

ULTRASOUND LECTURE SERIES

— Presented by —

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Sonographic Evaluation of Early First Trimester Bleeding

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Agenda

- 1. Introduce new ASRM/AIUM guidelines for early pregnancy ultrasonography.**
- 2. Describe ultrasound appearance of the early pregnancy.**
- 3. Evaluate abnormal intrauterine, ectopic pregnancy, and gestational trophoblastic disease.**
- 4. Discuss the clinical significance of first-trimester bleeding.**

First-Trimester Bleeding Case

- **20-year-old**
- **LMP 5-1/2 weeks ago (light)**
- **Chief complaint: lower abdominal pain and vaginal bleeding**
- **Positive urine pregnancy test**

Question: First-Trimester Bleeding– What is excluded by history?

20-year-old, LMP 5-1/2 weeks ago (light), pain and bleeding, pregnant

- 1. Threatened abortion**
- 2. Ectopic pregnancy**
- 3. Gestational trophoblastic disease**
- 4. Pregnancy with hematoma**
- 5. None of these are excluded by history**

Ultrasound Assessment of Early Pregnancy

- **Ultrasound is essential to assess early pregnancy viability in women with bleeding.**
- **Problem: critical data may be overlooked:**
 - **Accurate CRL, yolk sac size, FHR**
 - **Easy to overlook pathologic states that might compromise the pregnancy: uterine anomalies, gestational trophoblastic disease**

What Are the New ASRM/AIUM Reproductive Sonography Guidelines?

ASRM/AIUM Guidelines: First 10 Weeks

- 1. Gestational sac**
 1. Determine location (uterus, cervix, or adnexa).
 2. Yolk sac: note presence/absence.
 3. Measure embryonic size (CRL).
- 2. Cardiac activity: note presence/absence**
 - Document with M-mode if present.
- 3. Embryonic number**
 - Describe amnionicity and chorionicity.
- 4. Evaluate uterus, adnexa, and cul-de-sac**
 - Record presence, location, and size of adnexal masses.
 - Record presence of fibroids; measure largest or any potentially significant fibroids.
 - Assess cul-de-sac for presence/absence of fluid.

Case of First-Trimester Bleeding Continued

- **20-year-old, LMP 5-1/2 weeks ago (light), pain and bleeding**
- **Quantitative HCG 18**
- **Vaginal Ultrasound:**
 - Small uterine sac
 - No fetal pole
 - No yolk sac



Question: What's your best guess?

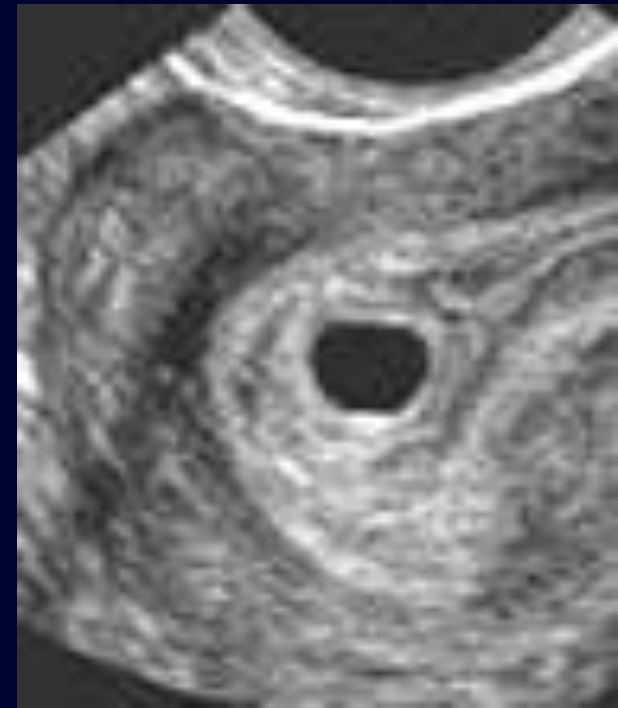
20-year-old, pain and bleeding, HCG 1800, small uterine sac

- 1. Empty sac/anembryonic pregnancy/blighted ovum**
- 2. Probable ectopic pregnancy**
- 3. Normal pregnancy ultrasound in spite of bleeding—threatened abortion**
- 4. Gestational trophoblastic disease**

