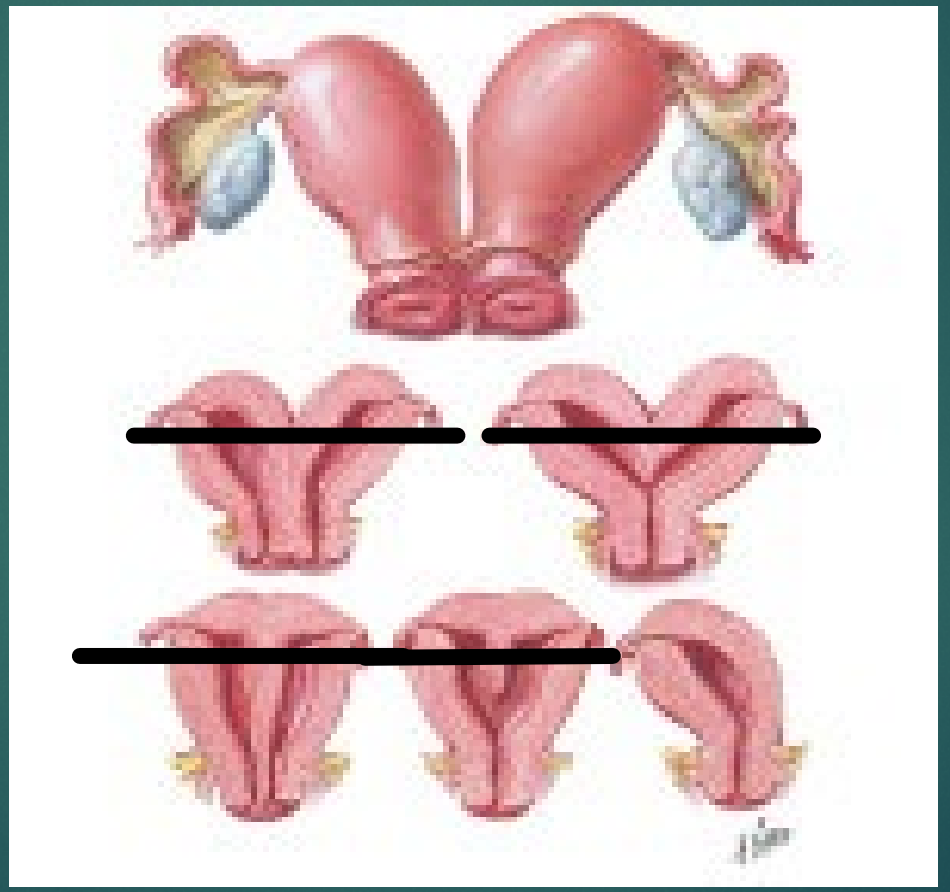
Printable version of the Müllerian Anomalies Classification Table.

Pfeifer. Müllerian anomalies classification tool. Fertil Steril 2021.

