

Emergency Pelvic Ultrasound

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US in OB/Gyn Emergencies

- Early pregnancy
- Late pregnancy
- Non-pregnant patients

Introduction

Objectives

- Ultrasound in:
 - early pregnancy
 - late pregnancy
 - non-pregnant patients

Introduction

Main Goals in Early Pregnancy

- Evaluate pain or bleeding in early pregnancy
- Rule out ectopic pregnancy
- US finding of IUP 70-80%

Introduction

Main Goals in Late Pregnancy

- Determination of gestational age
- Fetal cardiac activity, fetal movement
- Head position
- Placenta previa

Introduction

Main Goals in Non-pregnant Patients

- Pelvic vs GI cause of lower abdominal pain
- Hemorrhagic ovarian cyst
- Fibroid

Introduction

Saves Time and Money

- Navy Medical Center: ED transit time decreased from 235 to 165 minutes
- \$229-\$1,244 saved per ectopic
 - \$135 to call in tech
 - \$270-410 per pelvic ultrasound
 - \$54 for ED pelvic US

Burgher SW, Tandy TK, Dawdy MR: Transvaginal ultrasonography by emergency physicians decreases patient time in the emergency department. Acad Emerg Med 5:802-807, 1998.

Durston WE, Carl ML, Guerra W, et al: Ultrasound availability in the evaluation of ectopic pregnancy in the ED: comparison of quality and cost-effectiveness with different approaches. Am J Emerg Med 18:408-417, 2000.

Technical Considerations

Technical Considerations

Transabdominal Pelvic Ultrasound

- Bladder is acoustic window
 - bladder should be full
- Orientation is similar to abdominal ultrasound
- Wider field of view than transvaginal
 - image structures outside of true pelvis
 - large masses
- Lower signal frequency than transvaginal
 - more penetration, less resolution
 - IUP at 6-7 weeks

Technical Considerations

Transabdominal Pelvic Ultrasound



curvilinear probe



phased array probe

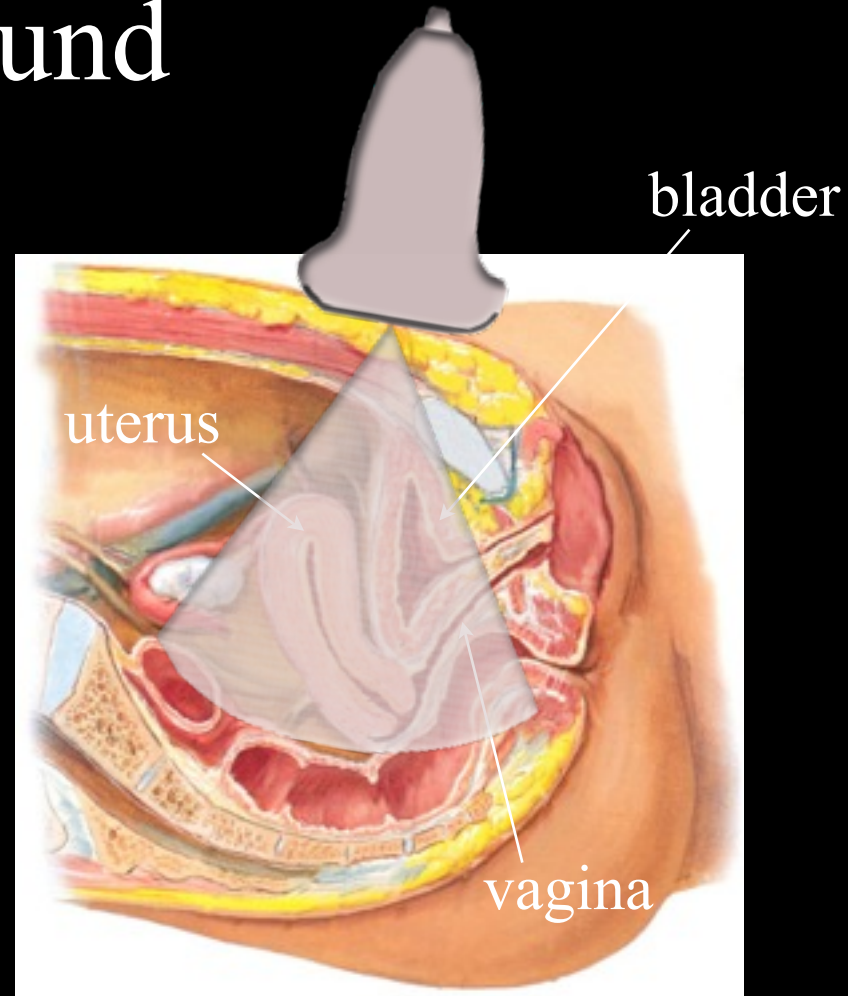
Use “OB” setting

Technical Considerations

Transabdominal Pelvic Ultrasound

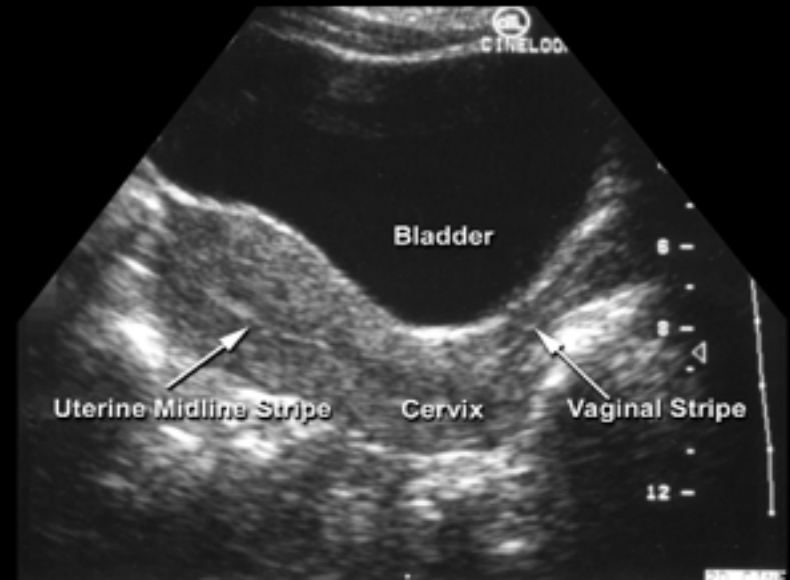
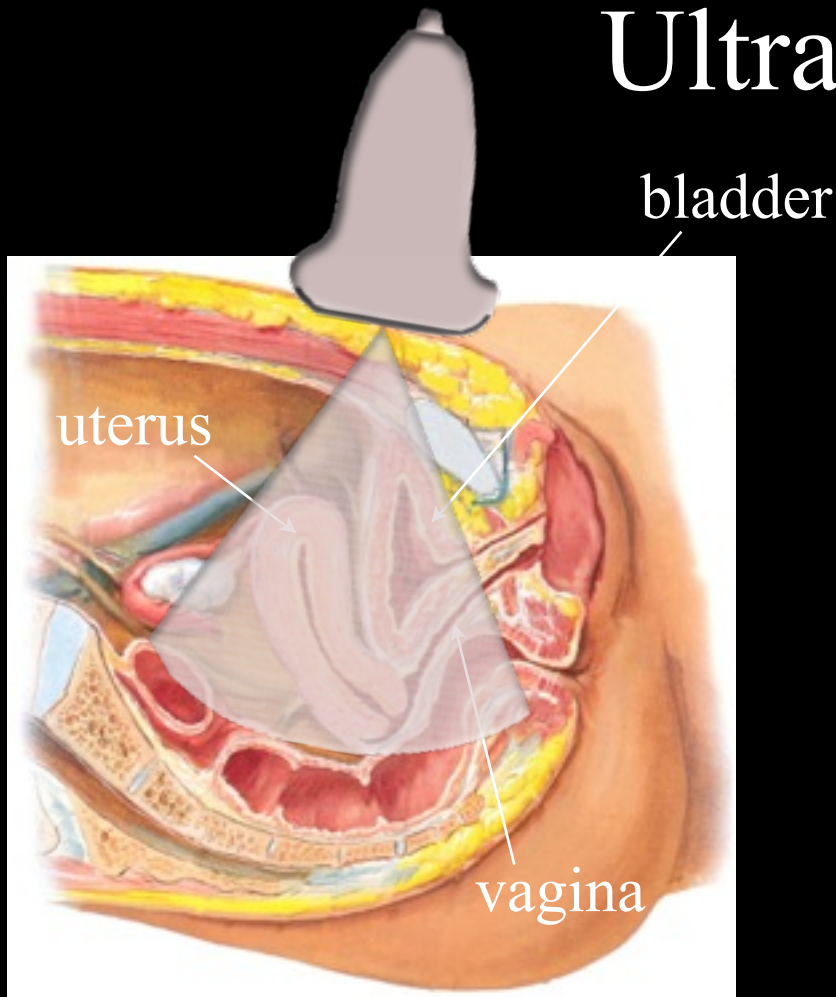


Longitudinal View



Technical Considerations

Transabdominal Pelvic Ultrasound



Longitudinal View

Technical Considerations

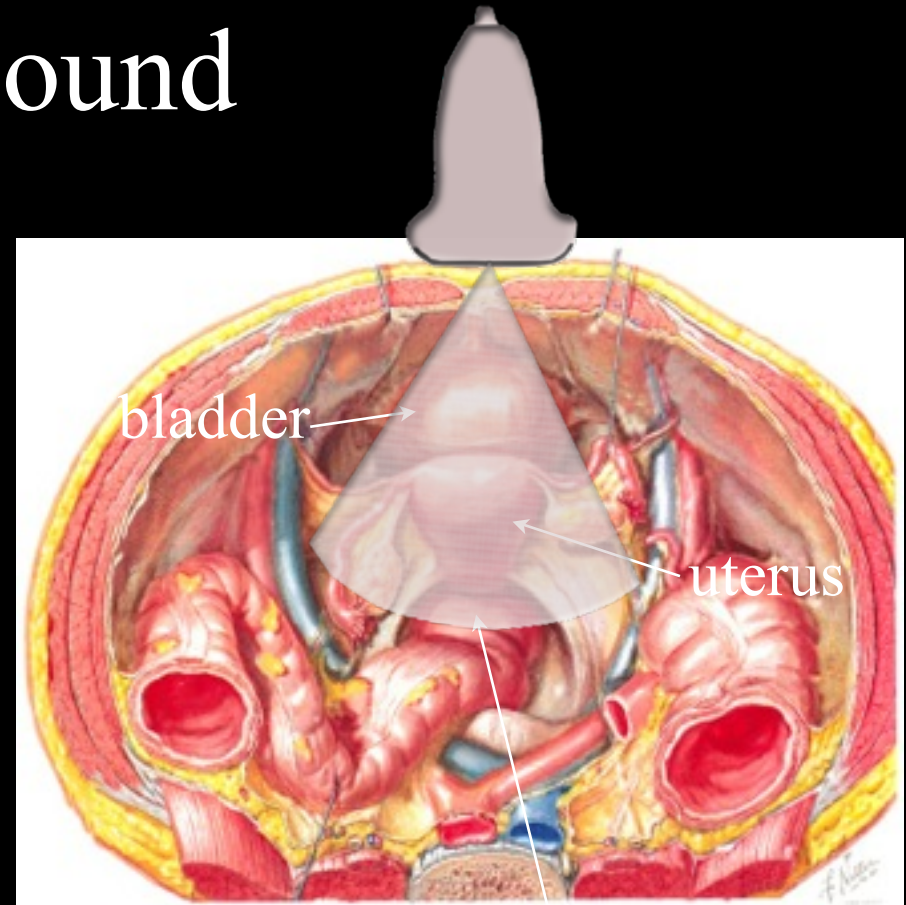
Transabdominal Pelvic Ultrasound



Longitudinal View

Technical Considerations

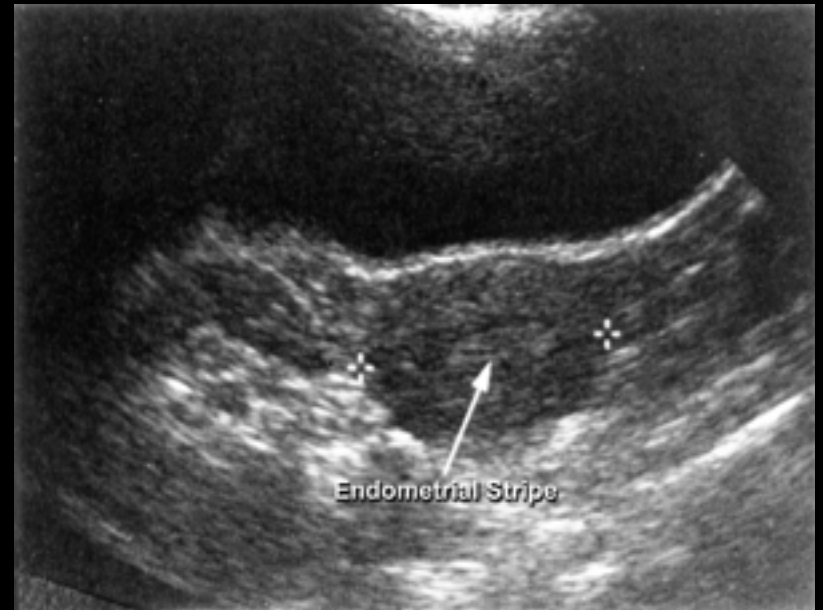
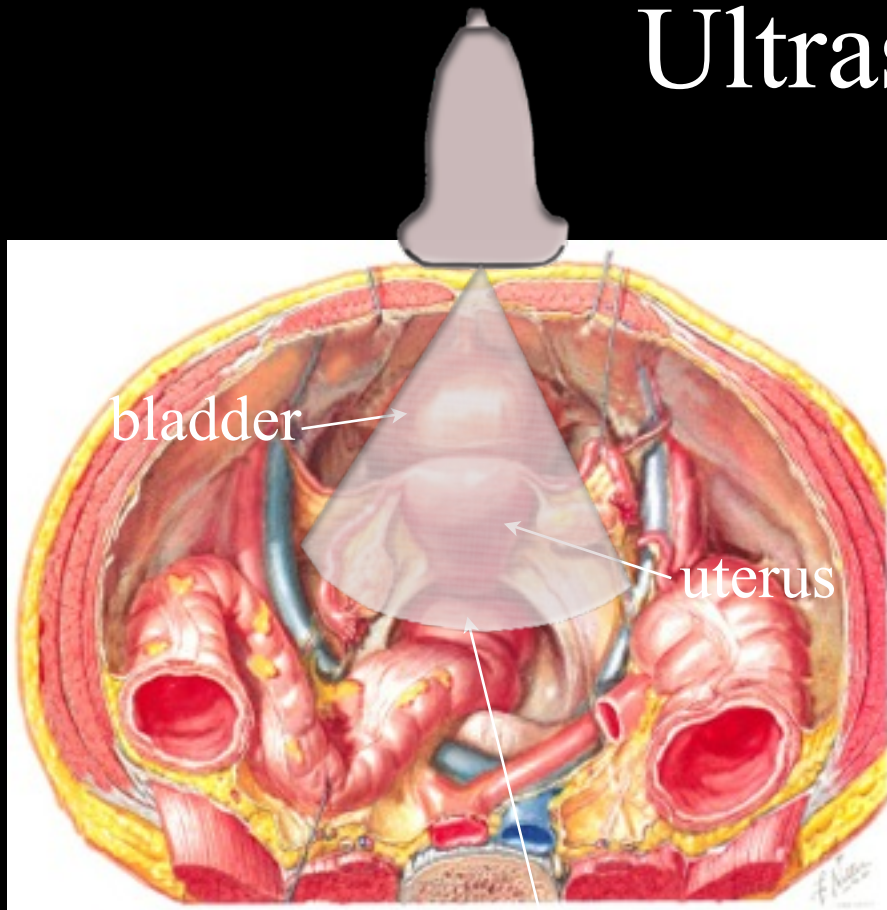
Transabdominal Pelvic Ultrasound



Transverse View

Technical Considerations

Transabdominal Pelvic Ultrasound



rectouterine pouch

Transverse View

Transvaginal Pelvic Ultrasound

- Vagina is acoustic window
 - bladder should be empty
- More difficult orientation
- Shallow field of depth
 - difficult to see large masses
 - best for 1st trimester
- High signal frequency
 - excellent for viewing small structures
 - ovaries
 - early pregnancy (IUP at 4-5 weeks)
- Easiest to learn if the same routine is followed every time

Transvaginal Pelvic Ultrasound



endocavitary probe

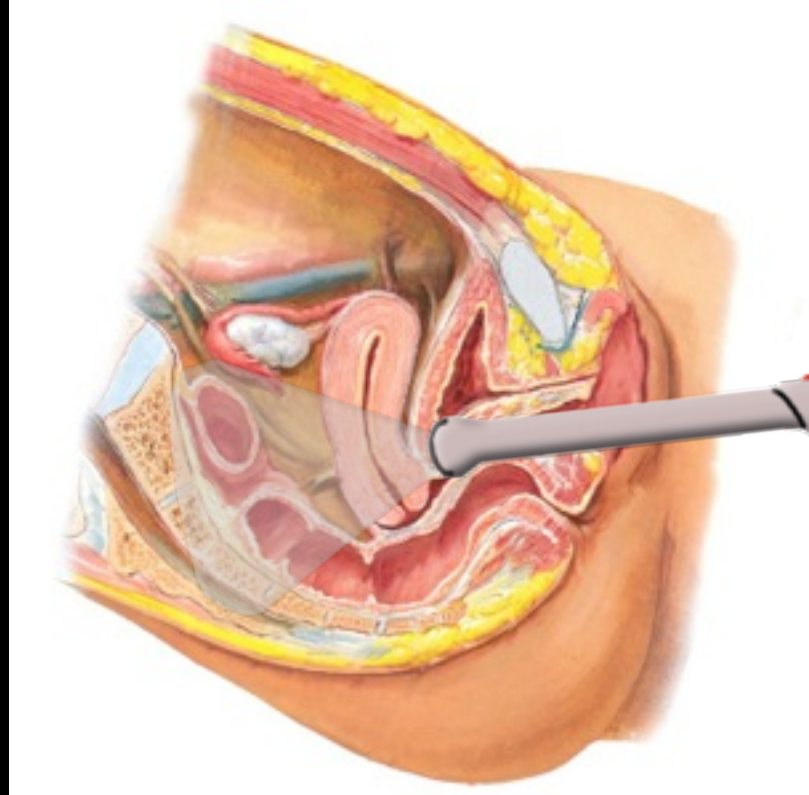
Technical Considerations

Transvaginal Pelvic Ultrasound

- performed after speculum and bimanual exams
- gel on probe, cover probe, gel on outside
- less uncomfortable than speculum exam
- place ultrasound machine on your left