Normal First-Trimester Pregnancy

Early Gestational Sac

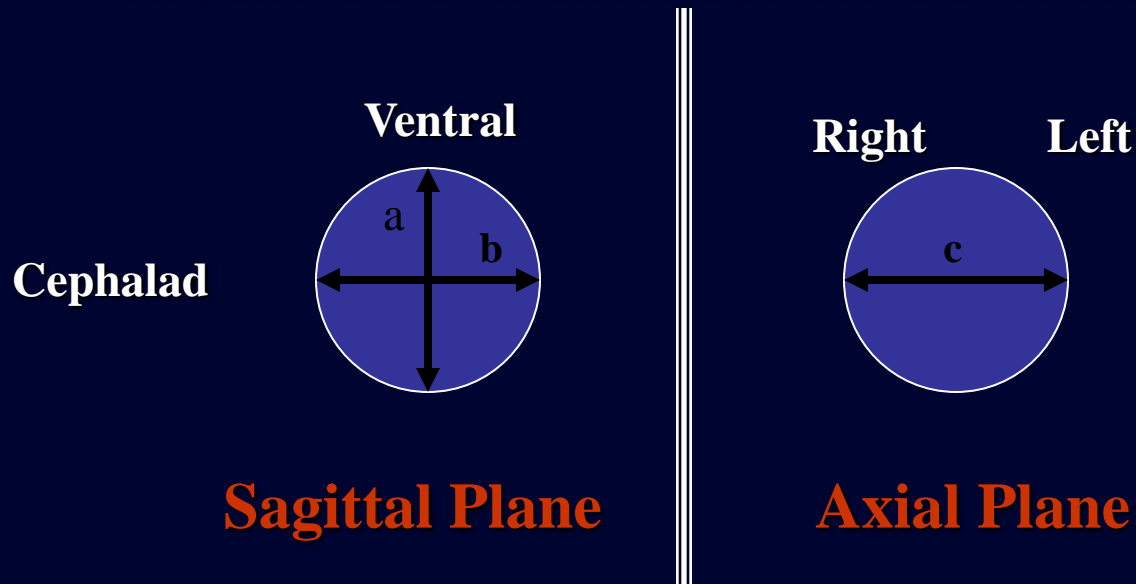
- Decidualized endometrium = echogenic
- Implantation approximately day 7 as a blastocyst
- Early gestational sac 16-21 days after conception
 - “Double decidual sac sign”
 - “Sac within a sac”
 - “Target sign”
- Differential diagnosis = “Pseudosac”



Gestational Sac Measurement

(±5-7 days)

- Mean sac diameter in centimeters:



$$\text{Mean diameter} = a + b + c/3$$

Early Embryonic Findings

- **Trilaminar disc**
- **Yolk sac**
- **Amnion**
- **“Crown-rump length”**
- **Cardiac pulsations**



Measurement of Embryonic Length

(±4.7 days)

CRL



Clinical Pearl: $CRL \text{ (cm)} + 6.5 \approx EGA \text{ (menstrual weeks)}$

Assessment of Pregnancy Viability

Prediction of Pregnancy Viability

- **Gestational sacs**
- **Fetal heart pulsations (“flicker”)**
- **Yolk sac diameter**
- **Influence of intrauterine hematomas**
- **Maternal age**
- **Other factors**

Potential Embryonic Viability:

(Differential Diagnosis = Empty Sac)

- Normal IUP
- Anembryonic pregnancy
 - “Blighted ovum”
 - Empty sac

Anembryonic and Nonviable Pregnancy

Normal Single Pregnancy Transabdominal and Transvaginal Ultrasound

Abdominal

Vaginal

Mean sac diameter

All embryos seen

≥2.5 cm

≥1.2 cm

Embryo length

All cardiac pulsations seen ≥0.9 cm

≥0.5 cm

Anembryonic pregnancy = high prevalence of trisomy 16

Predictors of Miscarriage

- Fetal bradycardia
- Discrepancy between menstrual and sonographic age of more than 1 week!!!