33 yo G1P0010 presents for an infertility work up and was mid-cycle

Uterine Anomalies

Duplex Bicornus



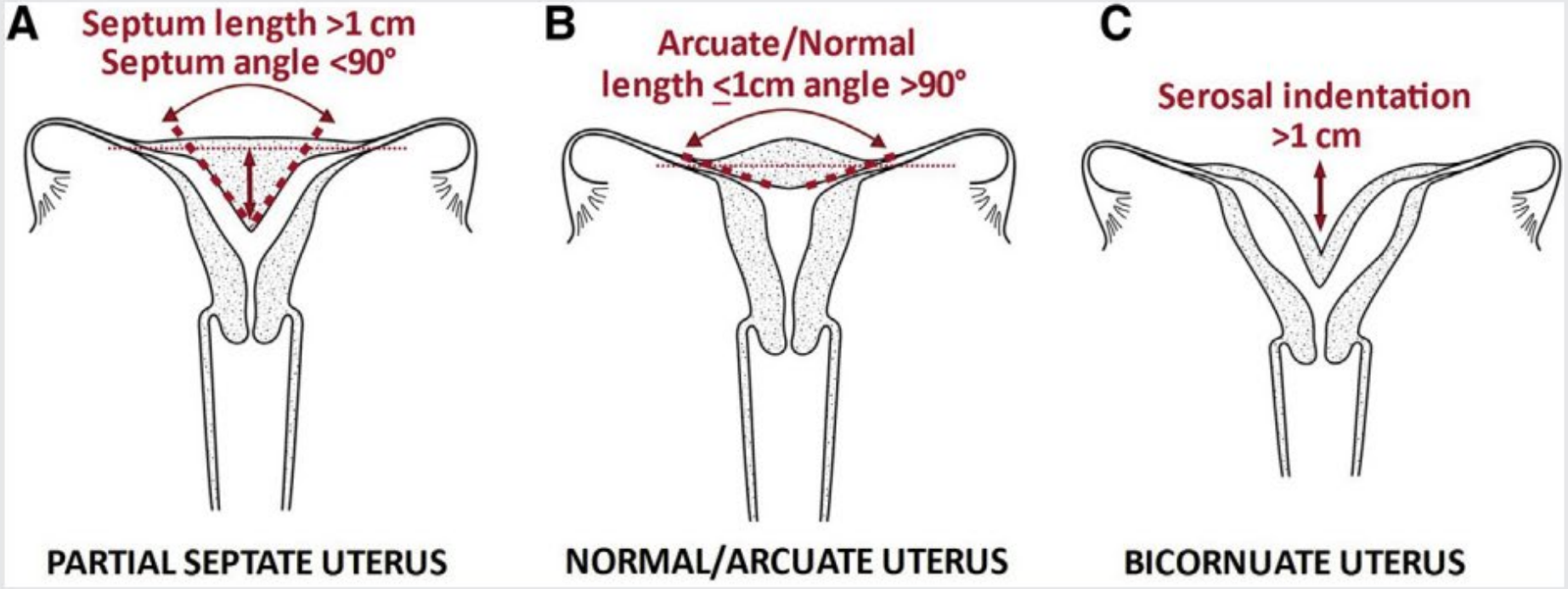
Didelphys

Bicornuate

Septum

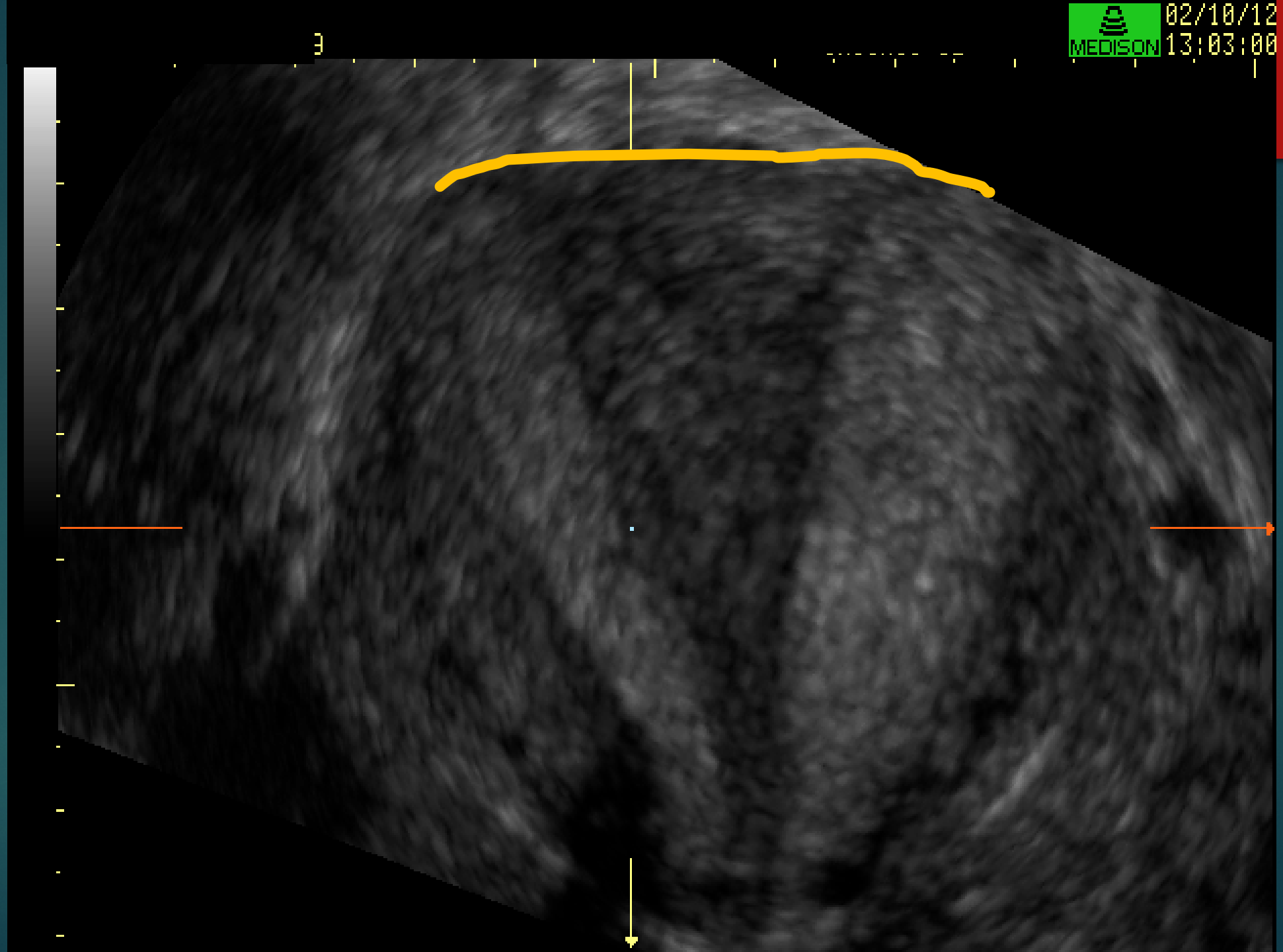
Unicornuate

2021 ASRM Guideline:

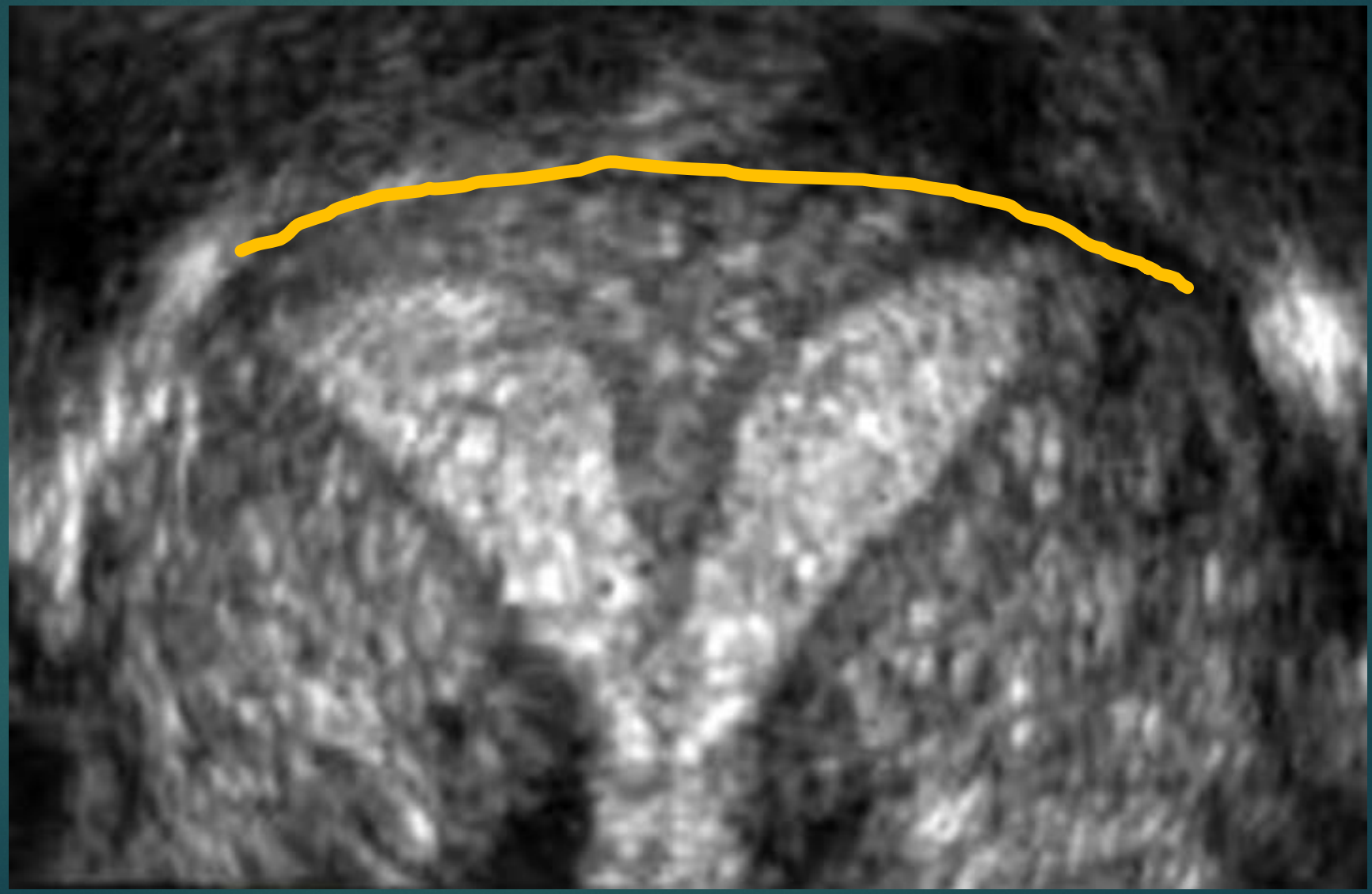


Diagnostic criteria for partial septate uterus.

Pfeifer. Müllerian anomalies classification tool. Fertil Steril 2021.


MEDISON
02/10/12
13;03:00

Our case: Uterine septum



Reproductive Outcome after Septum Repair

- Pregnancy live birth rates:
  Septum 12.4% vs 29.2% controls P=0.001

- Improved pregnancy rate after septum incision