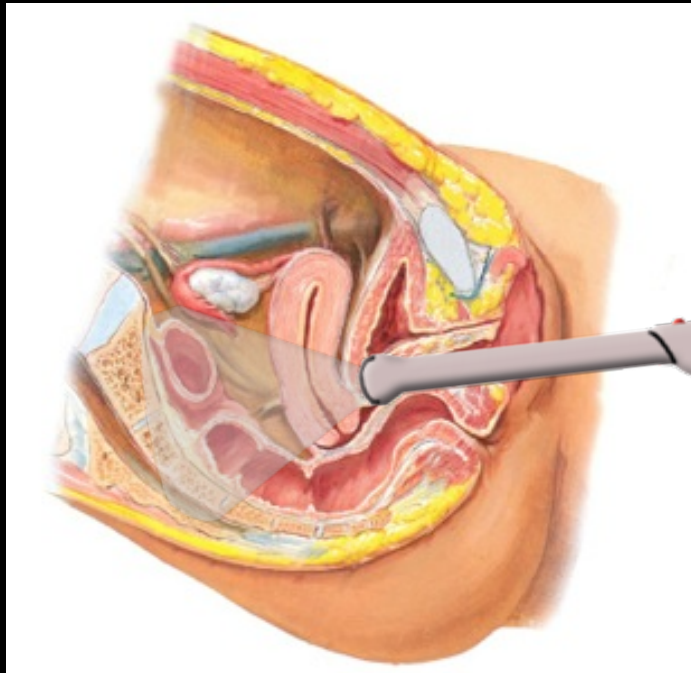
Transvaginal Pelvic Ultrasound



Longitudinal View

Technical Considerations

Transvaginal Pelvic Ultrasound



Longitudinal View

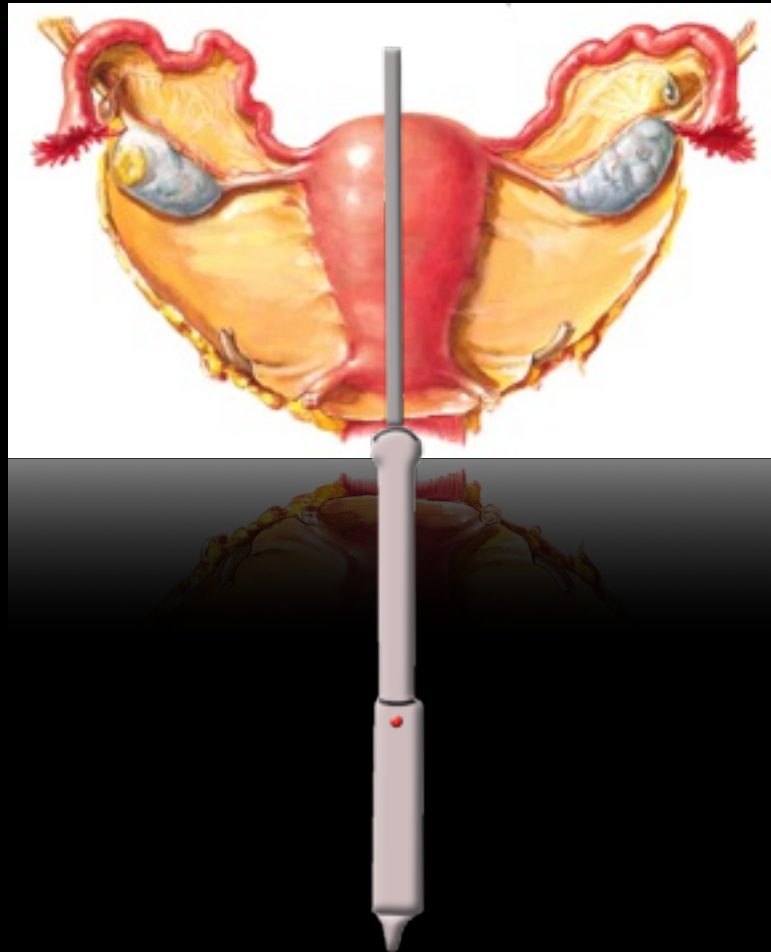
Transvaginal Pelvic Ultrasound



Longitudinal View

Technical Considerations

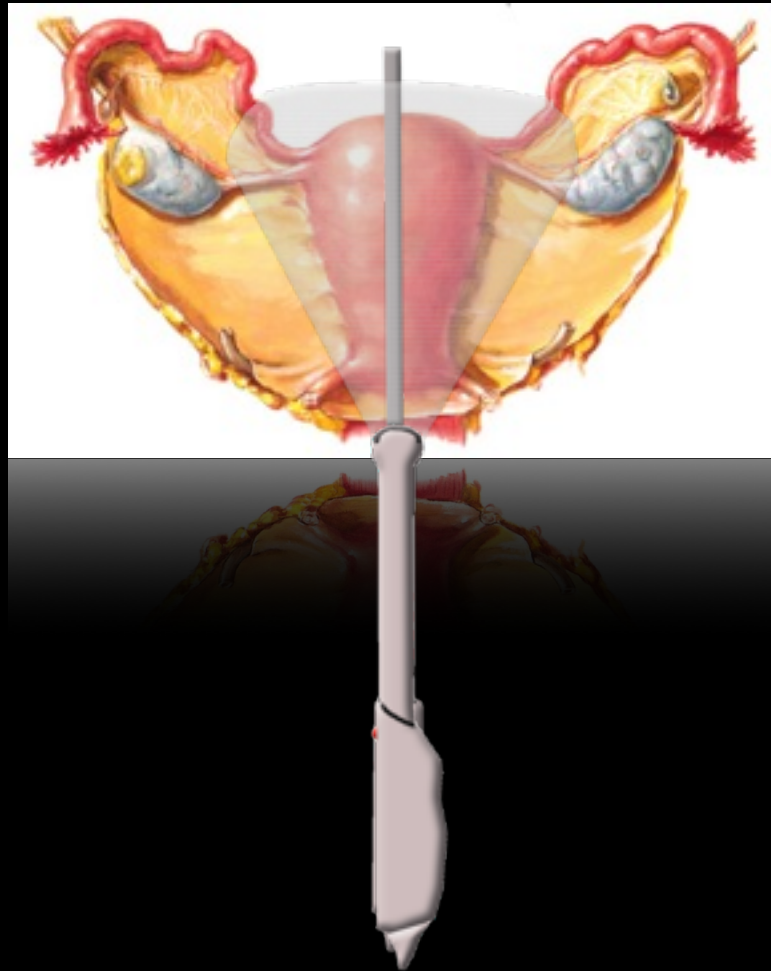
Transvaginal Pelvic Ultrasound



Longitudinal View

Technical Considerations

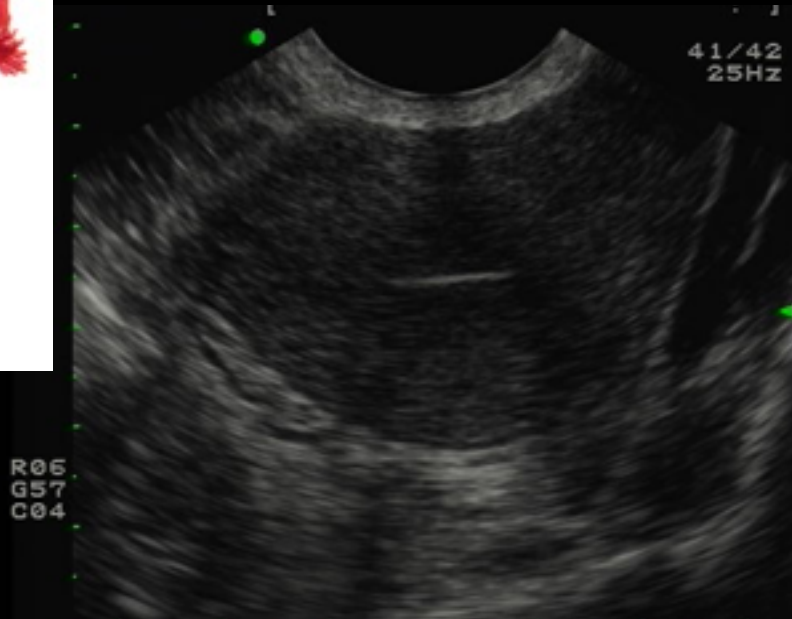
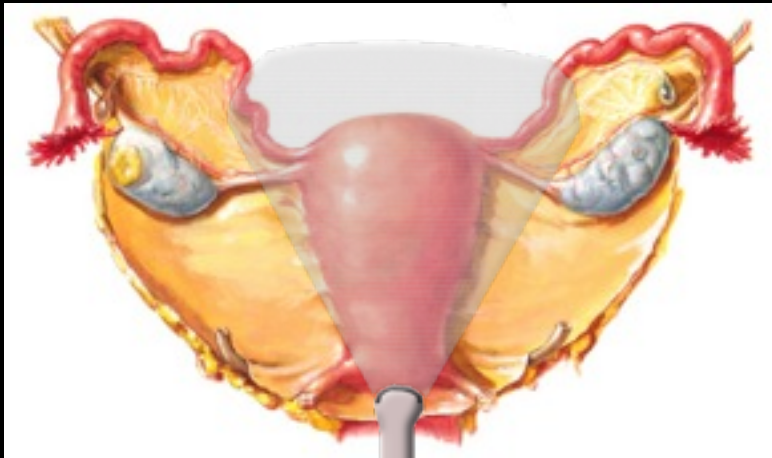
Transvaginal Pelvic Ultrasound



Transverse View

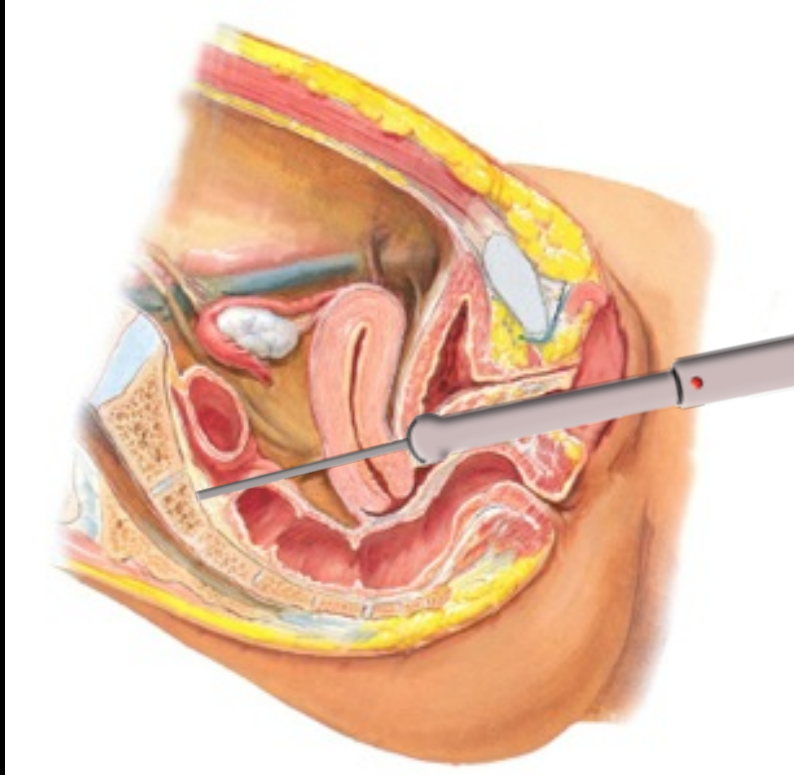
Technical Considerations

Transvaginal Pelvic Ultrasound



Transverse View

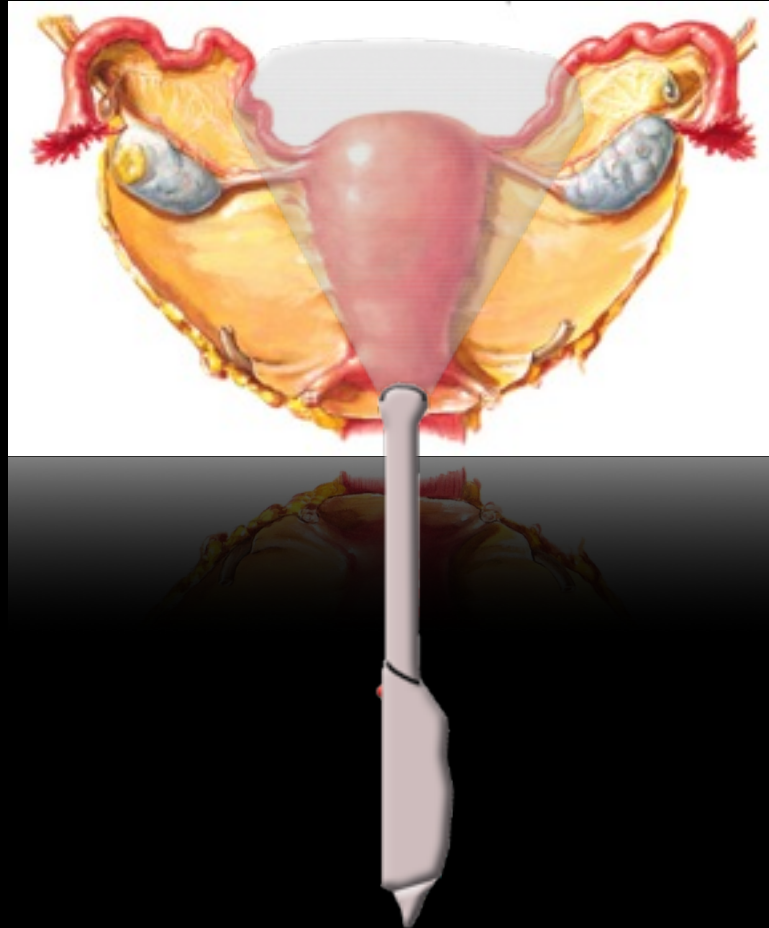
Transvaginal Pelvic Ultrasound



Transverse View

Technical Considerations

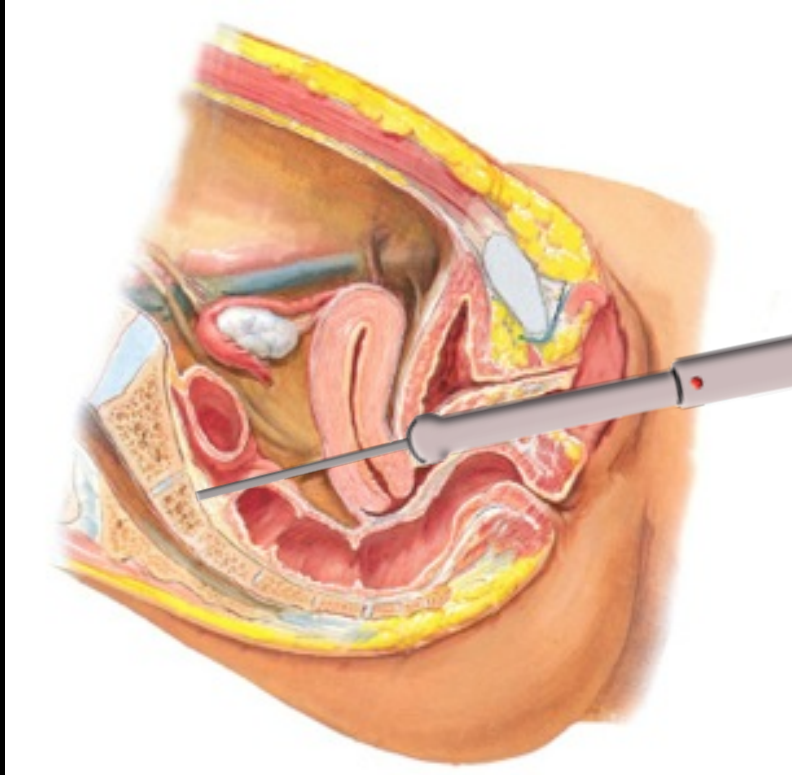
Transvaginal Pelvic Ultrasound



Transverse View

Technical Considerations

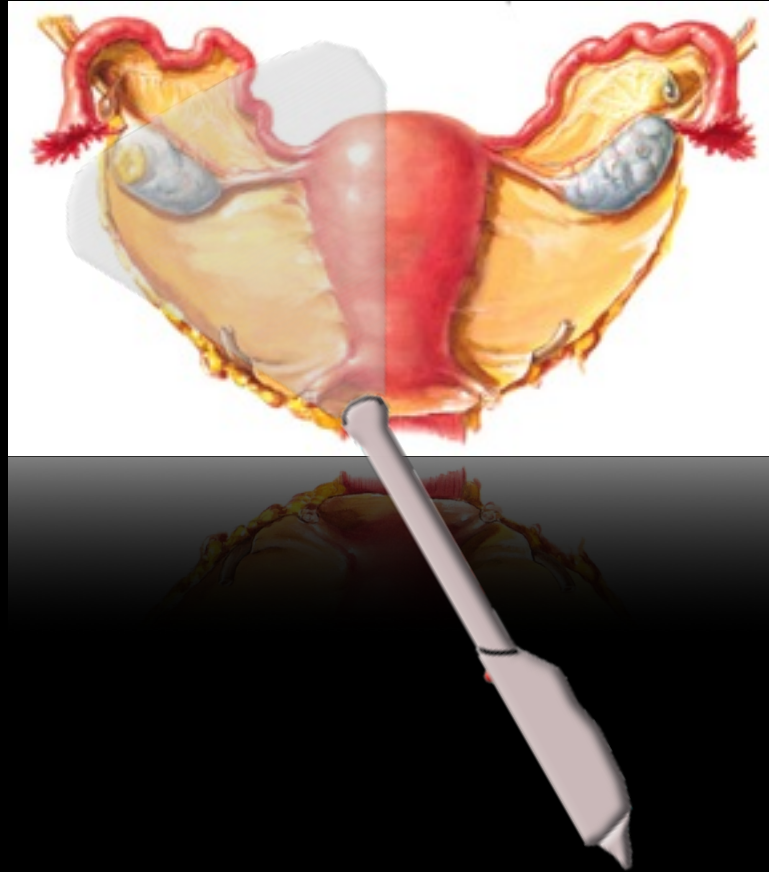
Transvaginal Pelvic Ultrasound



Transverse View

Technical Considerations

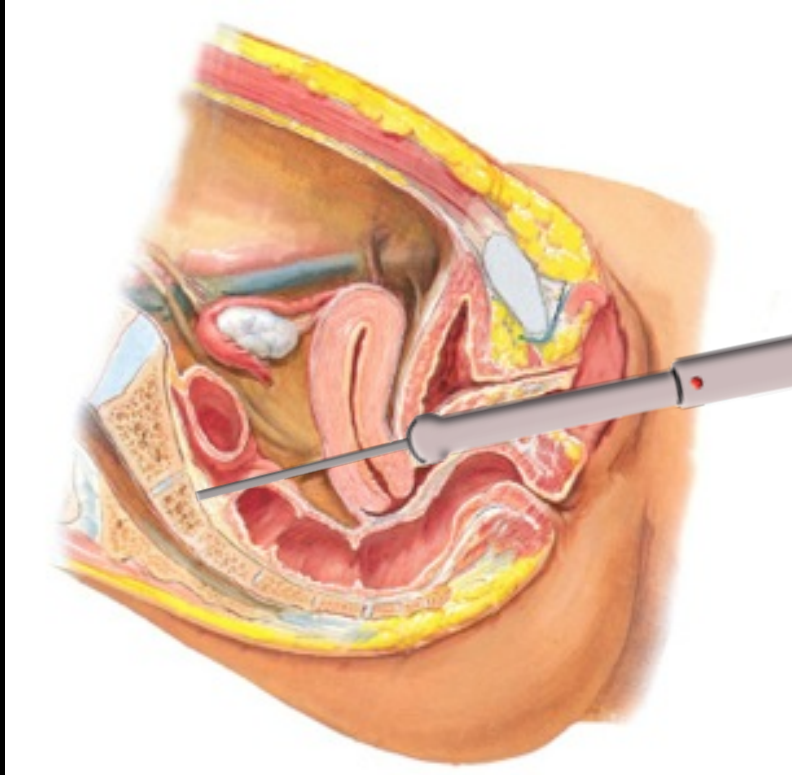
Transvaginal Pelvic Ultrasound



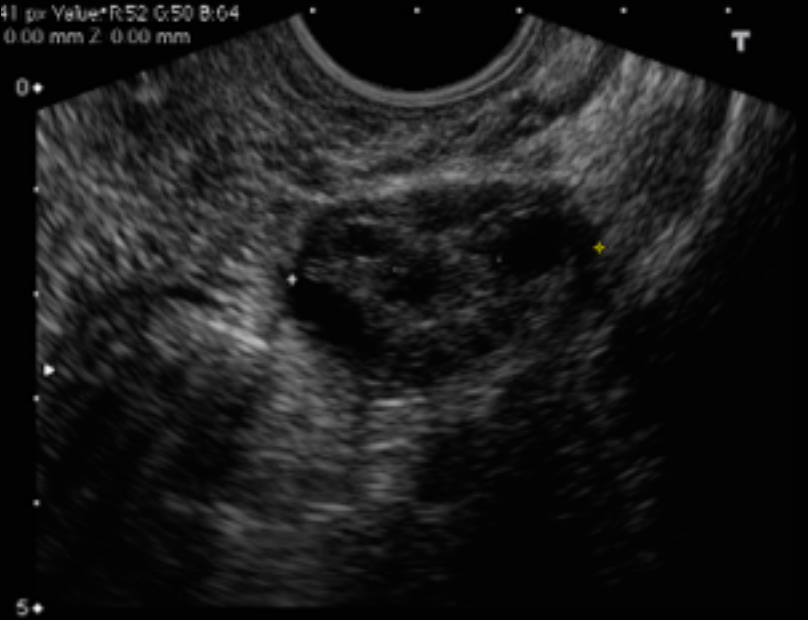
Transverse View

Technical Considerations

Transvaginal Pelvic Ultrasound



41 pr Value: R:52 G:50 B:04
0.00 mm Z: 0.00 mm



Transverse View

Technical Considerations

Transvaginal Pelvic Ultrasound



Transverse View--Ovary

Early Pregnancy

Main Goals in Early Pregnancy

- Evaluate pain or bleeding in early pregnancy
- Rule-out ectopic pregnancy
- US finding of IUP (70-80%)

Early Pregnancy

“I can’t diagnose an ectopic with ultrasound.”