Bradycardia and Miscarriage

- **Normal 5–6 weeks FHR average: 100 beats per minute (bpm)**
- **Normal 8–9 weeks: 140+ bpm**
- **SAB in all pregnancies with FHR <85/minute**
- **Bradycardia found in 80% of miscarriages**

Laboda et al. J Ultrasound Med 1989
Tezuka et al. Gynecol Obstet Invest 1991

First-Trimester Yolk Sac Size

- If yolk sac >5.6 mm <10 weeks
 - All pregnancies nonviable (n = 486)
- Other studies: high miscarriage and anomaly rate if yolk sac >5 mm
- Key point: measure yolk sac if large

Lindsay et al. Radiology 1992
Kucuk et al. J Perinat Med 1999
Chama et al. Obstet Gynecol 2005

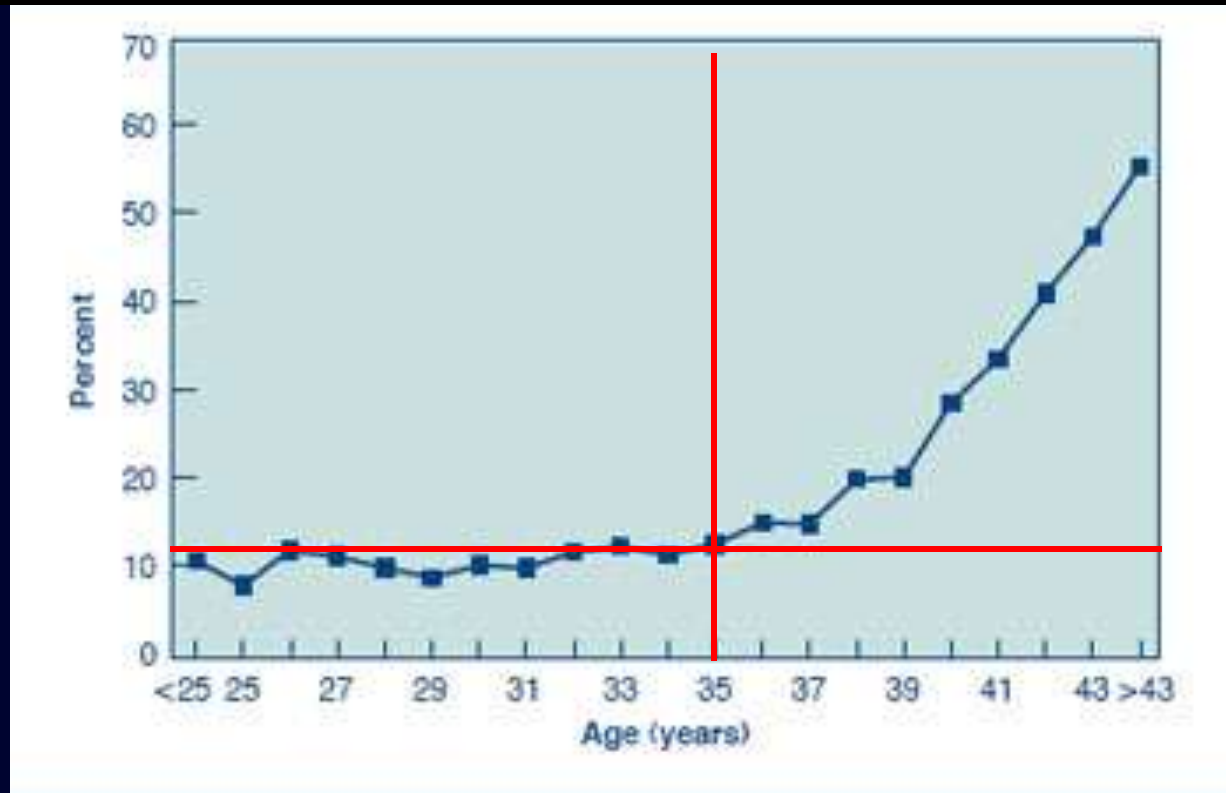
Question: What is most correct:
39-year-old, viable IUP, ultrasound
at 7 weeks?

The risk of miscarriage is:

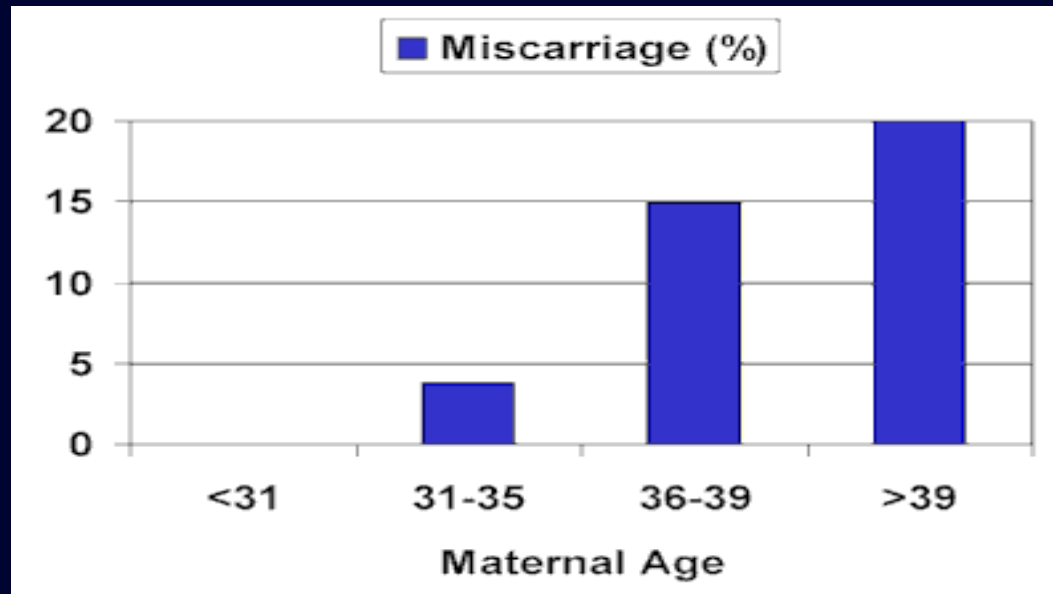
1. Less than 5%
2. Approximately 5%
3. Approximately 20%
4. Over 40%

Age and SAB Rate

Miscarriage rate after gestational sac is identified by ultrasound



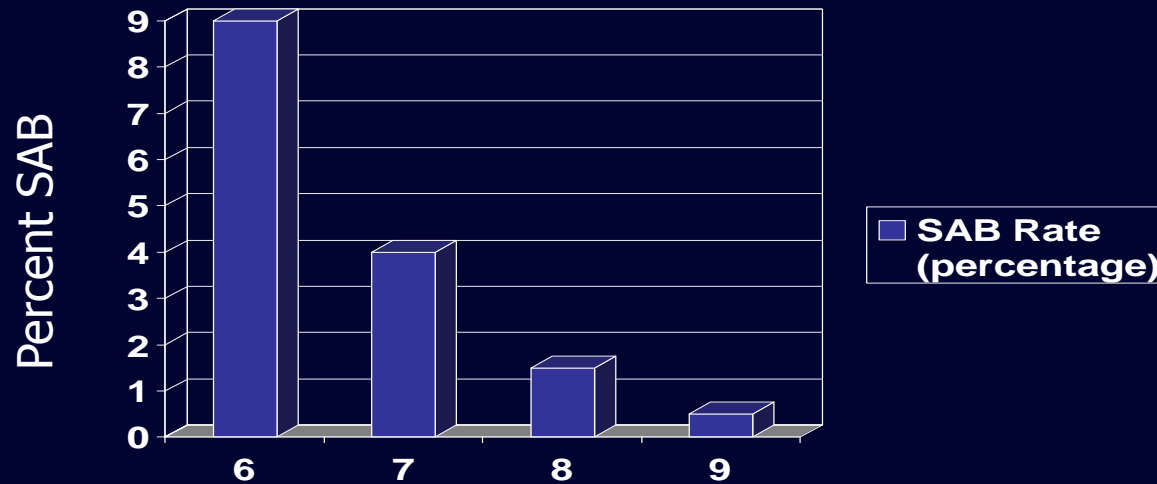
Risk of SAB After Cardiac Activity Seen With Ultrasound



201 pregnancies after ovulation induction ages 20–43; cardiac activity documented by vaginal ultrasound 7–8 weeks after ovulation.