  - Compared PR in Repaired vs Not repaired septum infertile controls
    OR 2.507, 95%CI (1.539-4.111), P<0.001
  - PR in septum repaired vs fertile controls NS 22.9% vs 26.0%
  - LB in septum repair vs fertile controls NS. 15.6% vs 20.9%

Fertil steril 2016;106(3):530-540

Case

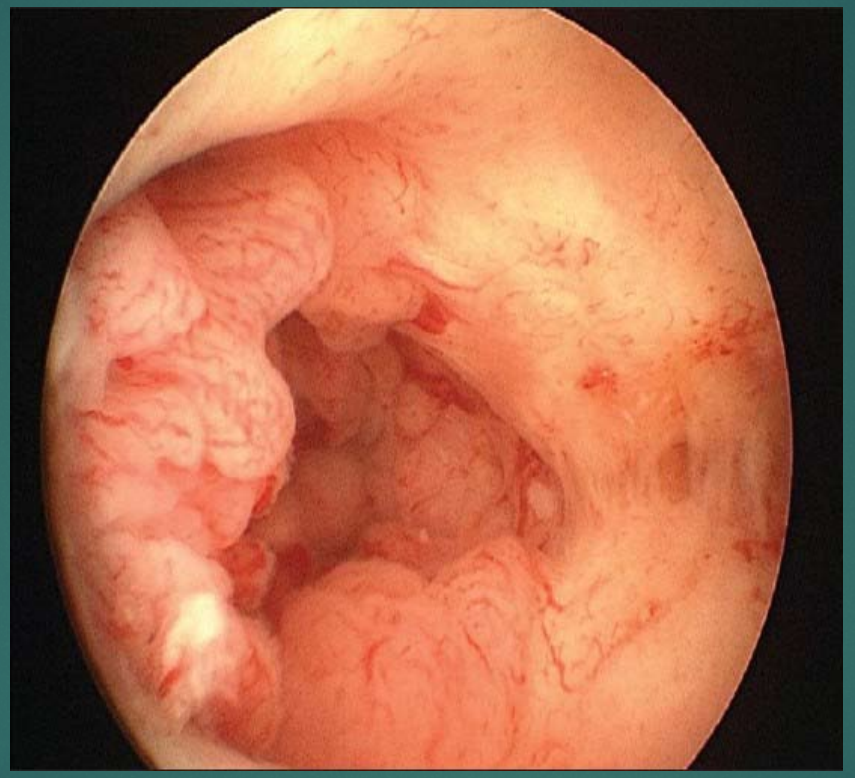
- 40 yo G0 with irregular cycles (PCO), chronic hypertension, and BMI 57 kg/m^2 and presented with infertility for 10 years.

- Initial ultrasound EM= 15 mm.
- Endometrial biopsy- Simple hyperplasia without atypia and she was treated with Provera for 3 months then referred to REI
- Saline sonohysterogram after Provera treatment