Main Goals in Early Pregnancy

- Categorize findings into:
 - normal intrauterine pregnancy
 - no intrauterine pregnancy
 - abnormal intrauterine pregnancy

US Findings in Normal IUP

- Gestational sac
- Double decidual sign
- Yolk sac
- Embryo
- Cardiac activity

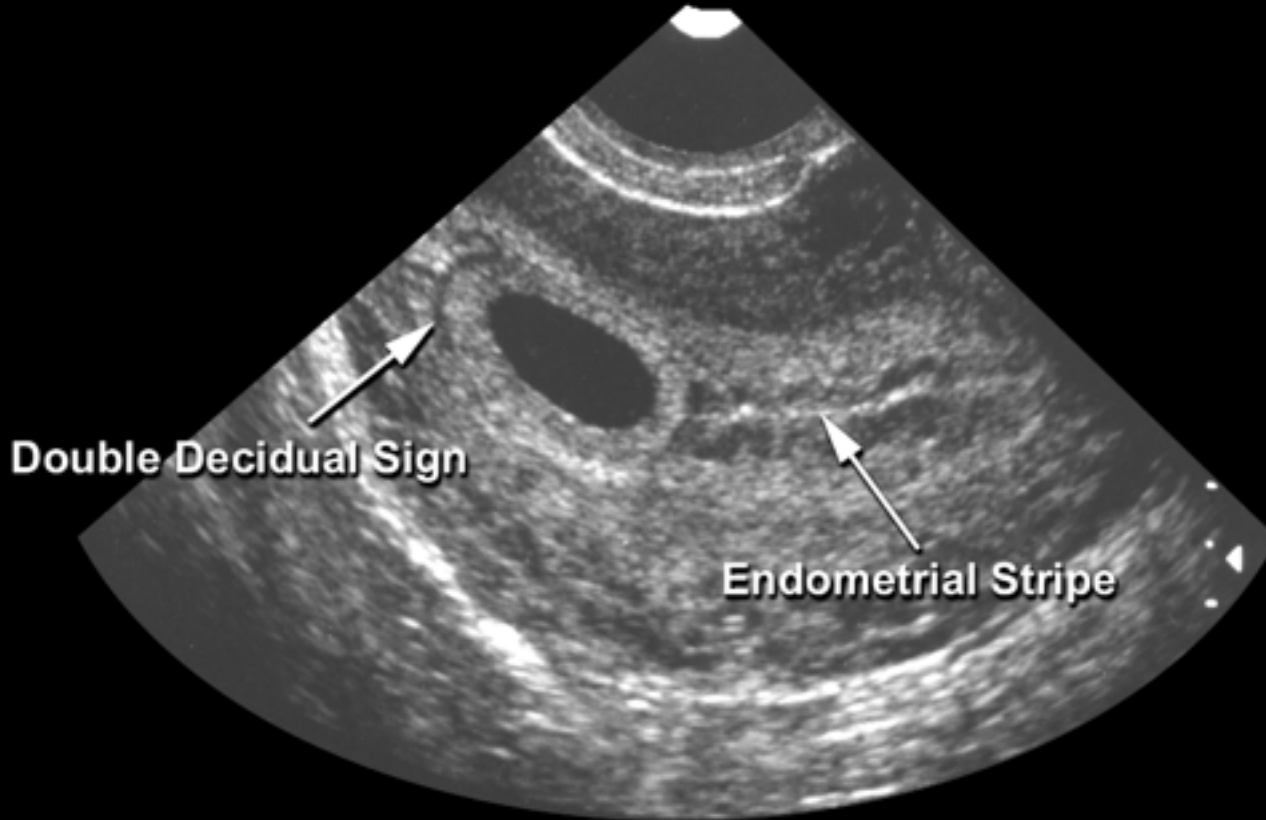
Early Pregnancy

Timing of US Findings

| <u>Embryonic Structure</u> | <u>Transvaginal Sonography</u> | <u>Transabdominal Sonography</u> |
|--------------------------------|------------------------------------|--------------------------------------|
| Gestational Sac | 4.5-5 wks | 5.5-6 wks |
| Yolk Sac | 5-5.5 wks | 6-6.5 wks |
| Fetal Pole | 5.5-6 wks | 6.5-7 wks |
| Fetal Heart Beat | <u>6 wks</u> | <u>7 wks</u> |

Early Pregnancy

Gestational Sac



double decidual sign and gestational sac

Early Pregnancy

Gestational Sac

- First indication of pregnancy
- Cystic structure in endometrium
- Transabdominal at 6 weeks
- Transvaginal at 4 1/2 weeks
- **Not definite proof of IUP**



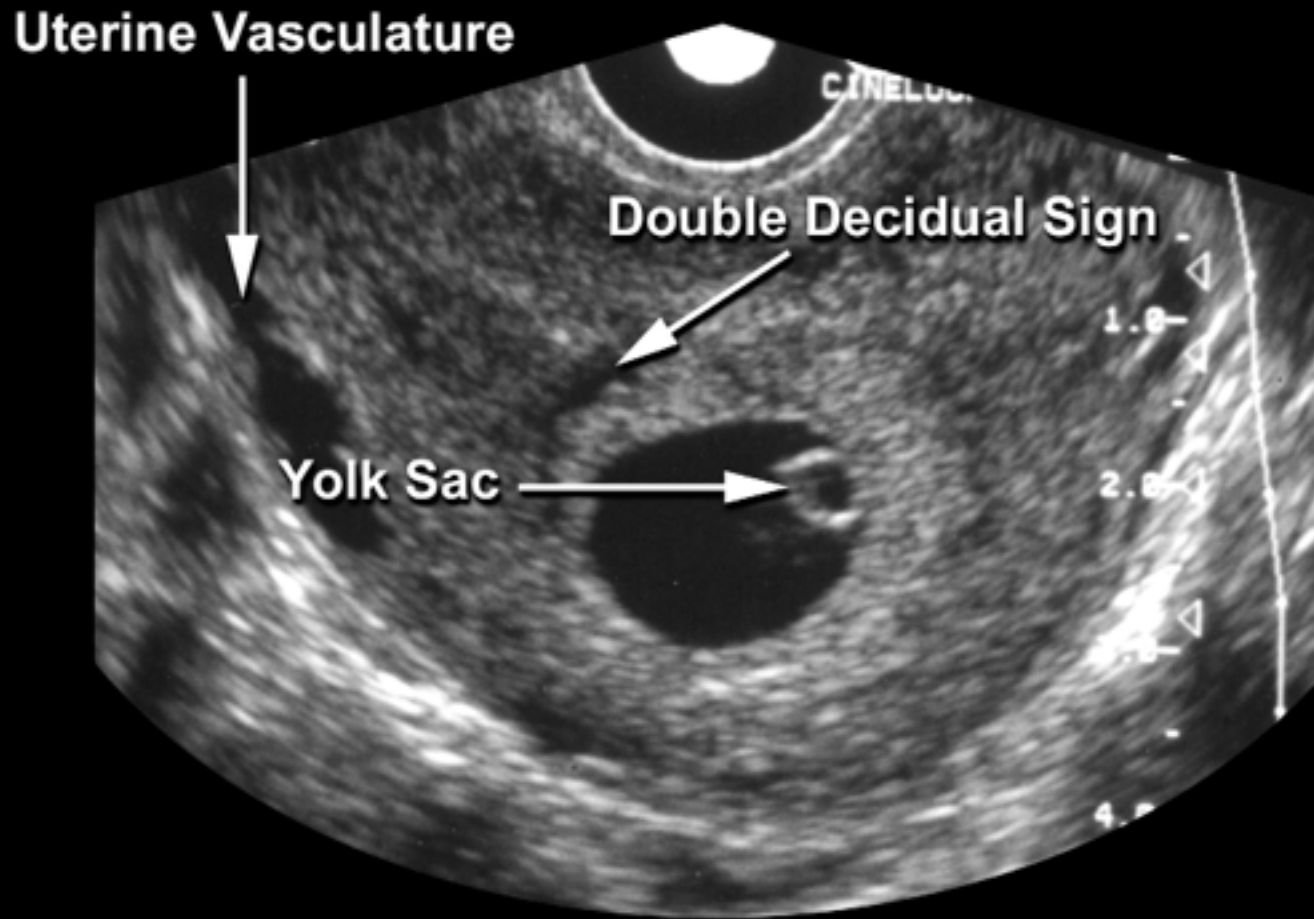
Double Decidual Sign

- Second indicator of pregnancy
- 2 bright echogenic rings around gestational sac
- Endometrial reaction to pregnancy
- **Not definite proof of IUP**



Early Pregnancy

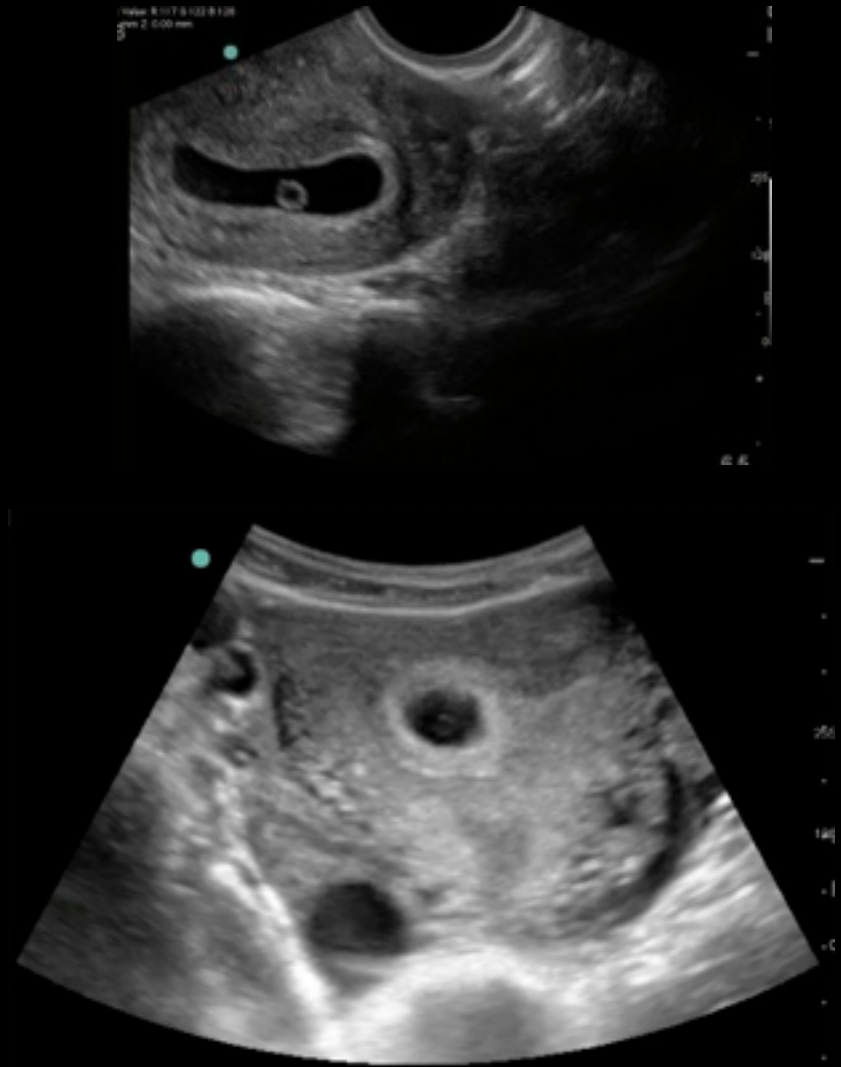
Yolk Sac



Early Pregnancy

Yolk Sac

- perfect circle inside gestational sac
- Appears at 5-6 weeks by transvaginal
- Disappears at 10-12 weeks
- **Definite marker of IUP**



Early Pregnancy

Fetal Pole

- Next embryonic structure visualized
- May be as small as 2mm
- Small mass adjacent to yolk sac



Early Pregnancy

Fetal Pole



Early Pregnancy

Fetal Pole



Early Pregnancy

Fetal Pole



Early Pregnancy

Crown-rump Length



crown-rump length

Crown-rump Length

- most accurate measurement for dating
- should always be obtained if possible
- should NOT include yolk sac

Cardiac Activity

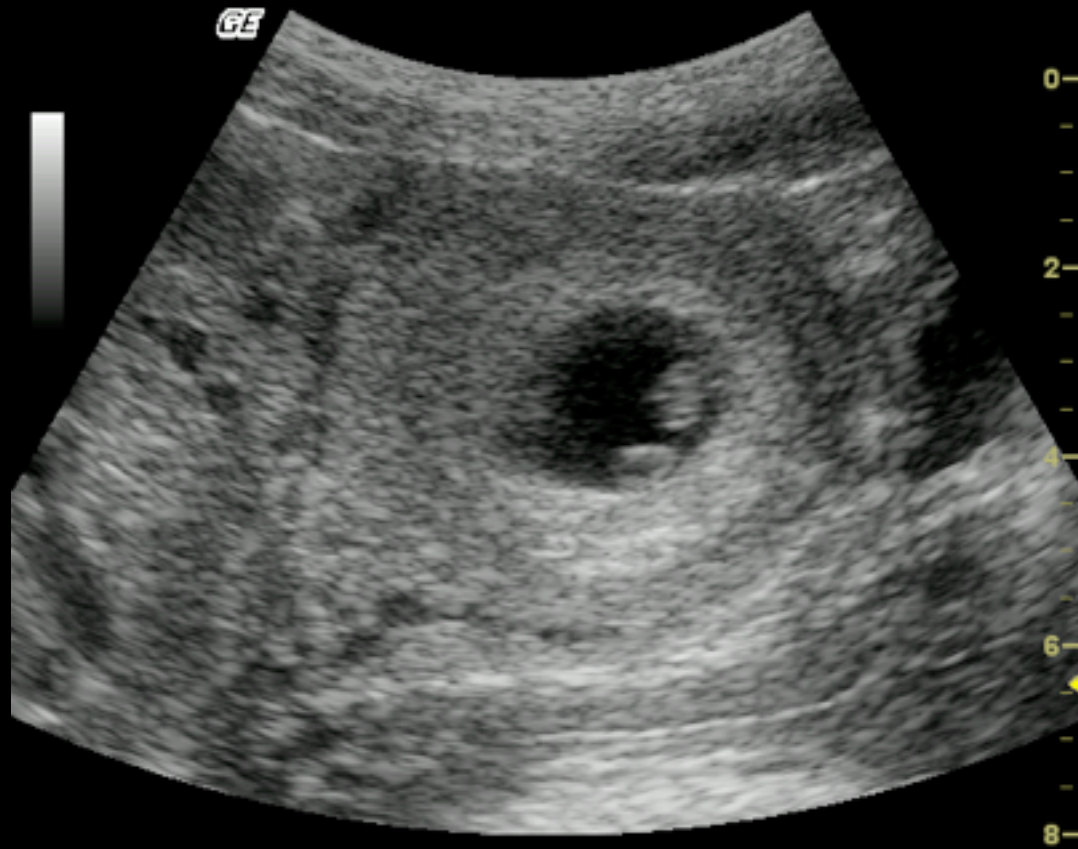
- Important prognostic indicator
- 33% SAB rate for all 1st trimester patients with pelvic pain/vaginal bleeding
- 2-5% with cardiac activity