SAB Rates After Cardiac Activity Decline With Gestational Age

- 696 “normal” pregnancies
 - mean maternal age 31



Weeks' gestation at ultrasound with + FHR

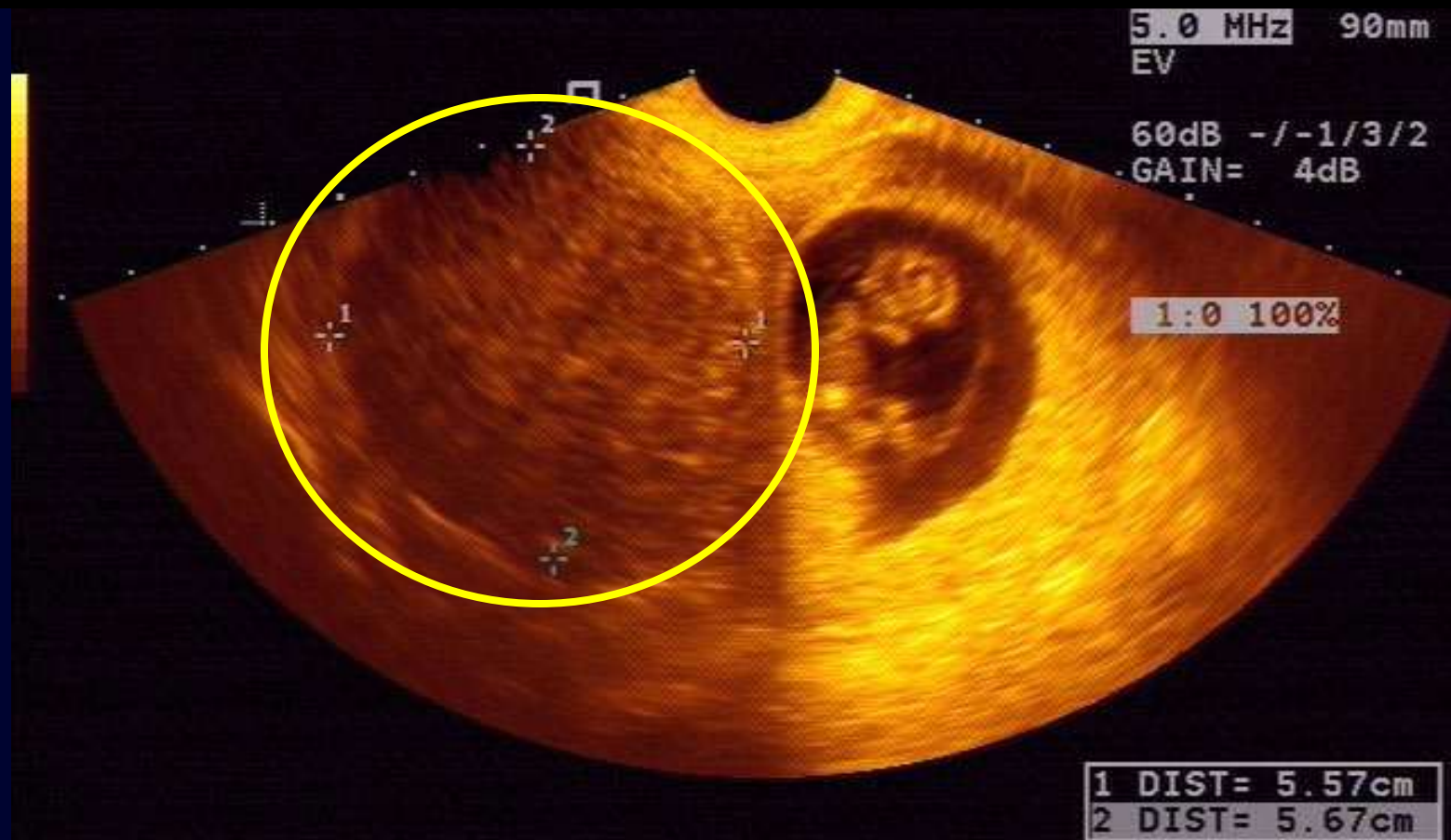
Possible Causes of Miscarriage

- **Genetic anomaly—more likely with:**
 - **Advanced maternal age, empty sac, large yolk sac**
- **Uterine anomaly**
- **Fetal developmental anomaly**
- **Other: metabolic abnormalities, hormonal abnormalities, drug/toxin exposure, etc**

Possible Causes of Miscarriage

- Genetic anomaly
- Uterine anomaly
 - Acquired: fibroids, polyps, adenomyosis, synechiae
 - Congenital: septum, bicornuate, unicornuate, didelphys
- Fetal developmental anomaly
- Other: metabolic abnormalities, hormonal abnormalities, drug/toxin exposure, etc

Nine-Week IUP + Myoma



Question: What's your best diagnosis?