Undiscovered Uterine Didelphys

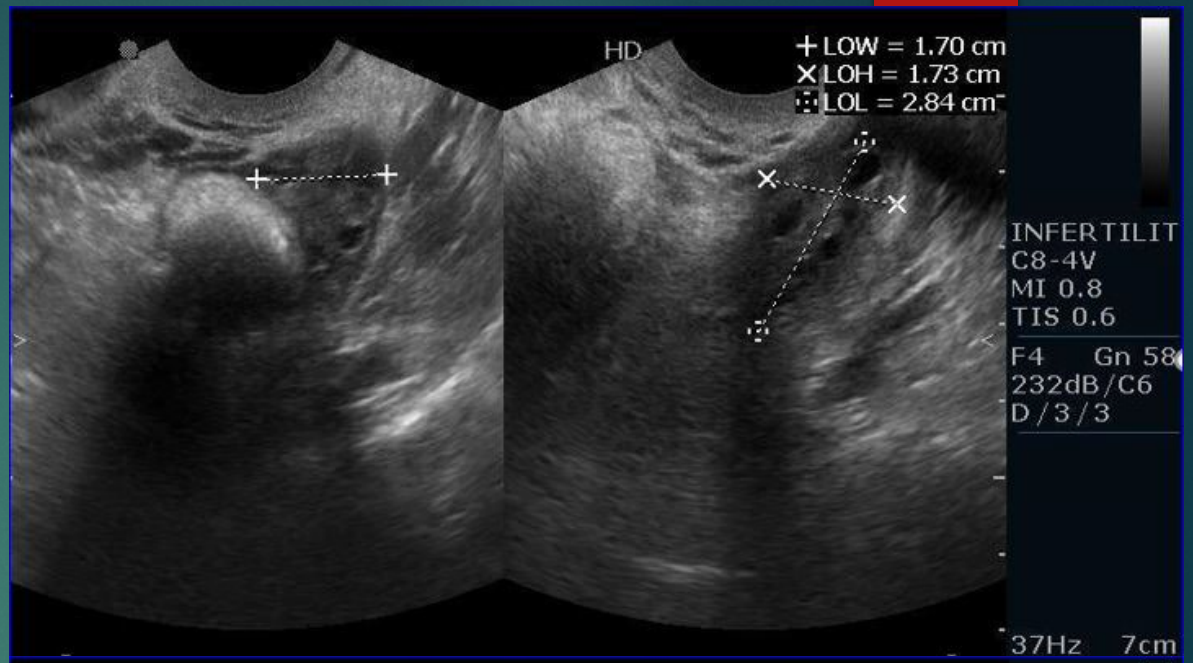
Do a full ultrasound sweep of the pelvis

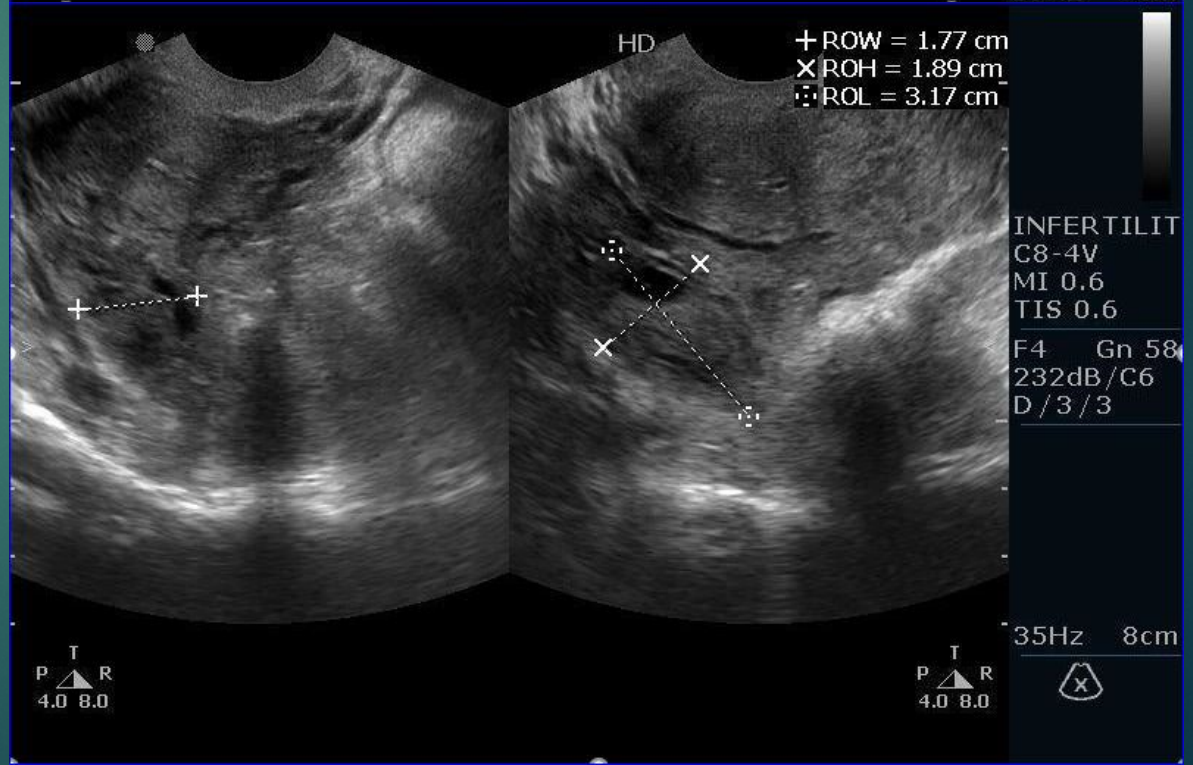
One side:



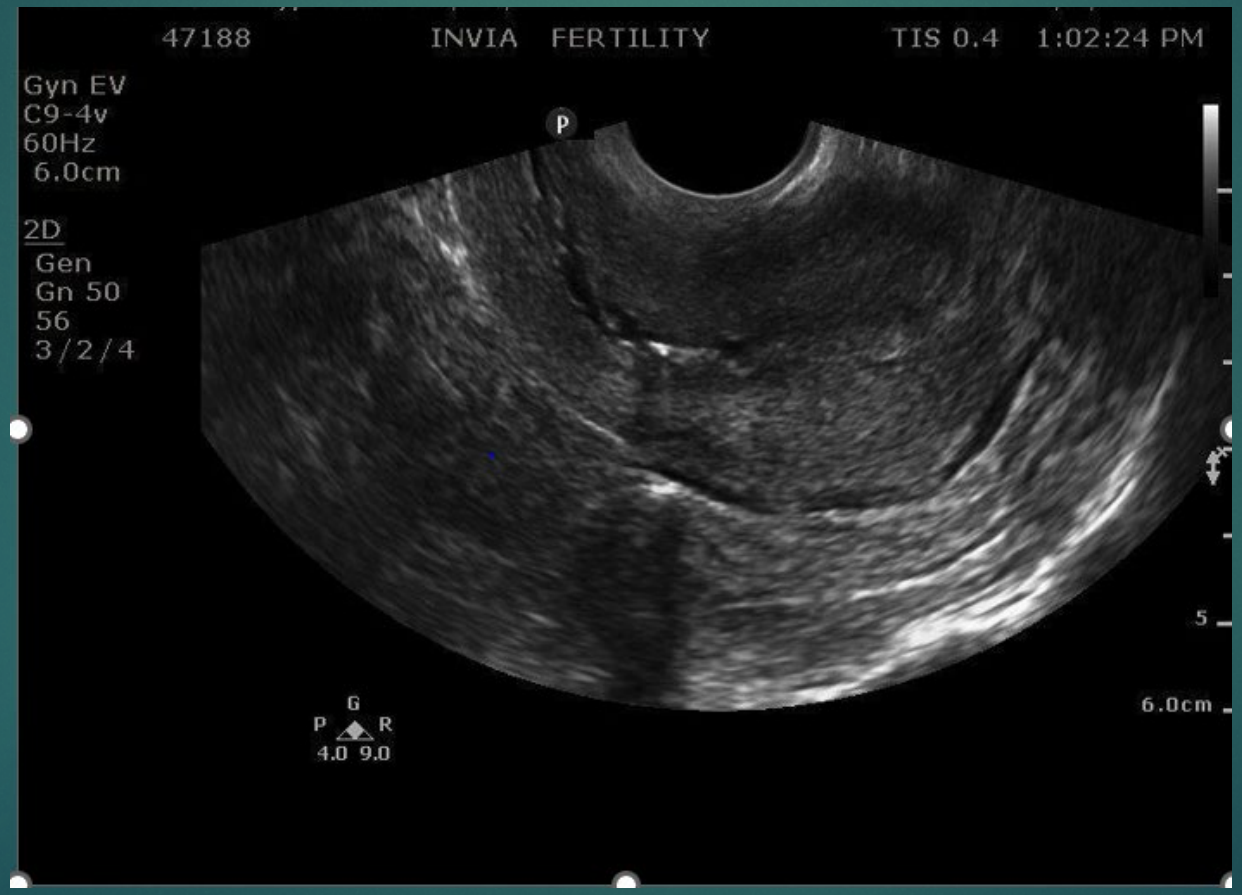
Pathology: Well Differentiated Adenocarcinoma

32 yo G1P0010 with hx missed abortion at 11 weeks and D&C. No period since. hCG neg





SIS: Unable to pass fluid



Follow up

- Ultrasound with indistinct endometrium
- Consider pretreatment with estradiol
- TA Ultrasound guided hysteroscopy—stopped with bleeding
- Placed pediatric foley and treated with estradiol and antibiotic
- Repeat SIS

SIS with Filling Defect:

Normal cavity after 2nd Adhesiolysis

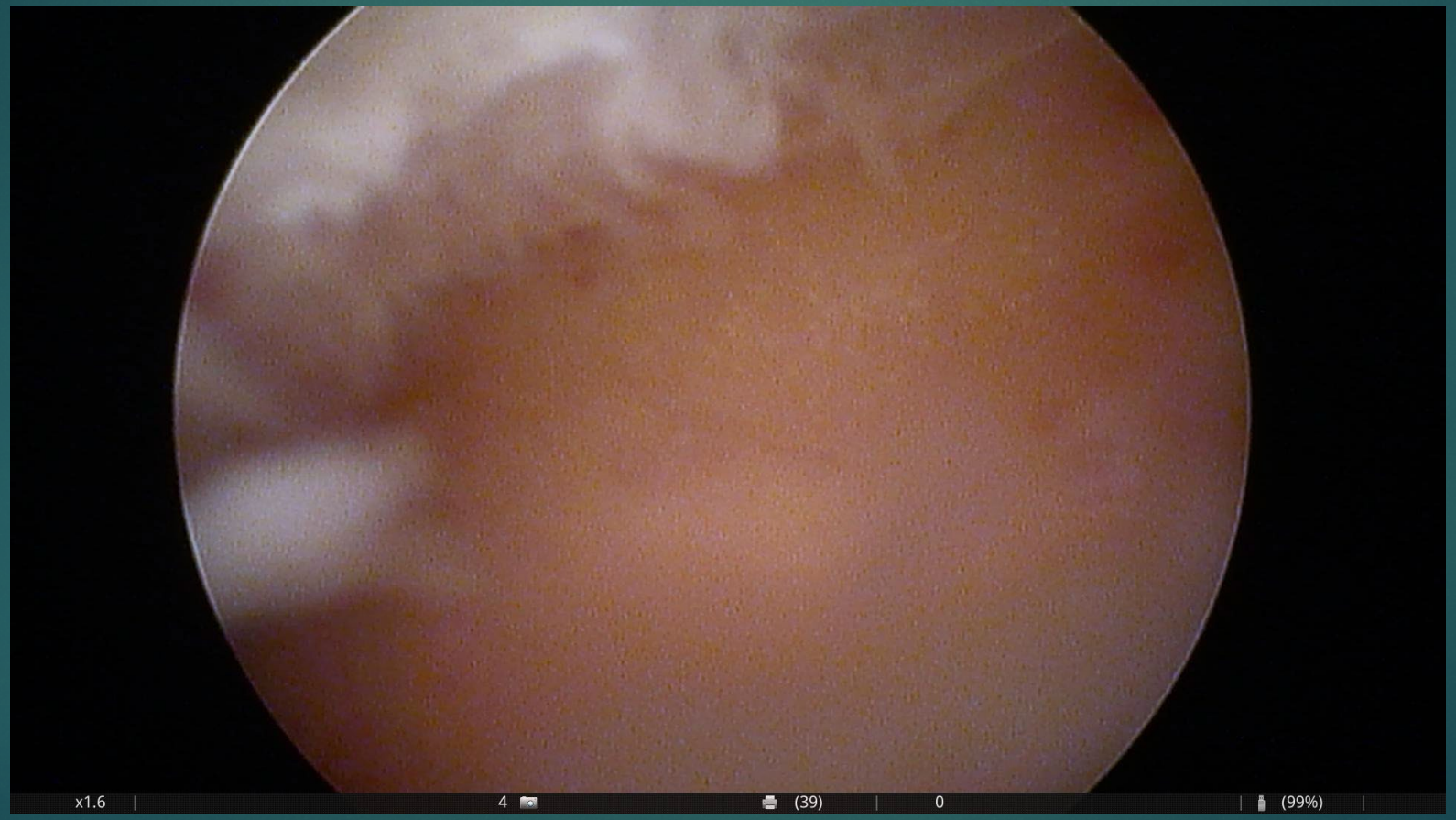


Table 1 Occurrence of Intrauterine Adhesions Following Surgery for Various Conditions and in Those with Various Symptoms

Condition/Procedure	%	Reference
Secondary amenorrhea	1.7	Jones[62]
Infertility	6.9	Nawroth et al[63]
Post cesarean delivery	2.8	Rochet et al[64]
Postpartum D&C (anytime)	3.7	Bergman[65]
Postpartum D&C (2nd–4th week)	23.4	Eriksen and Kaestel[8]
Early spontaneous abortion D&C	6.4	Adoni et al[10]
Late spontaneous abortion D&C	30.9	Adoni et al[10]
Missed abortion	35	Schenker and Margalioth[6]
Elective abortion D&C	13	Kralj and Lavric[66]
Recurrent abortion	39	Toaff and Ballas[17]
Retained products of conception	40	Westendorp et al[67]
Spontaneous abortion		
One	16.3	Friedler et al[68]
Two	14	
Three or more	32	
Hysteroscopic myomectomy		
Single	31.3	Taskin et al[7]
Multiple	45.5	
Hysteroscopic metroplasty	6.7	

D&C, dilation and curettage.

March C. Semin Reprod Med 2011;29:83-94

Table 4 Hysteroscopic Classification of Intrauterine Adhesions, Conception, and Outcome in 1240 Infertile Women Treated at This Center

	Hysteroscopic Classification			
	Mild	Moderate	Severe	Total
Treated	188	374	678	1240
Conceived (%)	172 (91)	278 (74)	314 (46)	764 (62)
Pregnancies	186	291	330	807
Spontaneous abortion	22	44	60	126 (16%)
Elective or therapeutic abortion	1	2	3	6
Ectopic pregnancy	1			1
Premature delivery	10	18	19	47 (7%)
Cervical incompetence	3	2	8	13 (2%)
P. accreta	1	2	10	13 (2%)
Hysterectomy (all for P. accreta)	0	1	3	4
Intrauterine growth restriction			3	3

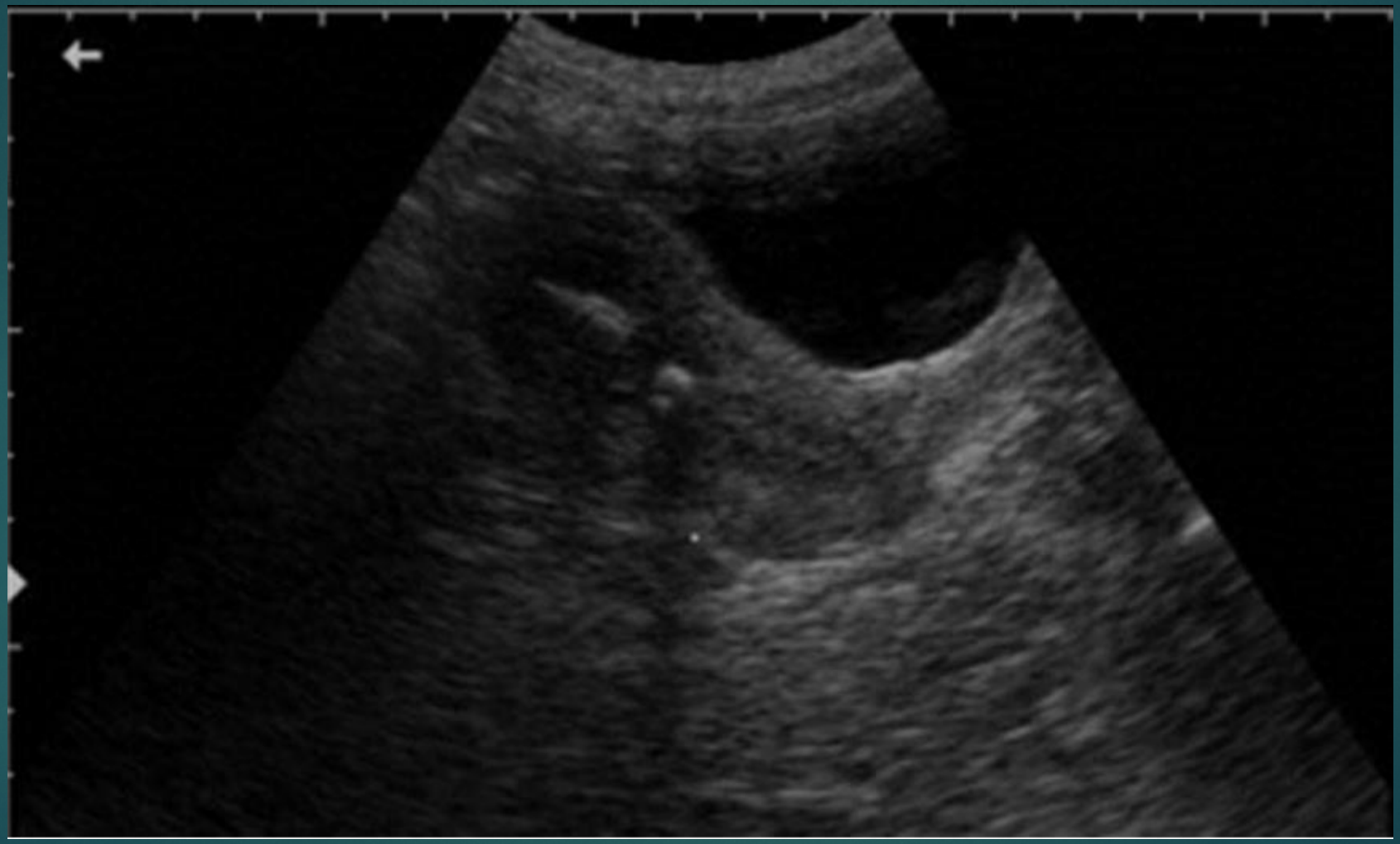
P. accreta, placenta accreta.