9.2

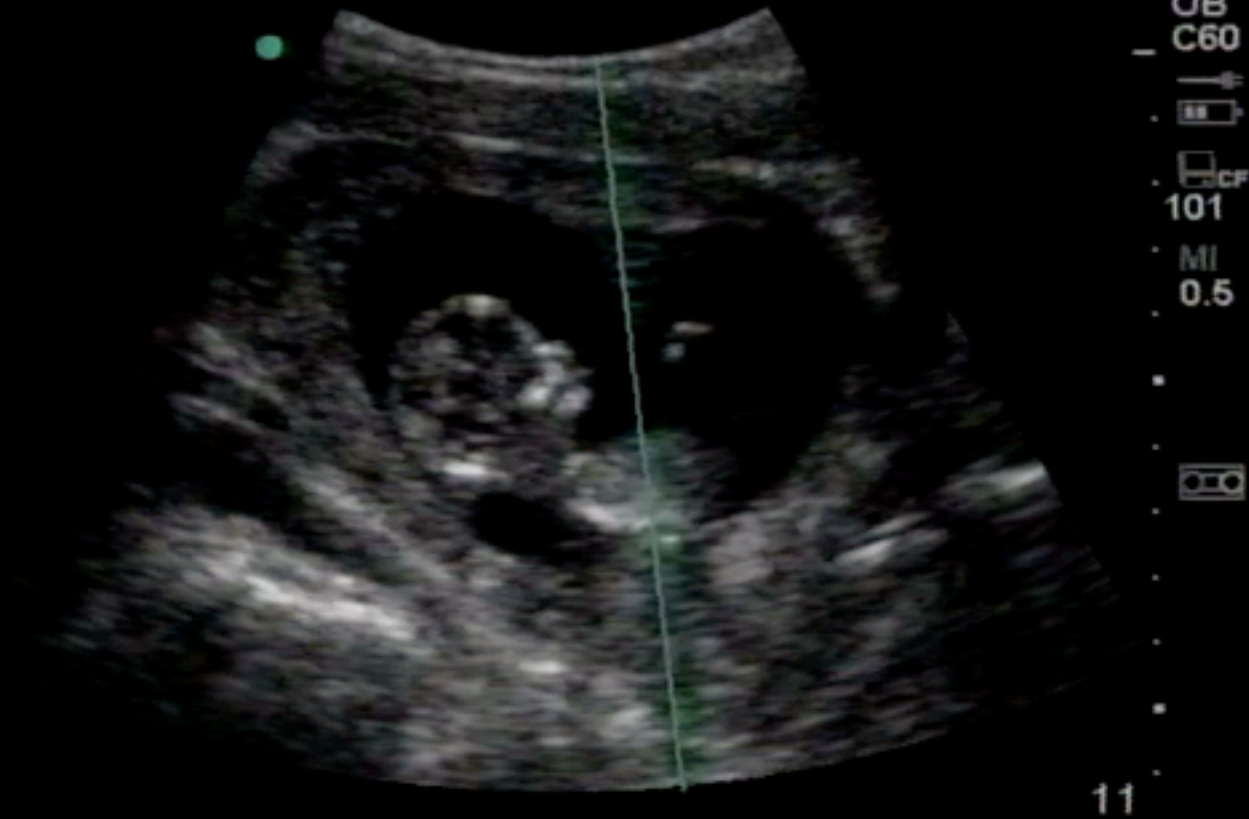
Early Pregnancy

Cardiac Activity



Early Pregnancy

Cardiac Activity

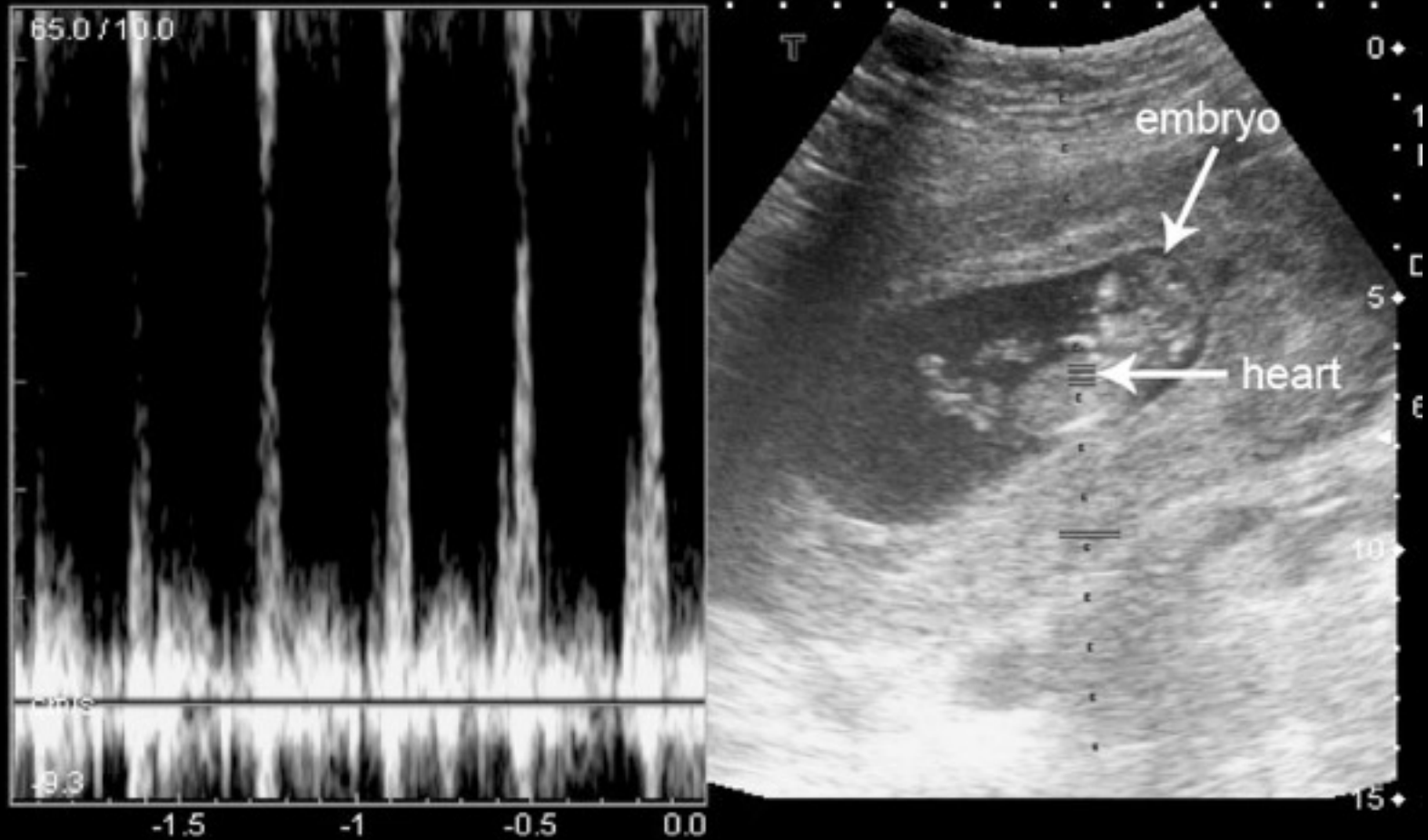


M-mode

11

Early Pregnancy

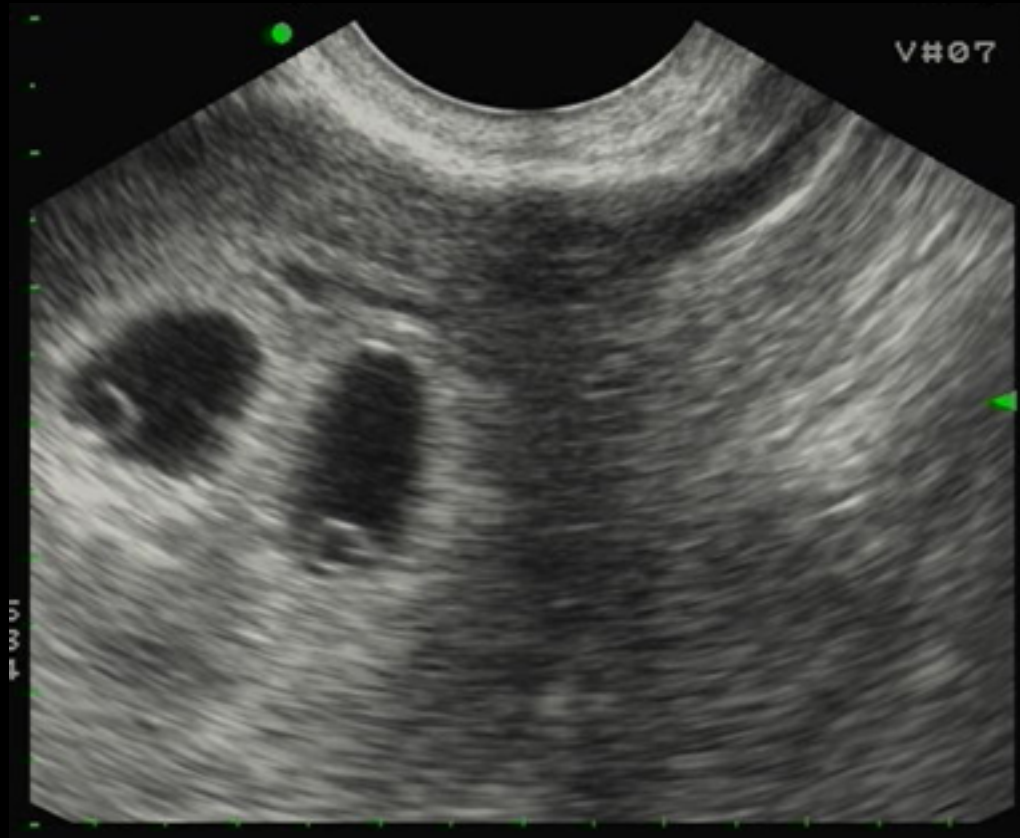
Cardiac Activity



power doppler ← do not use!

Early Pregnancy

Twin Gestation



Early Pregnancy

Twin Gestation



Early Pregnancy

Twin Gestation



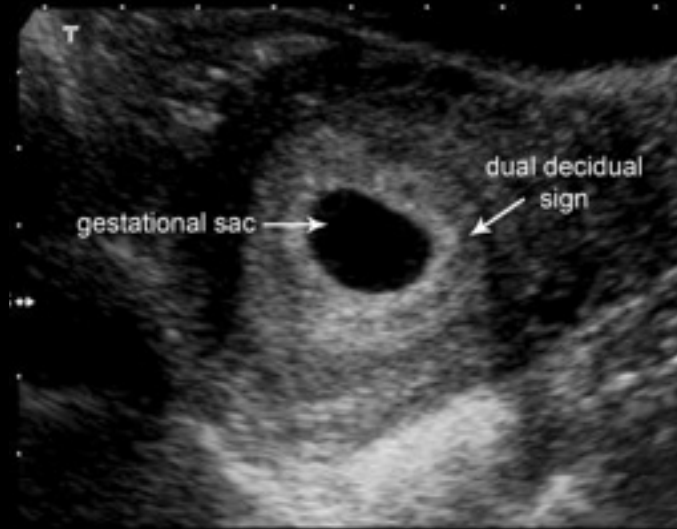
Early Pregnancy

Twin Gestation



twins

US Findings in IUP



Discriminatory Zone

| <u>Exam Type</u> | <u>Level of Beta HCG Above Which Intrauterine Pregnancy Typically Seen</u> |
|------------------------------|--|
| Transvaginal Ultrasound | 1,500-2,000 mIU |
| Transabdominal Ultrasound | 6,500 mIU |

Rule: Ectopics secrete Beta HCG at atypical levels and are commonly seen with levels less than 1,000

Ectopic Pregnancy

Epidemiology

- 2% of all pregnancies, 7-13% of those who present with pain or bleeding
- Incidence quadrupled in last 20 years
- 50% were missed before widespread use of ultrasound
 - 9% painless vaginal bleeding
 - 36% no adnexal tenderness
 - 24% ruptured ectopics without pelvic tenderness
- Still the #1 cause of maternal death in 1st trimester

Ectopic Pregnancy

To Rule out Ectopic:

- Find an IUP
- Chance of both IUP and EP is 1/8000-1/30,000
- As high as 1/100 if pt takes fertility agents

Ectopic Pregnancy

β -hCG Levels

- Correlate roughly with gestational age
- One level means almost nothing
- Serial levels are helpful
- 40% ectopics have a β -hCG level <1000

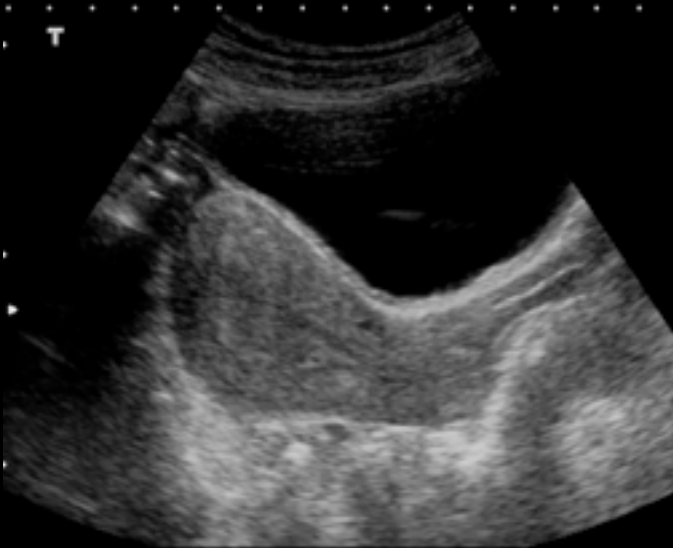
Ectopic Pregnancy

Ultrasound Findings

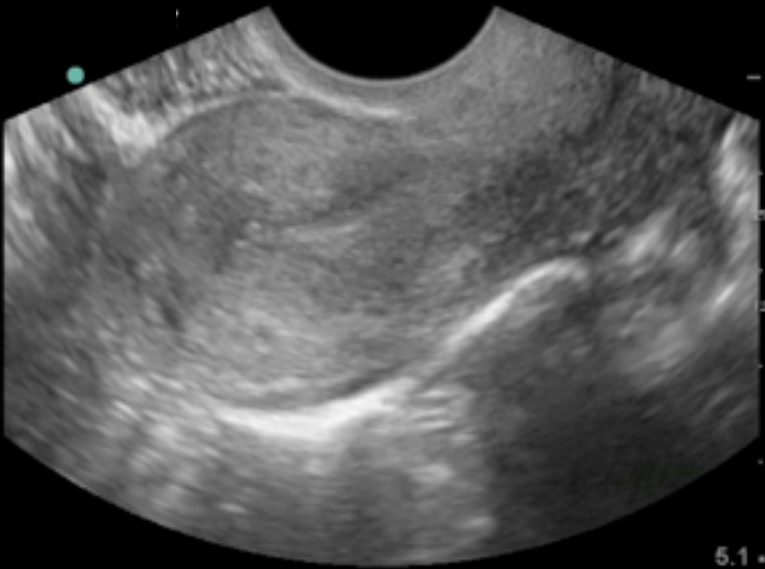
- Empty uterus (or pseudosac)
- Blood in pouch of Douglas
- Blood in Morison's pouch
- Tubal ring
- Complex mass
- Obvious ectopic pregnancy

Ectopic Pregnancy

Empty Uterus

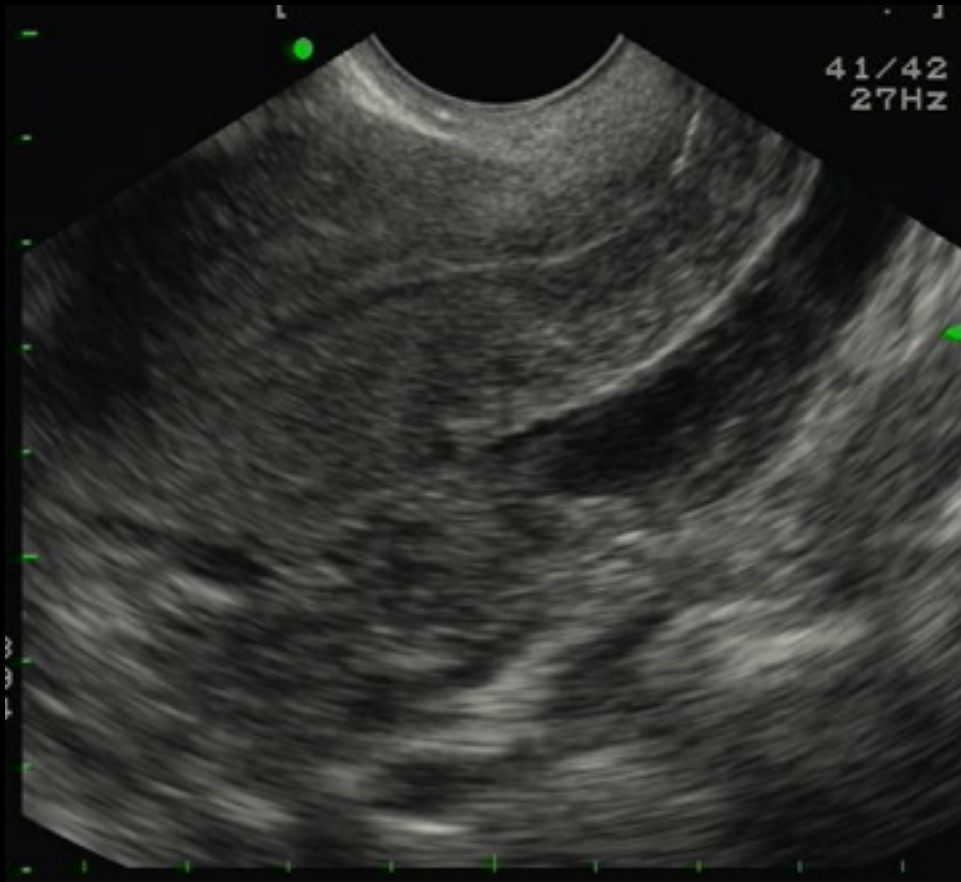


- Empty uterus in presence of positive B-HCG: suspect ectopic
- Obtain formal ultrasound



Ectopic Pregnancy

Free Pelvic Fluid



- Fluid in recto-uterine space
 - sensitive not specific sign of ectopic
 - small amount of fluid is normal