- 1. Bicornuate uterus**
- 2. Septate uterus**
- 3. Didelphic uterus**
- 4. Normal uterus**



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Uterine Septum: 12 Weeks

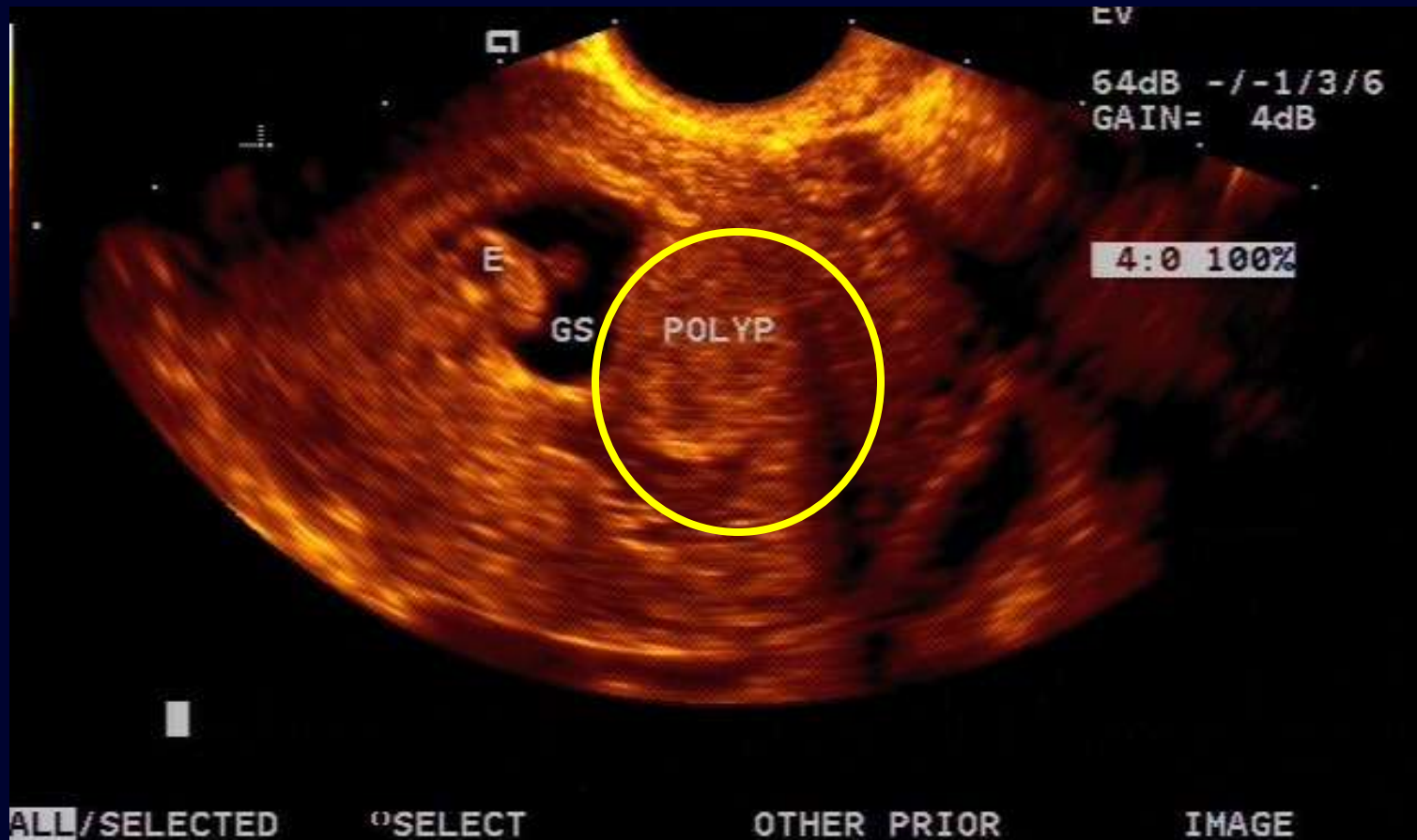


Bicornuate Uterus–Rare!!! Don't Be Misled



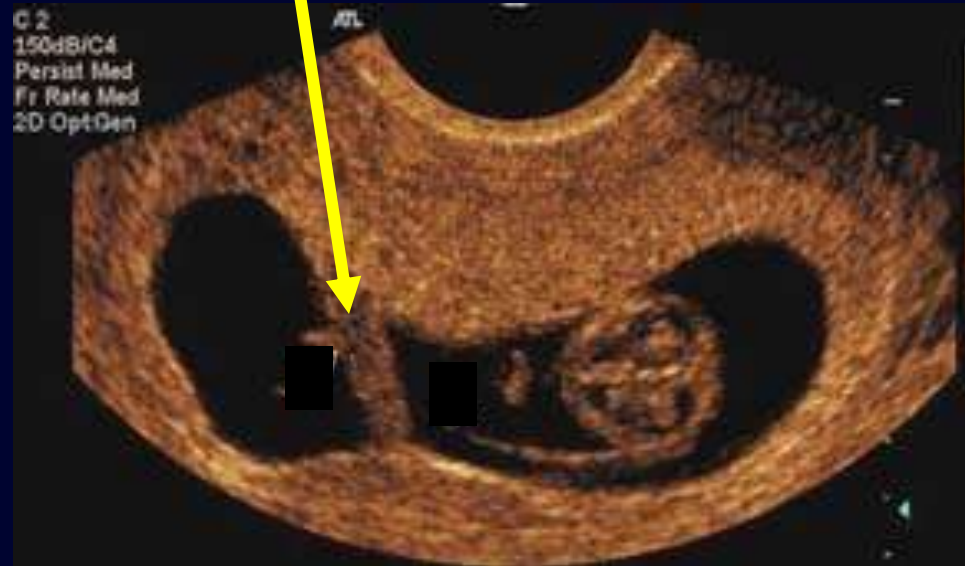
Bicornuate—clear separation between right and left horns
Septate—myometrium separates right and left horns (much more common)