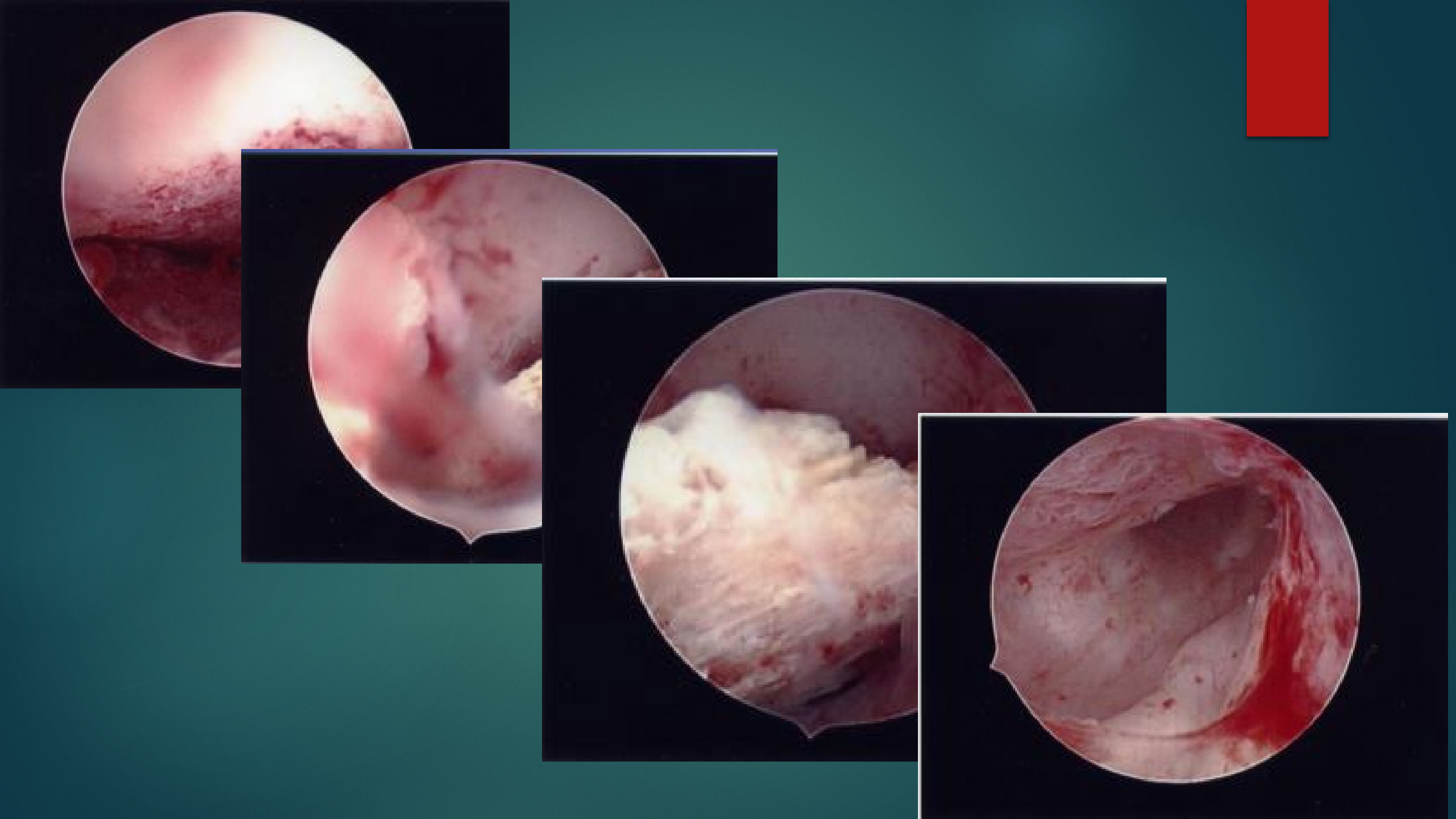
March C. Semin Reprod Med 2011;29:83-94

Case

- 47 yo G0 after 10 years of infertility and requesting donor egg. Husband had normal SA.
- She had a basic infertility evaluation and mild treatments over the past 8 years.
- She was told that the uterine cavity was normal by HSG.