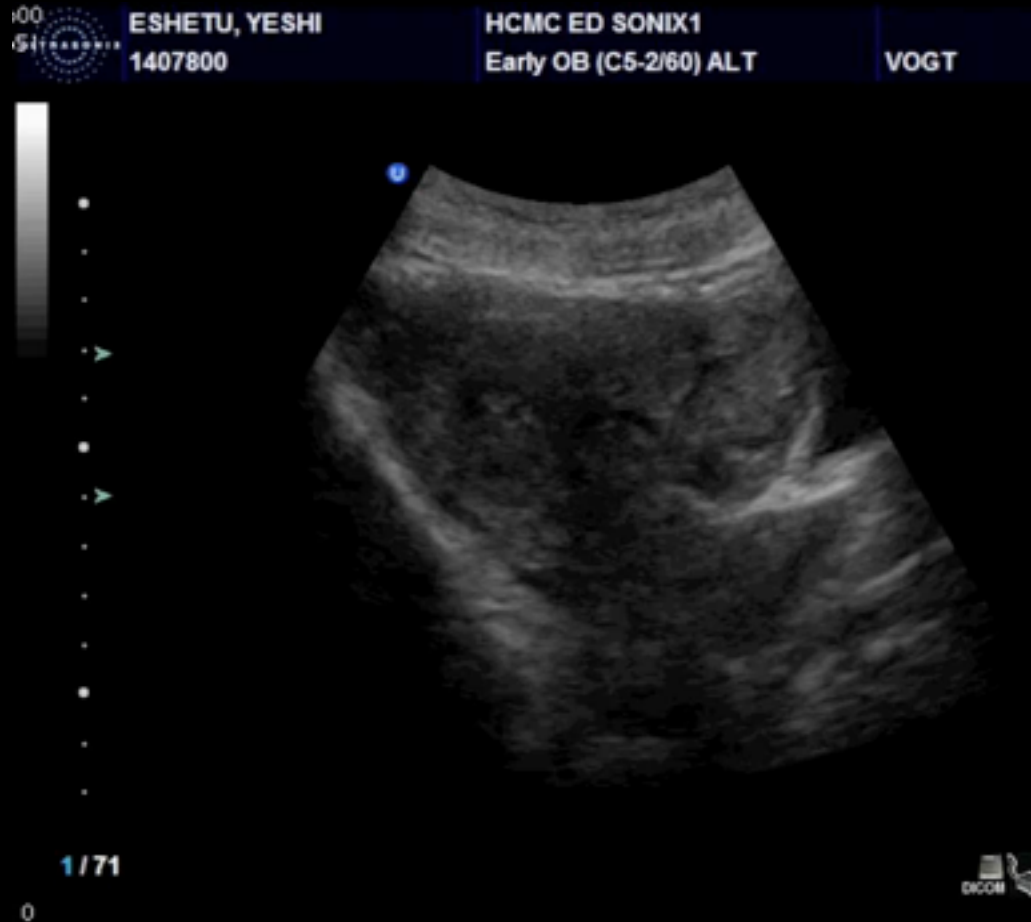
Ectopic Pregnancy

Free Pelvic Fluid



Ectopic Pregnancy

Free Pelvic Fluid



Ectopic Pregnancy

Free Pelvic Fluid



free fluid and clot

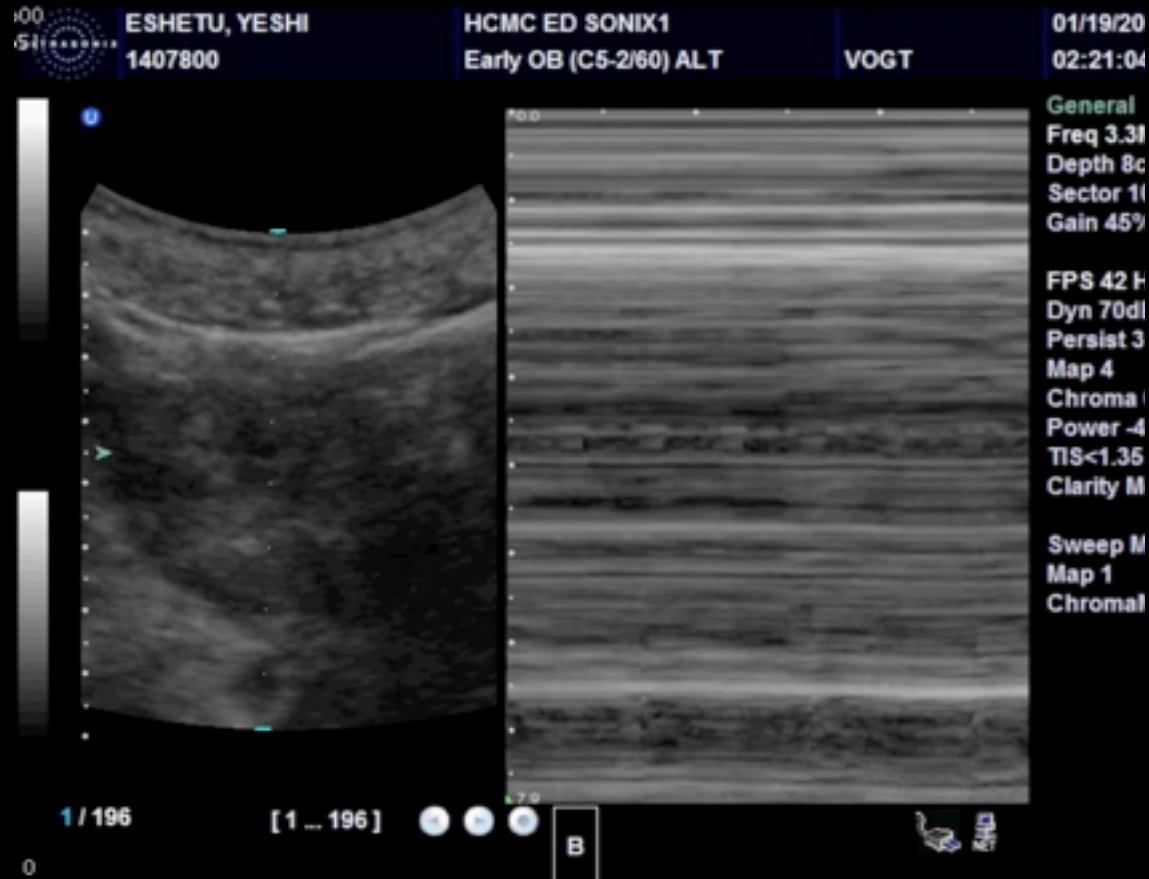
Ectopic Pregnancy

Adnexal mass

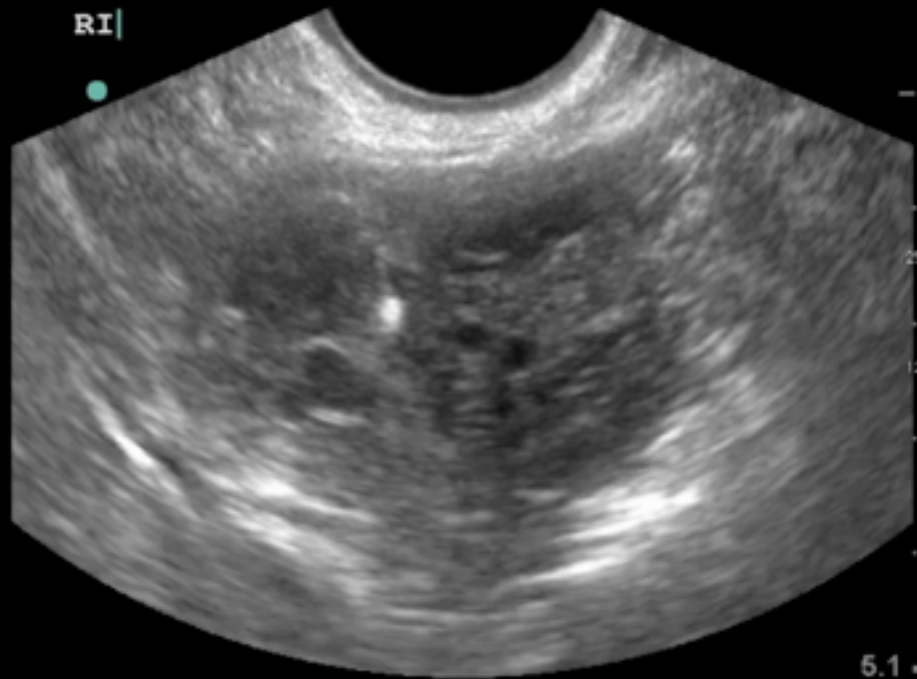


Ectopic Pregnancy

Adnexal mass



Adnexal mass



- Usually present but may be difficult to discern from surrounding structures
- In conjunction with, +BHCG, empty uterus and free fluid, adnexal mass is *very* suggestive of ectopic

Ectopic Pregnancy

“Ring of Fire”

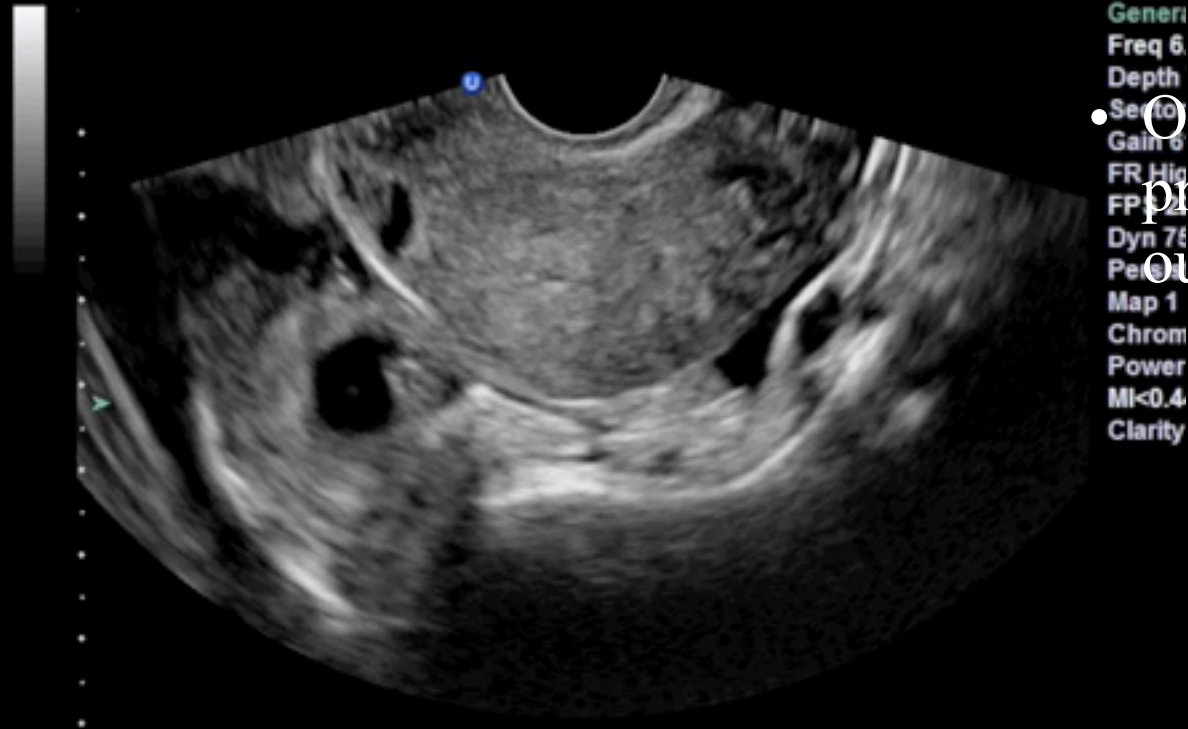


- Ectopic is usually highly vascularized
- Color flow on adnexal mass may demonstrate “ring of fire” appearance

Ectopic Pregnancy

Obvious Ectopic

600
673 U
GAINES, HCMC ED SONIX1 (5069768A-2286-4f79-96F5-7f) EC9-5/10-OB-[Early OB] (5069768A-2286-4f79-96F5-7f) 08:17:



- Occasionally a developed pregnancy may be seen outside the uterus

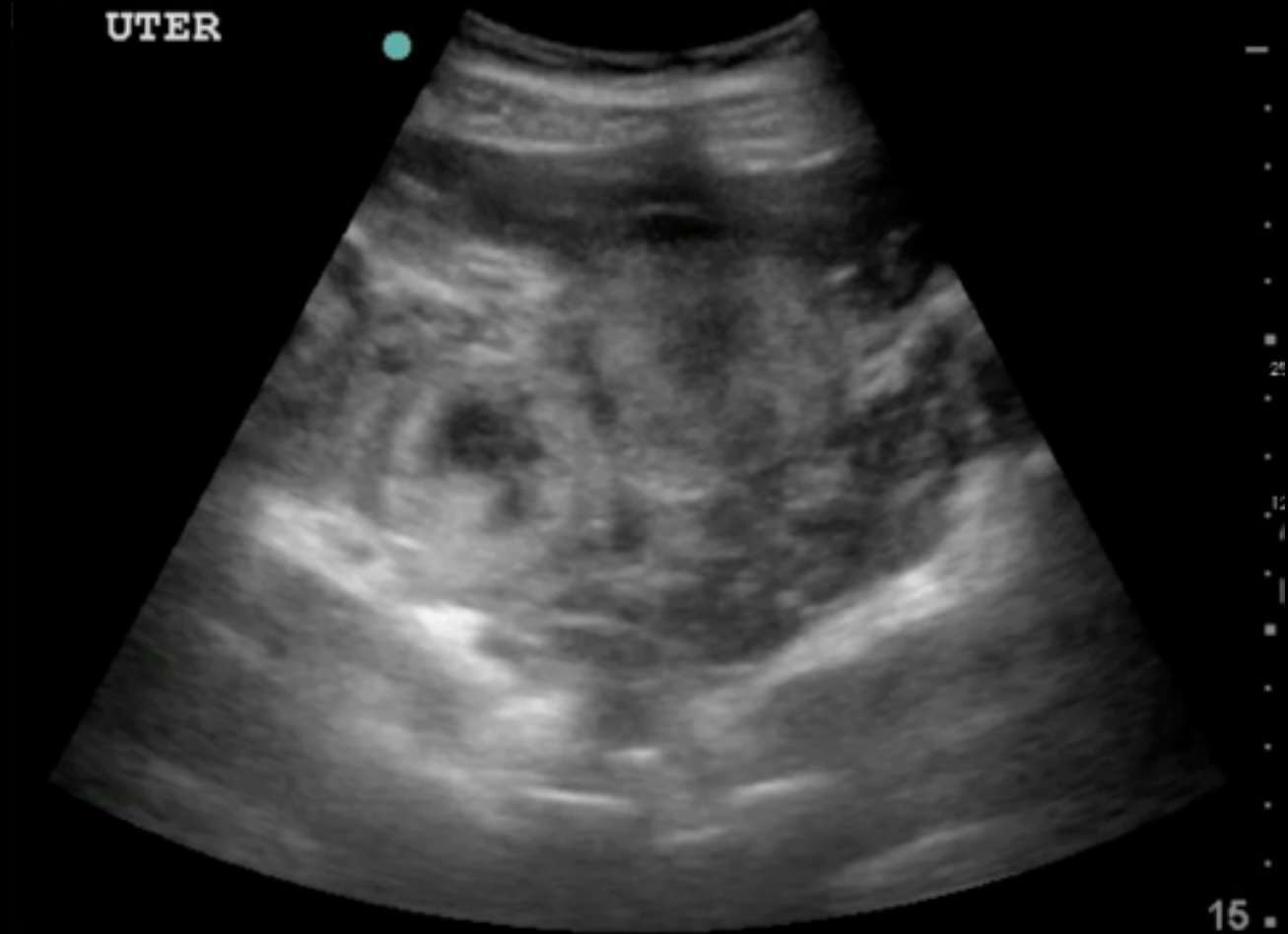
Ectopic Pregnancy

Obvious Ectopic



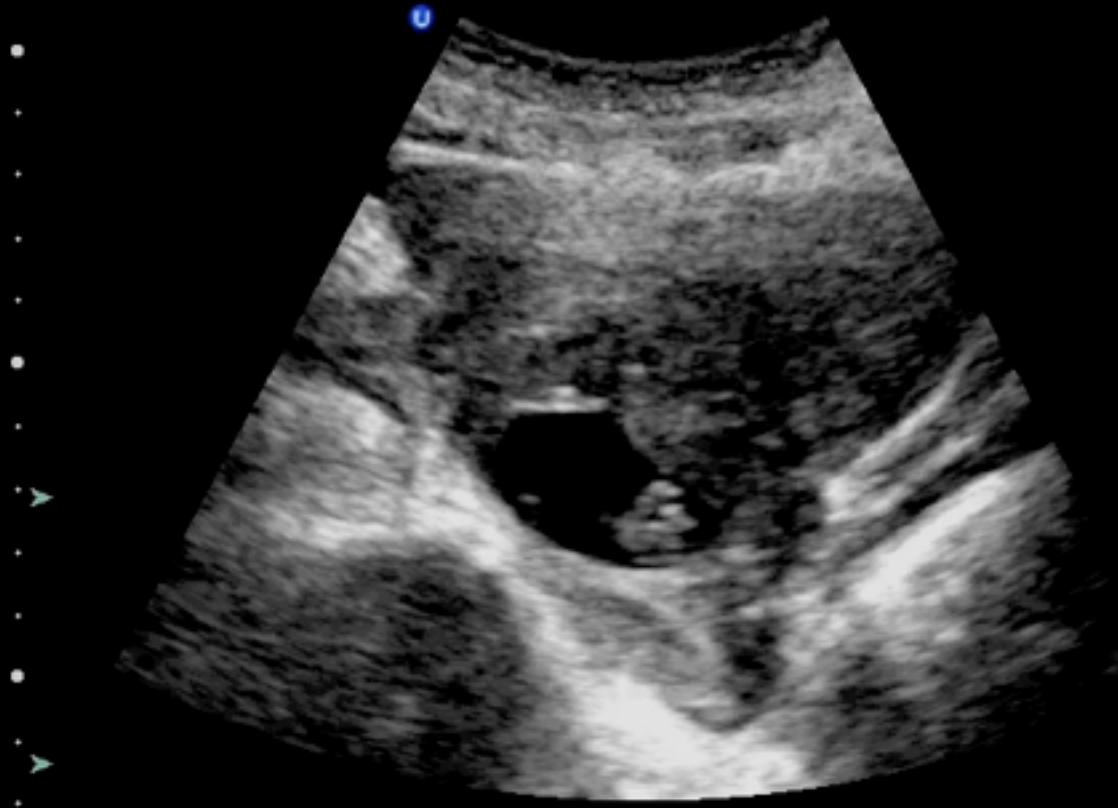
Ectopic Pregnancy

Obvious Ectopic



Ectopic Pregnancy

Obvious Ectopic



Ectopic Pregnancy

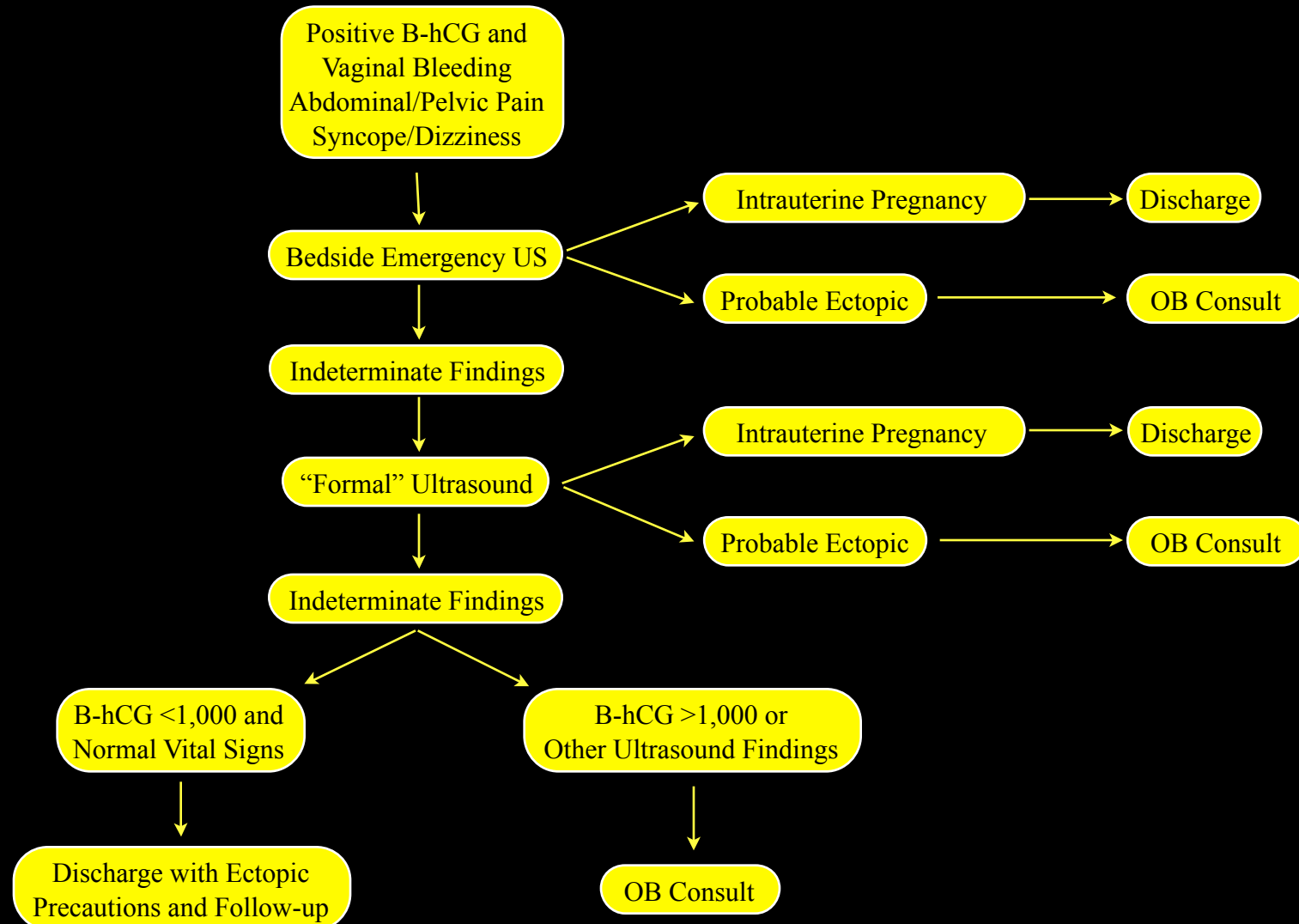
Free Intra-abdominal Fluid



- Ectopic in presence is free intra-abdominal fluid is surgical emergency
- FAST exam should be performed

Ectopic Pregnancy

Management Algorithm



Ectopic Pregnancy

Management Algorithm

- Young woman with hypotension and abdominal pain
- Positive pregnancy test
- Empty uterus
- FAST exam
- Directly to OR