Uterine Polyp: 9 Weeks



Question: What's your best diagnosis?

1. Twin pregnancy
2. Single pregnancy plus empty sac
3. Normal singleton pregnancy
4. Uterine synechia (adhesion)



Possible Causes of Miscarriage

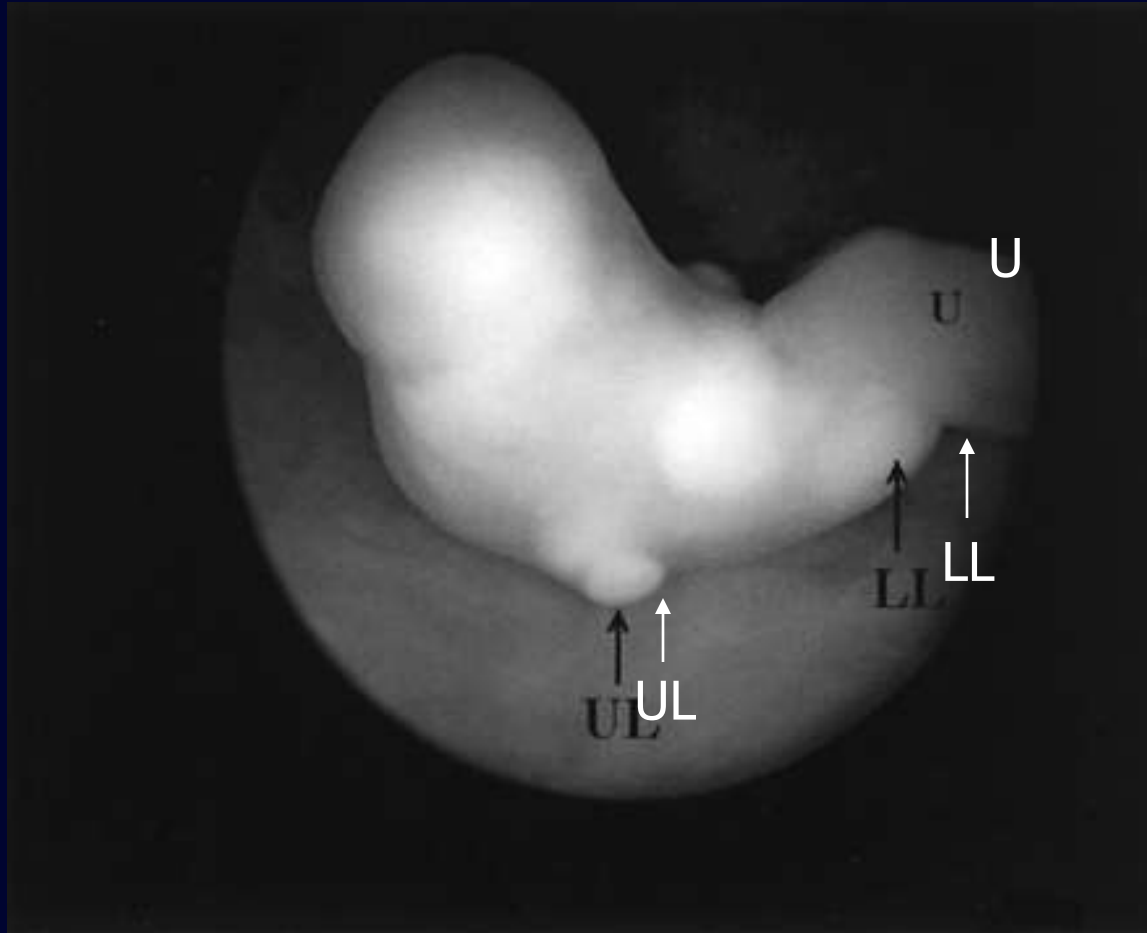
- Genetic anomaly
- Uterine anomaly
- **Fetal developmental anomaly**
- Other: metabolic abnormalities, hormonal abnormalities, drug/toxin exposure, etc