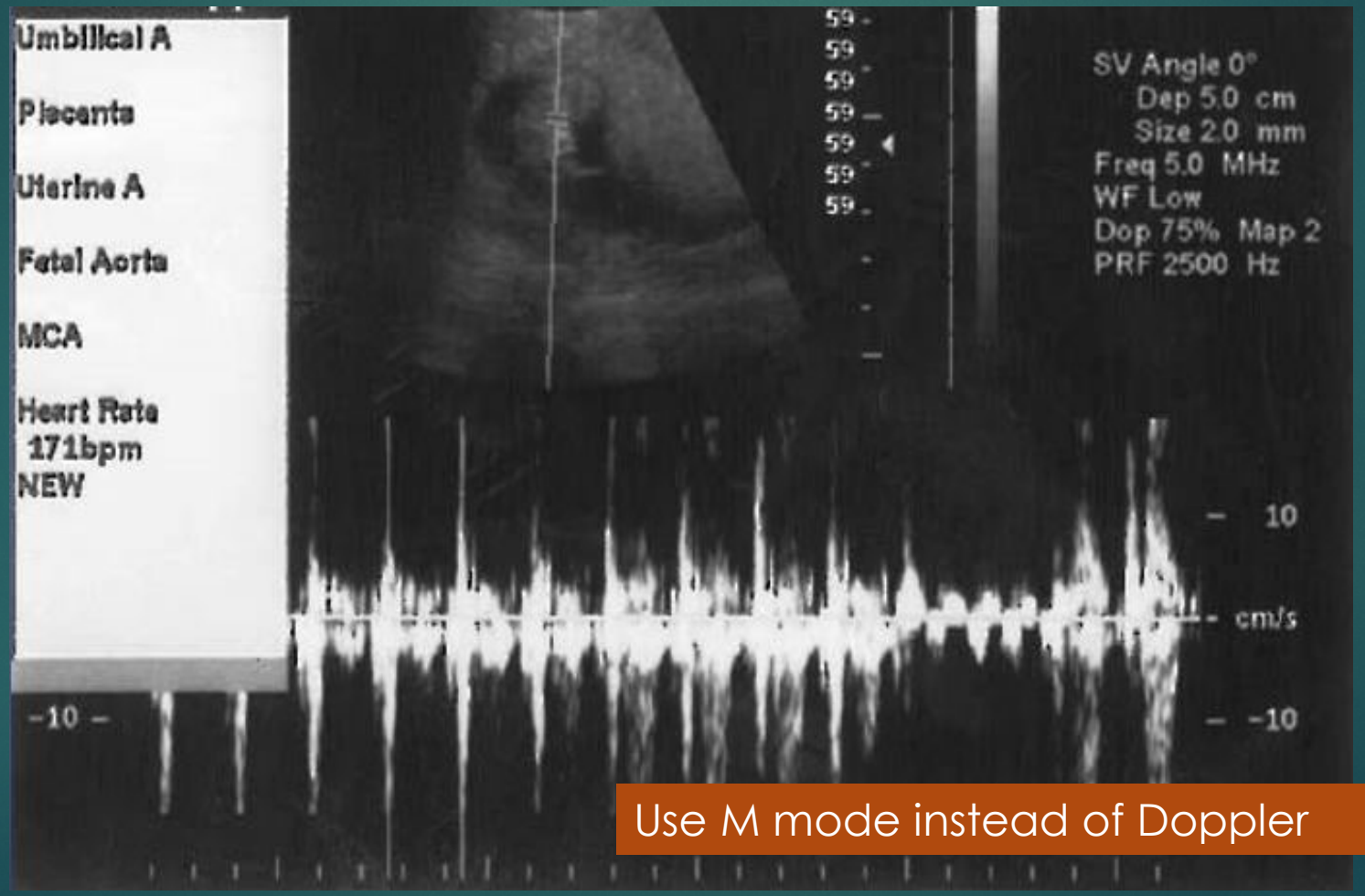
Baseline ultrasound: Artifact? History?





Path

Best news after Donor Egg ET:



Use M mode instead of Doppler

Conclusions:

- HSG and SIS are both good techniques
- Reduce pain: Vocal local, catheter placement and pretreatment
- Think about Normal anatomy and complete evaluation
- Sliding organ sign: Negative can detect frozen pelvis
- Fibroids/polyps: Filling defect on HSG or diagnose on SIS
- Congenital uterine anomalies—3D really helps
  - Unicornuate—2D difficult to identify without 3D or HSG
  - Septum—Diagnosed on 3D ultrasound. Defect noted on HSG and 2D-SIS
- Adhesions intrauterine –Detected similarly on HSG and SIS
- Tubes : normal patency or occlusion (or spasm---high false positive rate!)
  - SIS THINK LEMON for appropriate location and look for bubbles or stretch/swirl
  - Hydrosalpinx may look like ovaria cyst. Turn probe or do 3D with inversion
  - Only call it patent when you are sure!

Thank you!

Questions?

References:

- ACR Practice Parameter for the performance of hysterosalpingography. Revised 2022.
- AIUM practice parameter for the performance of sonohysterography and hysterosalpingo-constrast sonography (HyCoSy). J Ultrasound Med 2021 40:E39-E45.
- Christianson MS, Legro RS, Jin S, et al Comparison of sonohysterography to hysterosalpingogram for tubal patency assessment in a multicenter fertility treatment trial among women with polycystic ovary syndrome J Asist Reod Genet 2018;35:2173-2180
- Jitchanwichai J and Soonthornpun K. Effect of premedication Hyoscine-N-Butylbromide before HSG for diagnosis of proximal tubal obstruction in infertility women: a Randomized double-blind controlled trial. JMIG 2019;26:110-116
- Lindheim SR, Sprague C, Winter TC. Hysterosalpingography and sonohysterography: lessons in technique. AJR Womens imagin 2006;186:24-29.
- Maheux-Lacroix S, Boutin A, Moore L, et al. Hysteosalpingosonography for diagnosing tubal occlusion in subfertile women: systematic review with meta-analysis Hum Reprod 2014;29:953-962.
- Pereira N, Hutchinson AP, Lekovich JP, et al. Antibiotic prophylaxis for gynecologic procedures prior to and during the utilization of assisted technologies: A systematic review. J Pathogens 2016; 8 pages.
- Gringovich M et al Evaluating fallopian tubes; what the radiologist needs know. Radiographics 2021: 41: 1876-1896
- Pfeifer S, et al. ASRM mullerian anomalies classification 2021. Fertil Steril 2021;116:1238-52
- Timmerman et all. External validation of ovarian adnexal reporting and data system lexicon and the IOTA 2-step strategy to stratify ovarian tumors into O-RADS risk groups. Jama Oncology 2023; 9(2):225-233
- https://www.mdcalc.com/calc/10517/international-ovarian-tumor-analysis-iota-simple-rules-risk-assessment
- Levine D, et al. Management of asymptomatic ovarian and other adnexal cysts imaged at US. Radiology 2010; 256:943-954