Abnormal Pregnancy

Abnormal Pregnancy

Blighted Ovum

- no evidence of yolk sac and/or fetal pole
- gestational sac greater than 2cm



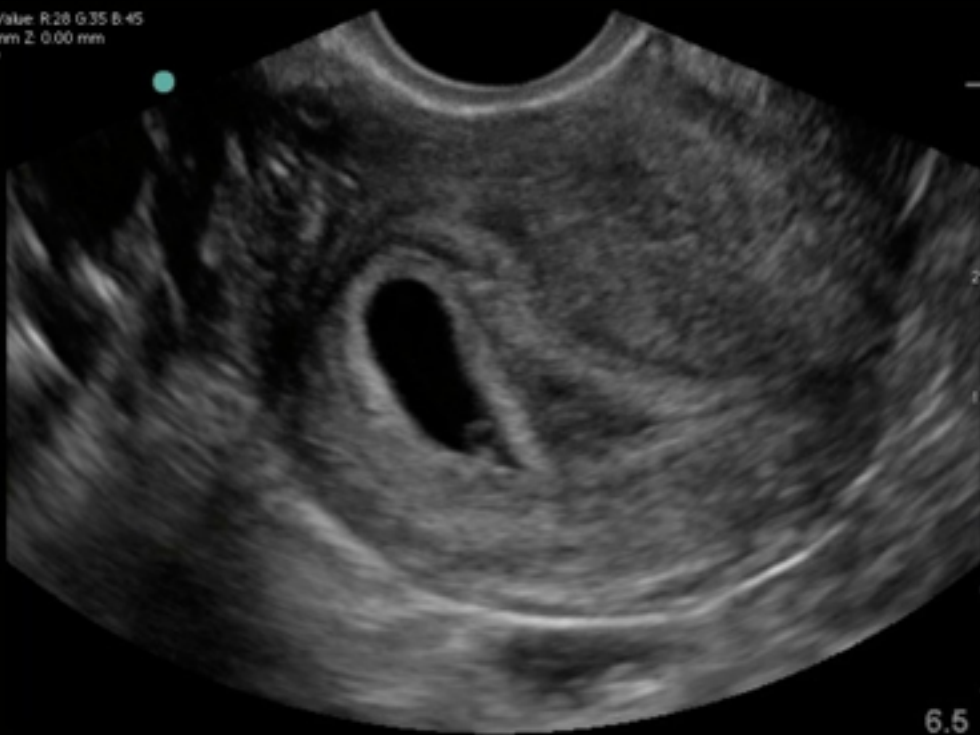
Abnormal Pregnancy

Blighted Ovum



Abnormal Pregnancy

Subchorionic Hemorrhage



- hematoma development between chorion and uterine wall
- common cause of 1st trimester bleeding
- does not always lead to spontaneous abortion

Abnormal Pregnancy

Subchorionic Hemorrhage

Image size: 640 x 480
Size: 1447 bytes
WL: 127 Ww: 255



Zoom: 2268
Fps: 1/180

Incomplete Abortion



No cardiac activity

Abnormal Pregnancy

Intrauterine Fetal Demise

ue: R28 G.55 B.45
a Z: 0.00 mm



255
128
0
15

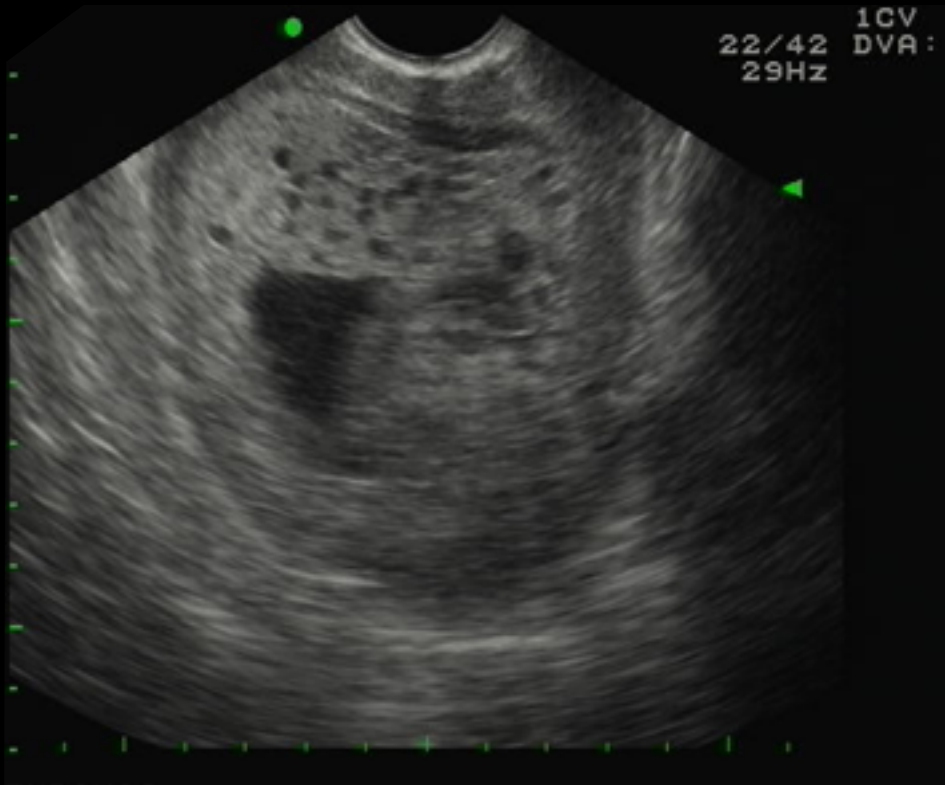
- IUFD: presence of fetus without cardiac activity
- advisable to obtain formal US

Gestational Trophoblastic Disease

- Proliferative disease of the trophoblast
- 80% benign hydatidiform mole
- 12-15% invasive mole
- 5-8% choriocarcinoma
- Vaginal bleeding, uterine size >> dates, severe persistent hyperemesis, early preeclampsia, β hcg >100,000

Abnormal Pregnancy

Gestational Trophoblastic Disease



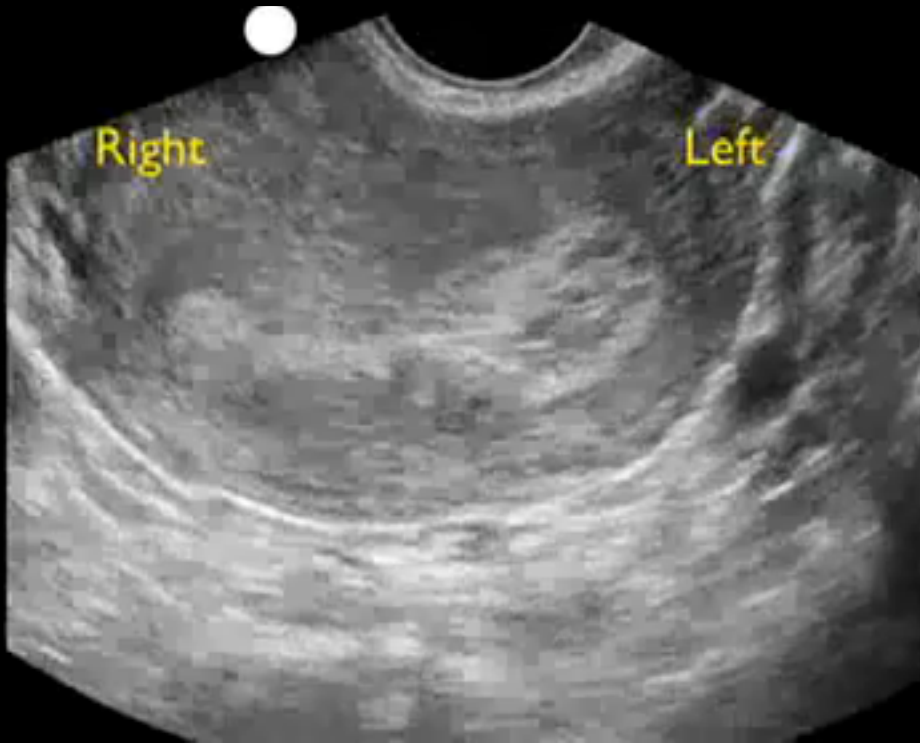
- Sonographic appearance often called “snow storm” or “grapes”

Abnormal Pregnancy

Gestational Trophoblastic Disease



Interstitial Pregnancy



- Rare form of ectopic
- Pregnancy implanted and grows into the uterine wall
- Associated with high mortality if ruptured

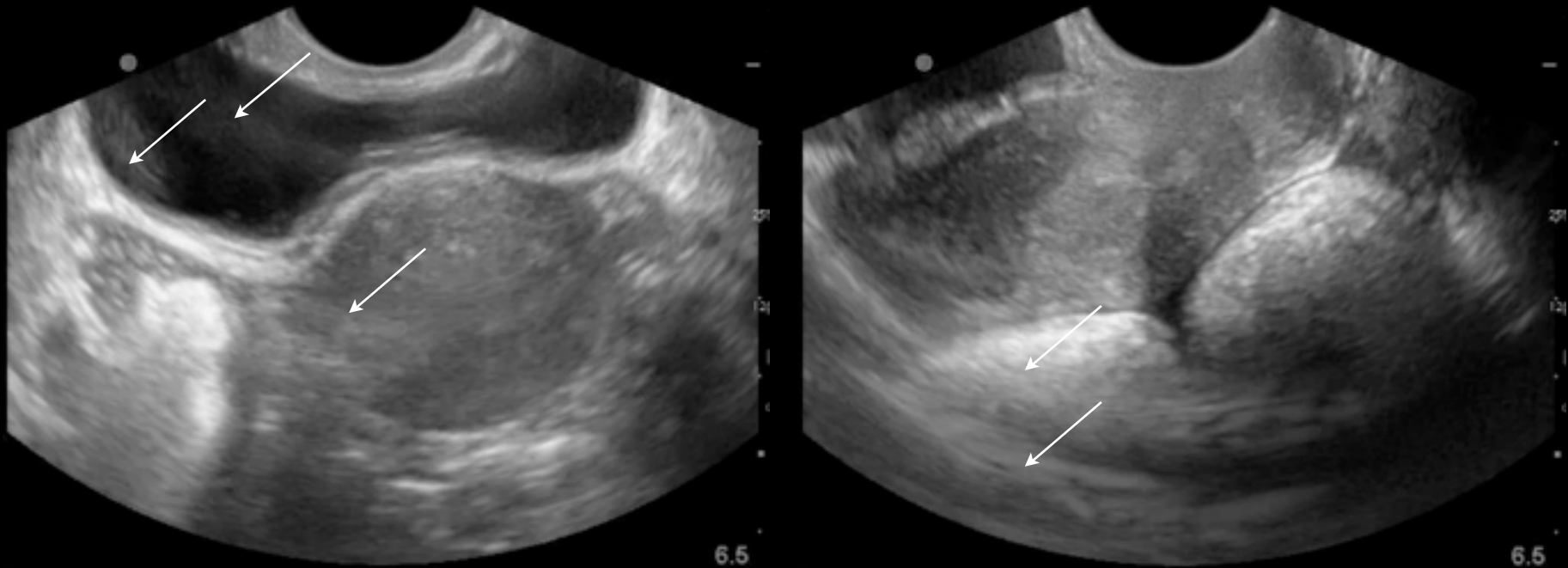
*courtesy of Phil Perrera

Pitfalls

Common Errors

- Failure to perform pelvic US because of low Beta HCG
- Performing transvaginal ultrasound without transabdominal scan
- Transabdominal probe allows broader view of pelvis

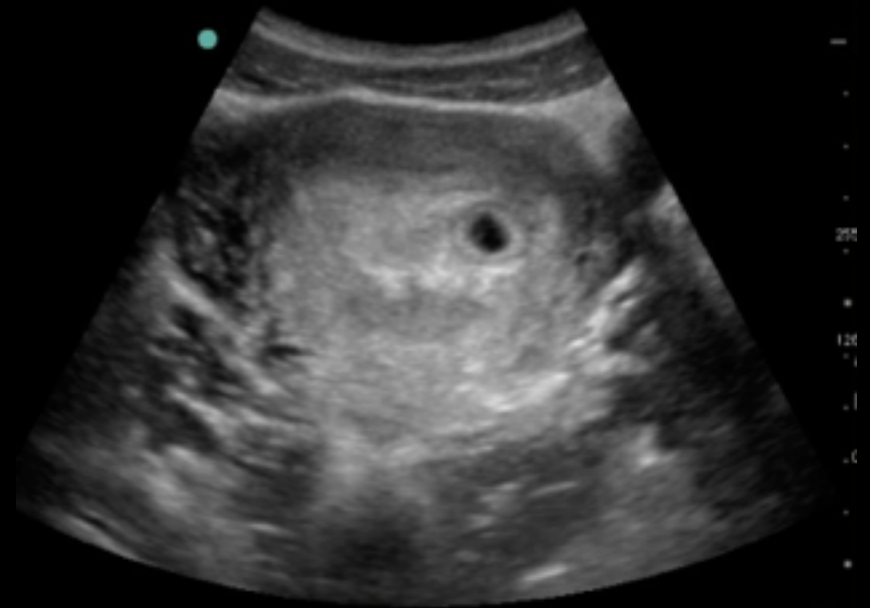
Reverberation Artifact



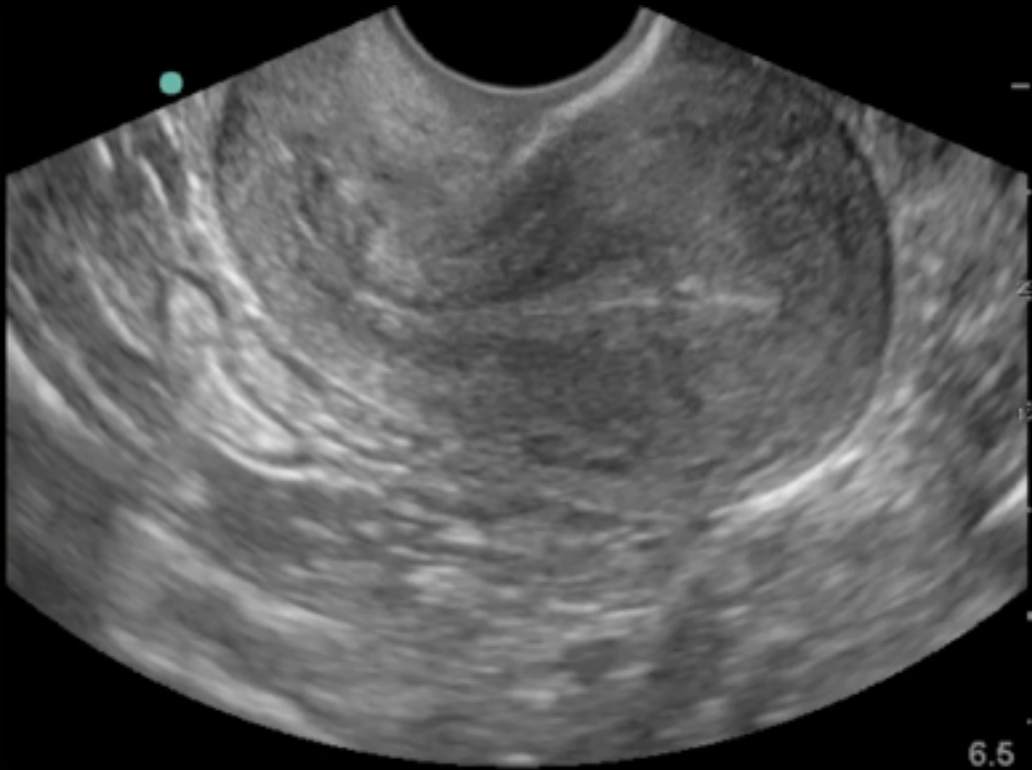
- Reverberation artifact from full bladder obscures view
- Empty bladder before transvaginal ultrasound

Pseudogestational Sac

- seen in small percentage of ectopics
- decidual tissue reaction
- typically less than 10mm
- no double decidual sign
- may be confused with gestational sac



Retroverted Uterus



- Common finding
- Cervix seen on left with uterine body on right

Heterotopic Pregnancy



- *Extremely* uncommon unless patient on fertility agents
- Always ask this question!

Late Pregnancy

Late Pregnancy

Main Goals in Late Pregnancy

- Determination of gestational age
- Fetal cardiac activity, fetal movement
- Head position
- Placenta - placenta previa

Late Pregnancy

Main Goals in Late Pregnancy



cardiac activity

Late Pregnancy

Main Goals in Late Pregnancy



fetal motion

Late Pregnancy

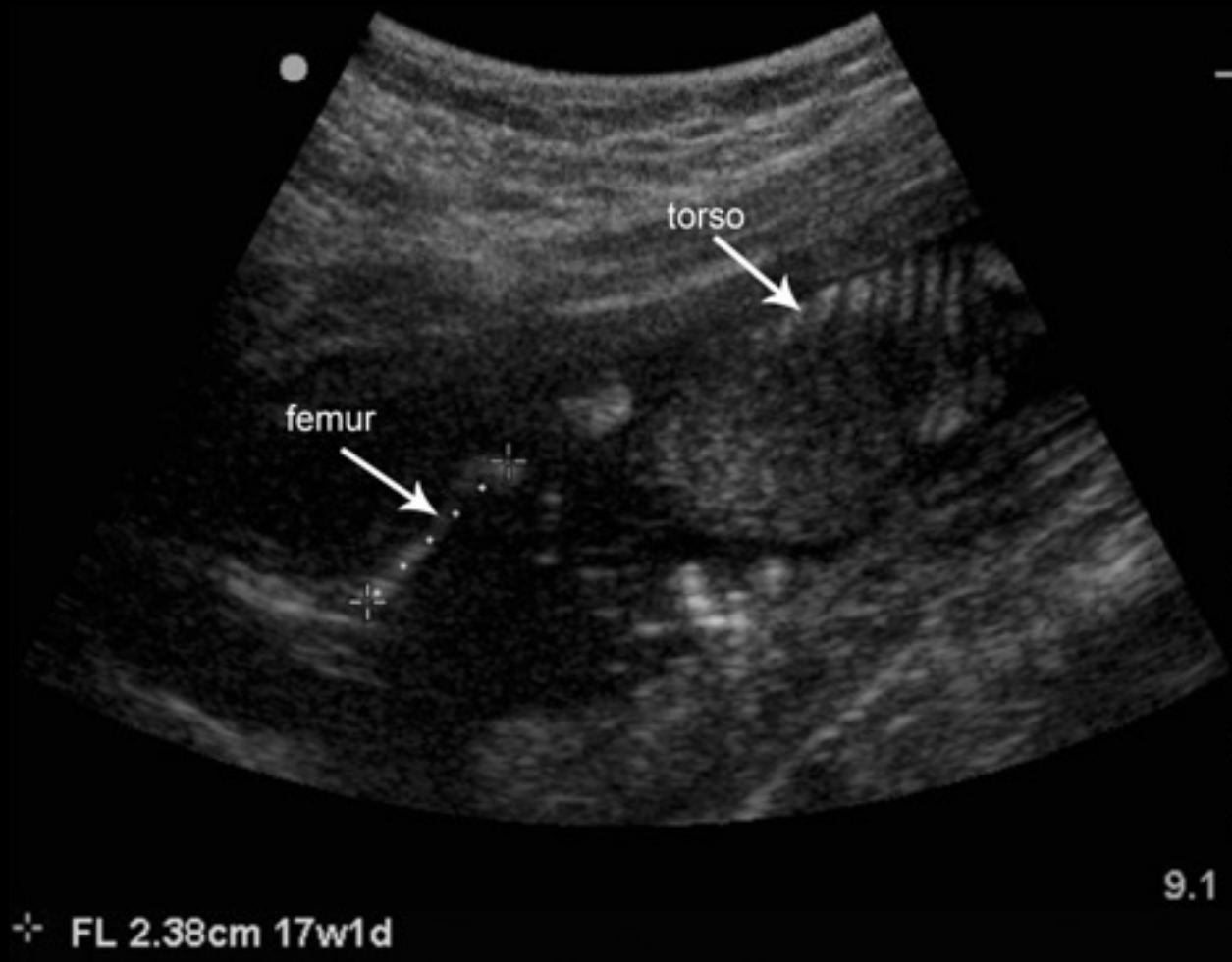
Main Goals in Late Pregnancy



gestational age - biparietal diameter 9.1

Late Pregnancy

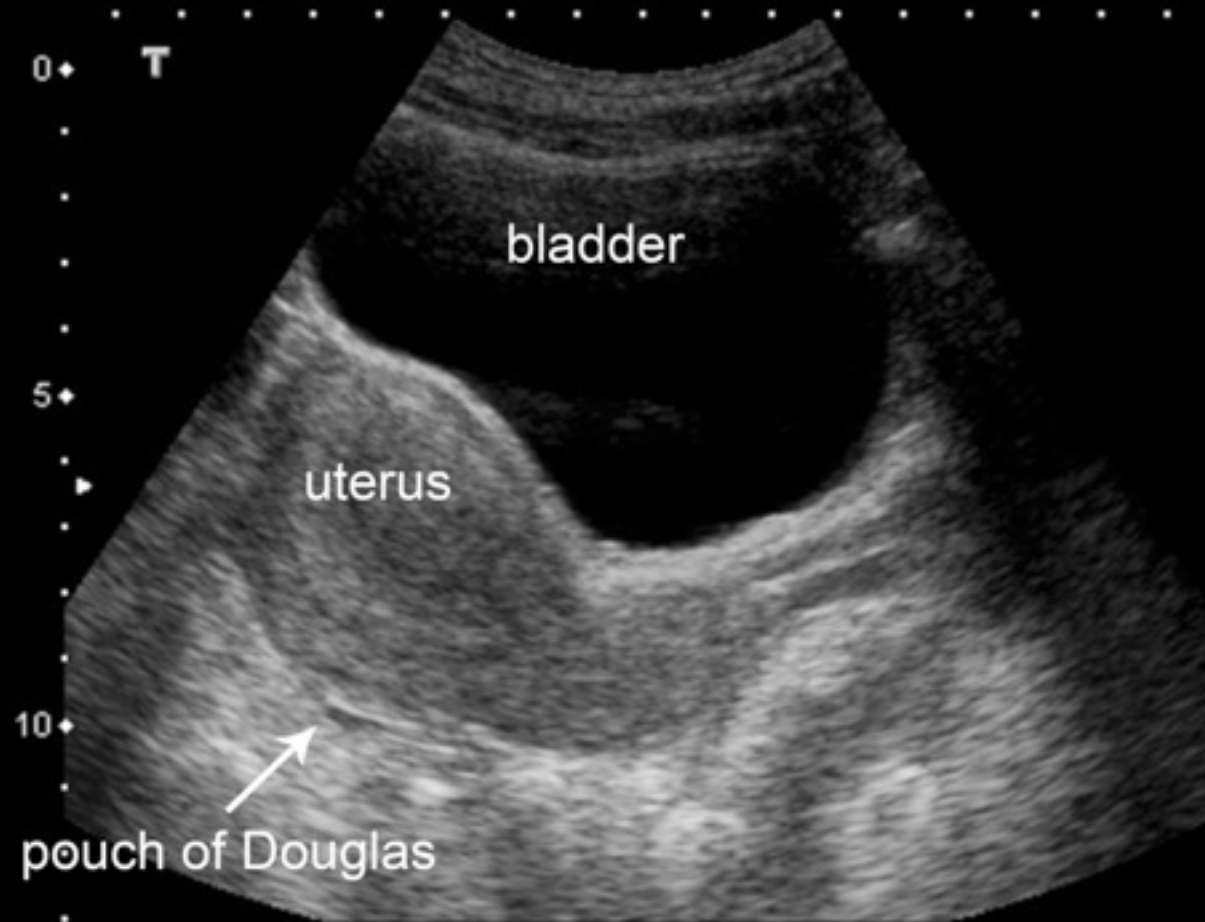
Main Goals in Late Pregnancy



gestational age - femur length

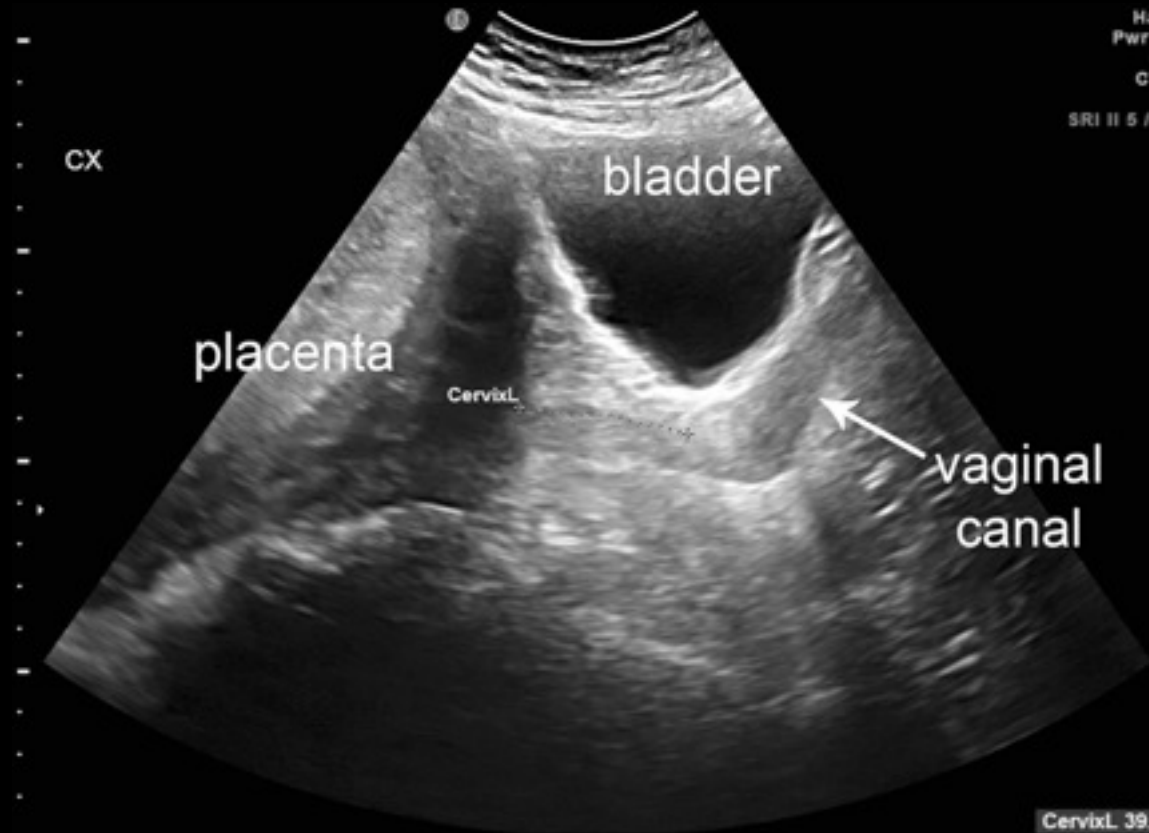
Late Pregnancy

Main Goals in Late Pregnancy



Late Pregnancy

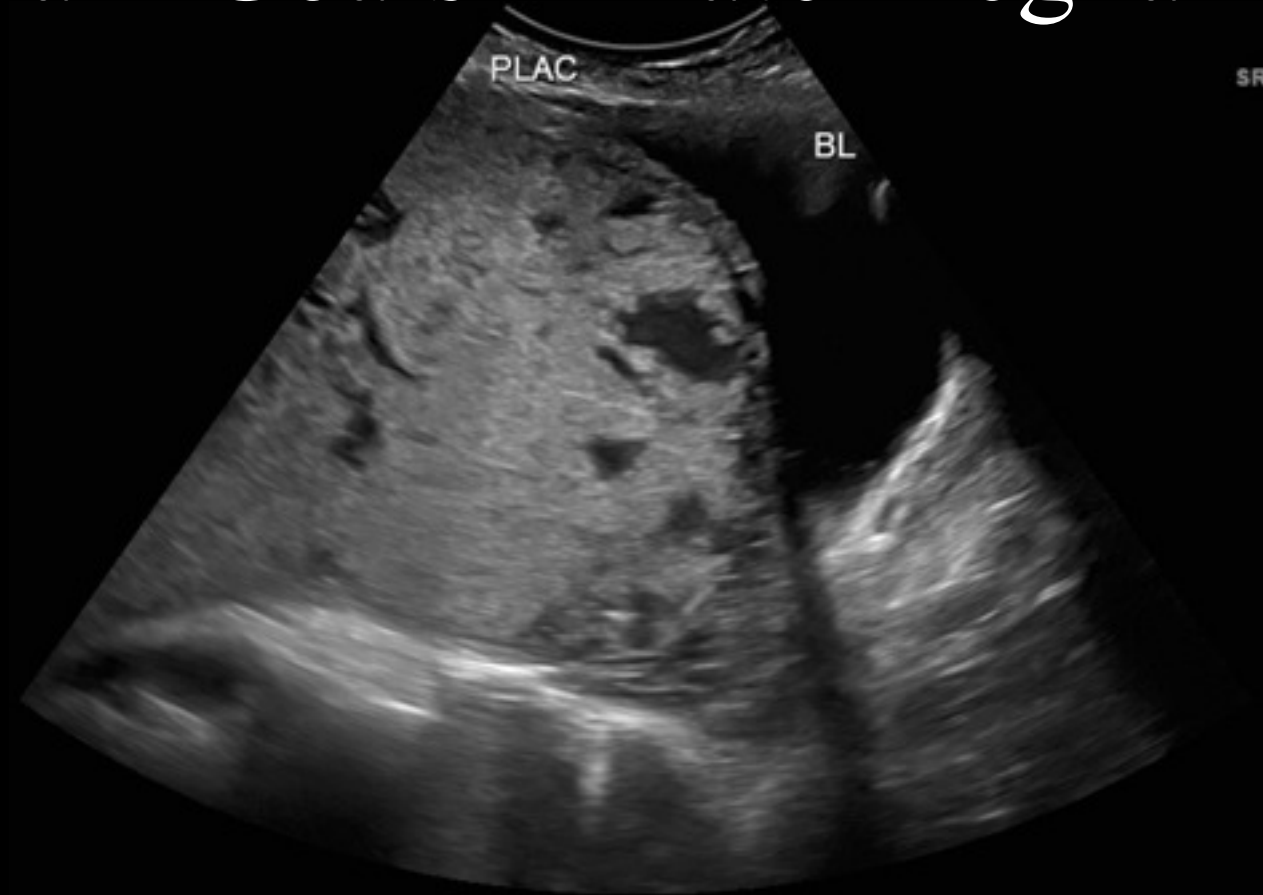
Main Goals in Late Pregnancy



placenta previa

Late Pregnancy

Main Goals in Late Pregnancy



placenta previa

Placental Abruption

- Abnormal placental separation after 20wks
- Vaginal bleeding, abdominal pain unreliable
- Rule out placenta previa
- Ultrasound shows hemorrhage in 50%
 - not good enough
- Diagnosis is clinical and employs cardiotocographic monitoring

Non-pregnant Patients

Non-pregnant Patients

Main Goals in Non-pregnant Patients

- Determining the etiology of abdominal pain
-pelvic organs or other etiology
- Hemorrhagic ovarian cyst
- Fibroids
- Ovarian torsion
- Tubo-ovarian abscess

Non-pregnant Patients

Case

- 21 y/o female with 1 day of constant, worsening RLQ pain
- No F/C/diarrhea/back pain/dysuria/hematuria/constipation. +N/V
- Sexually active, LMP 2 weeks ago, no vaginal sx's.
- No previous surgery.

Non-pregnant Patients

Case

- Vitals: P 110, BP 115/90, T 99.0, 100% RA
- Abd: soft, diffusely tender, much worse in RLQ.

Non-pregnant Patients

Differential

- appendicitis
- pid
- ectopic
- ovarian cyst
- torsion
- tubo-ovarian abscess
- endometriosis
- kidney stone
- musculoskeletal pain
- constipation

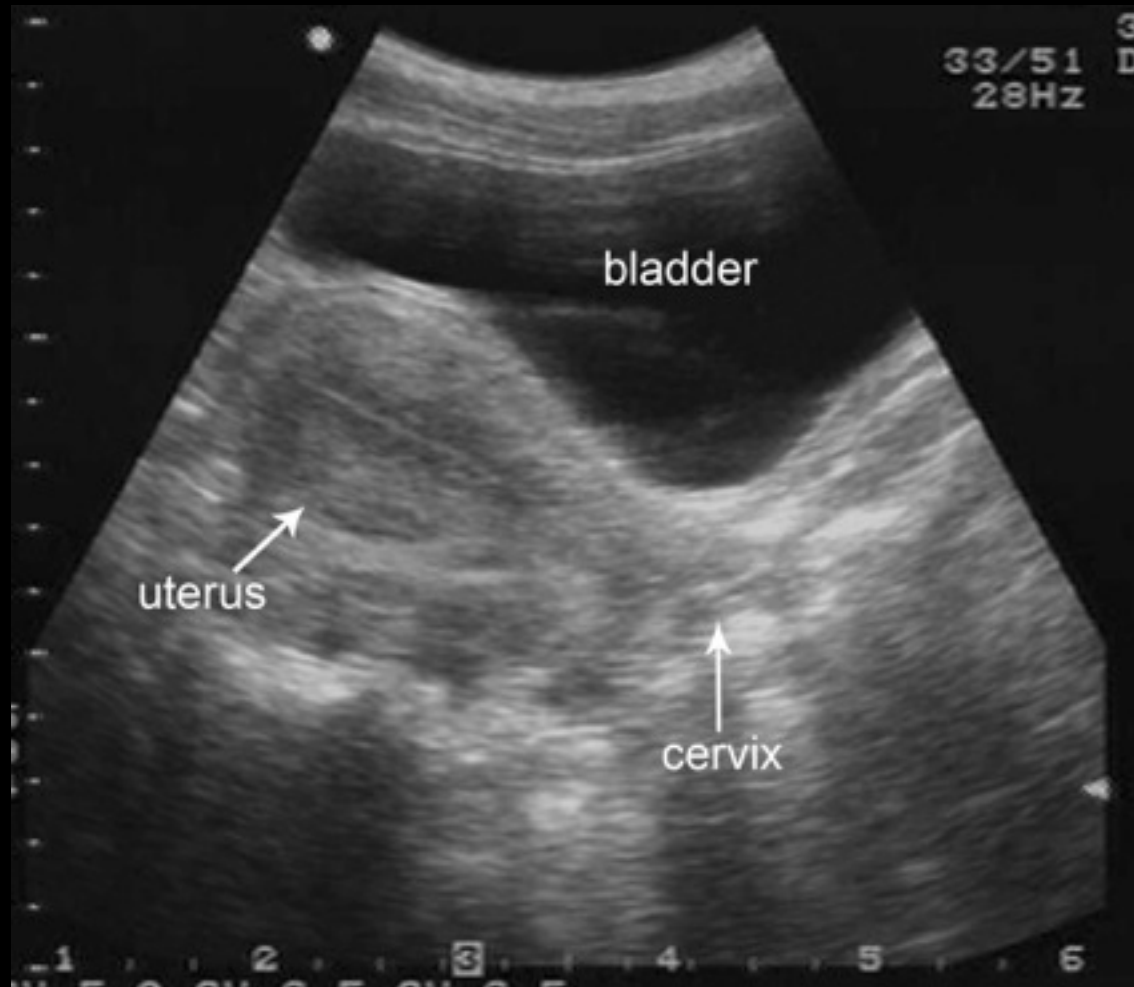
Non-pregnant Patients

Case



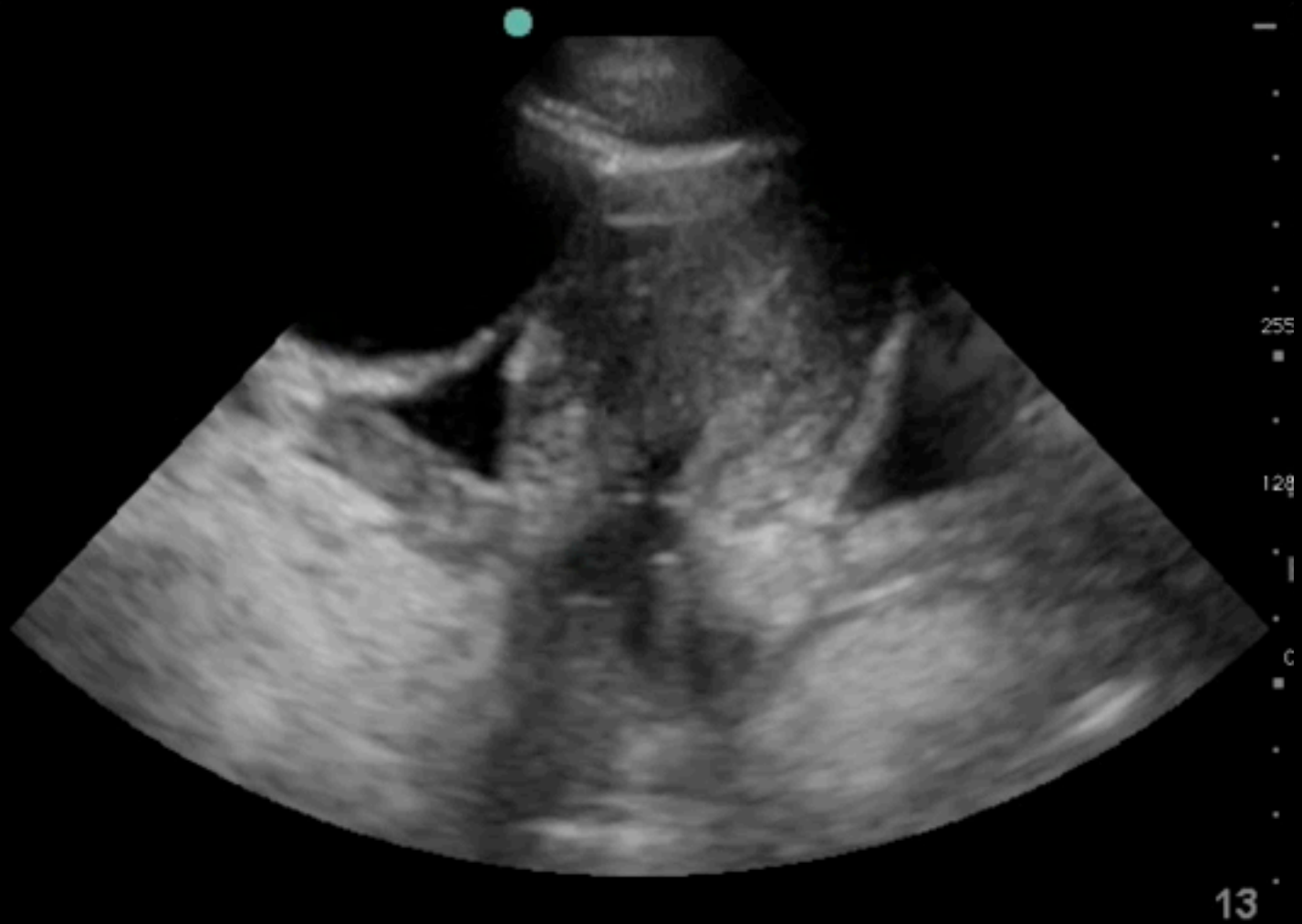
Non-pregnant Patients

Case



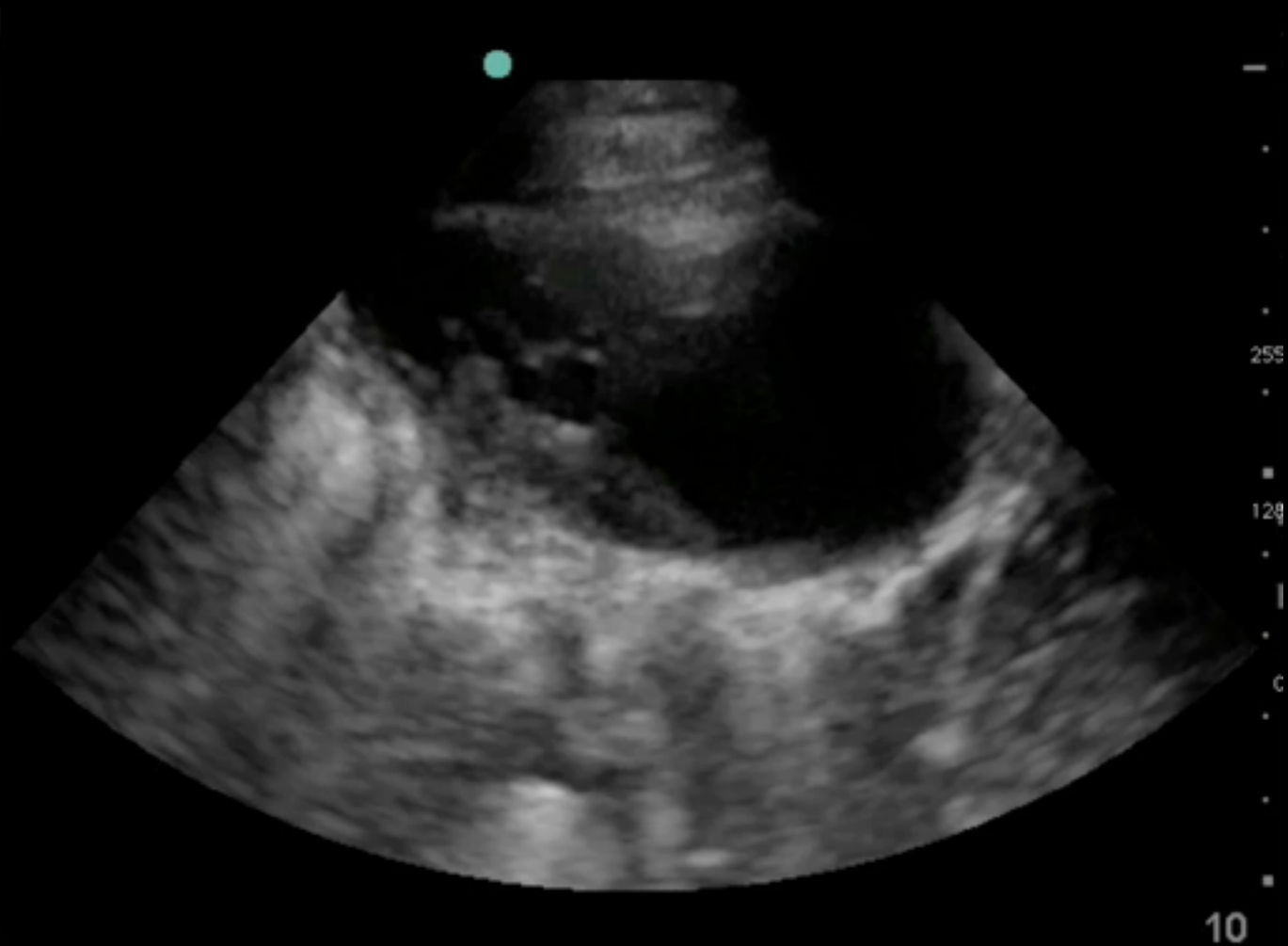
Non-pregnant Patients

Case



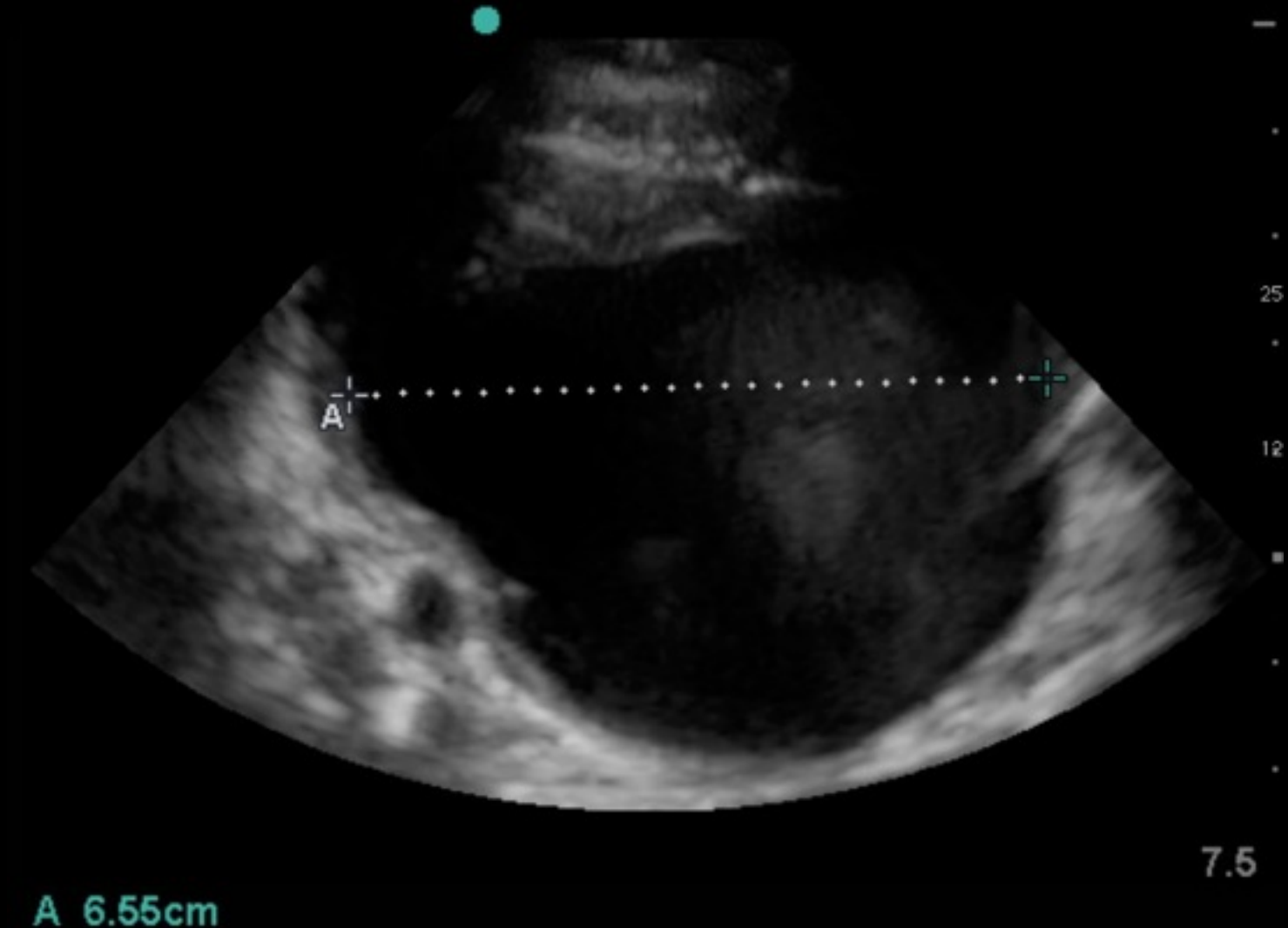
Non-pregnant Patients

Main Goals in Non-pregnant Patients



Non-pregnant Patients

Main Goals in Non-pregnant Patients



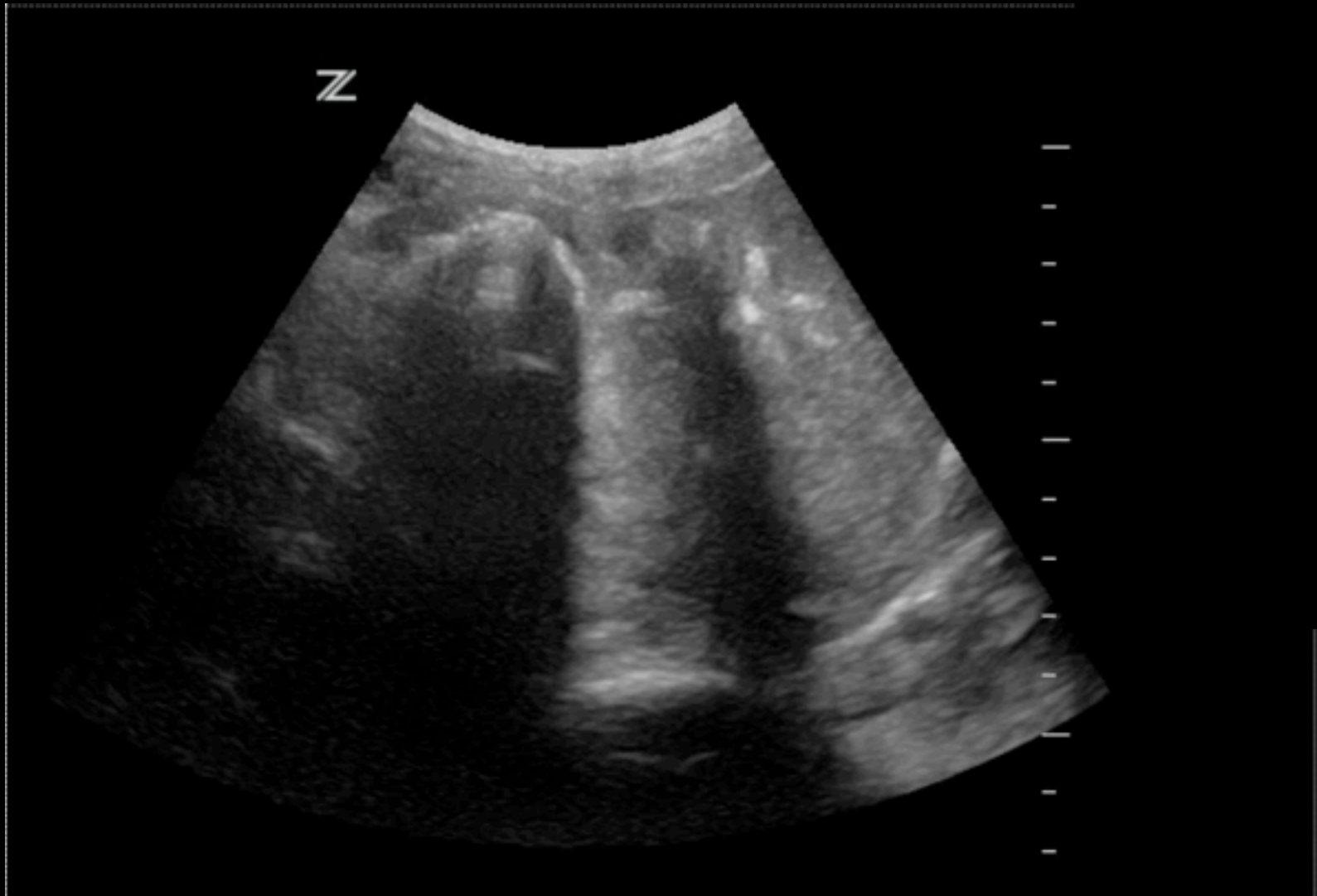
Non-pregnant Patients

Case

- BhCG (-)
- Labs otherwise normal
- Formal pelvic ultrasound: 7cm hemorrhagic R. ovarian cyst, normal blood flow

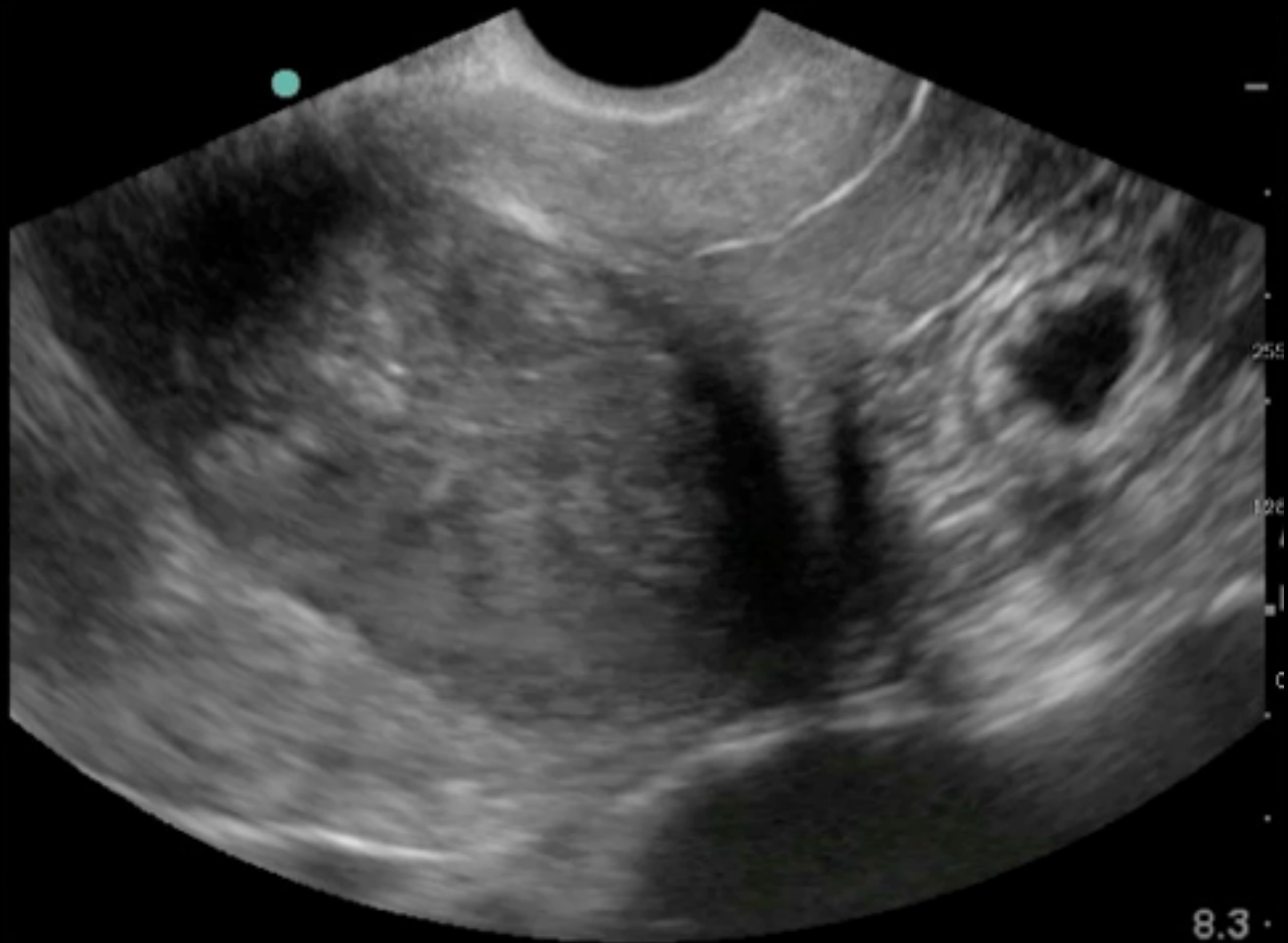
Non-pregnant Patients

Uterine Fibroids



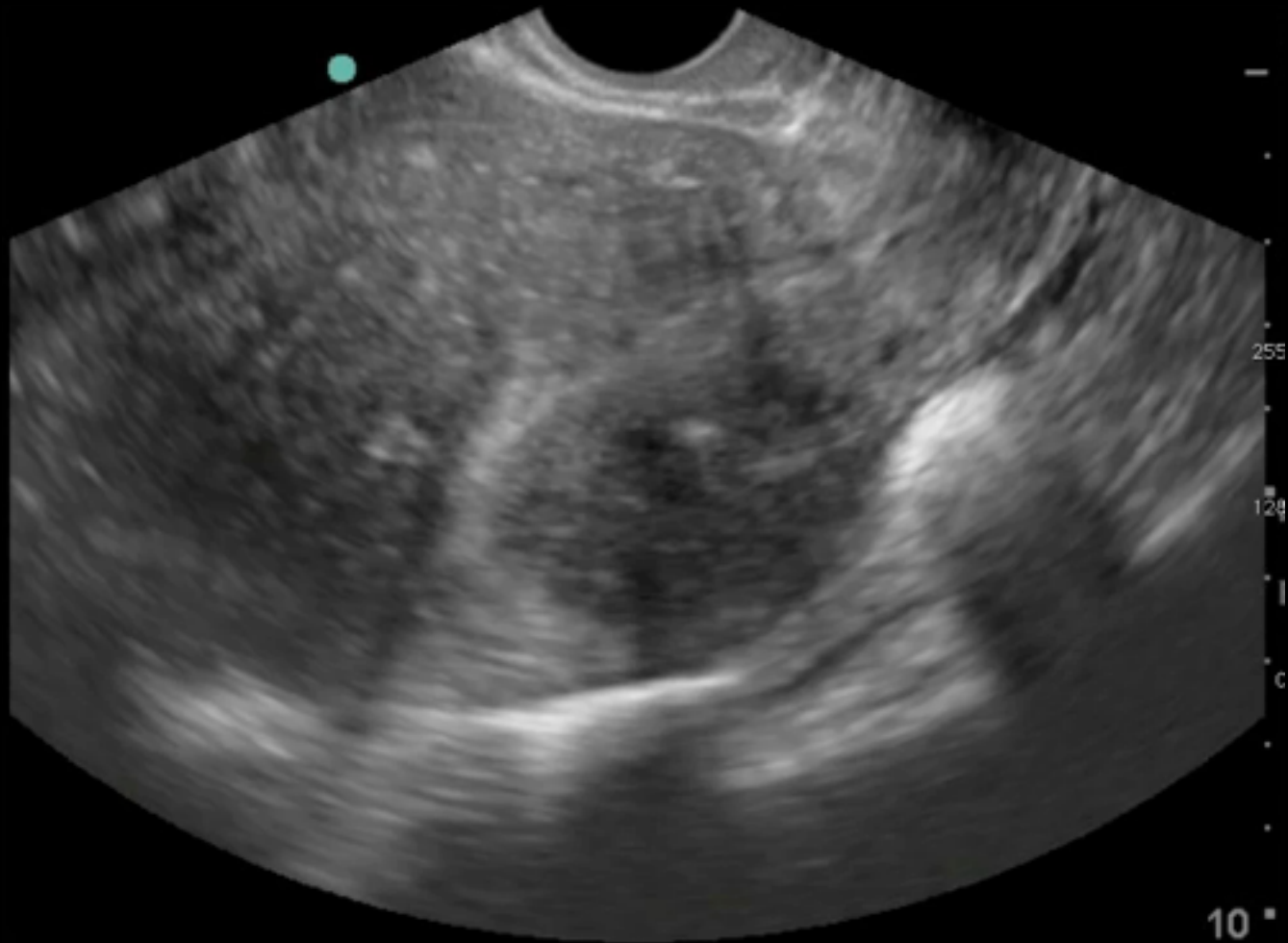
Non-pregnant Patients

Uterine Fibroids



Non-pregnant Patients

Uterine Fibroids



Summary

- Using ultrasound as part of the bimanual pelvic examination is logical
- Point-of-care pelvic US to evaluate for ectopic pregnancy is well accepted
 - establish IUP to r/o ectopic
- Formal ultrasound when your results are inconclusive