Summary of Structural and Cytogenetic Findings in 233 Missed Abortions

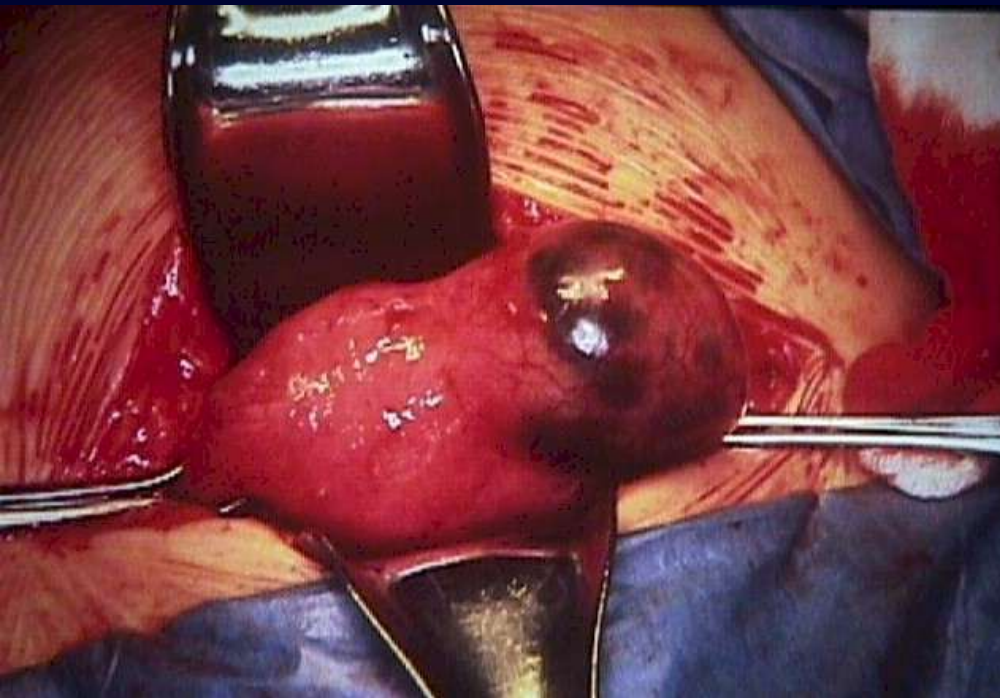
Karyotype	No external embryonic abnormalities	Growth disorganized	Combined developmental defects	Isolated developmental defects
XX/XY	16	20	16	4
Aneuploid	13	39	60	7

- 40/56 (~70%) “euploid” miscarried embryos had fetal structural abnormalities.

Growth-disorganized 10-mm embryo with normal 46,XY karyotype
Retarded upper (UL) and lower (LL) limb buds
No facial structures can be seen. U = umbilical cord



Preclinical Diagnosis of Ectopic Pregnancy



Cornual Pregnancy



Tubal Pregnancy

Case

- 20-year-old, LMP 5-1/2 weeks ago (light), pain and bleeding
- Quantitative HCG 2100 mIU/mL
- Vaginal ultrasound:
 - No uterine sac
 - No fetal pole
 - No yolk sac
 - Small amount of cul-de-sac fluid
 - Right 3-cm ovarian hemorrhagic cyst

Question: What diagnosis is most likely?

20-year-old, pain and bleeding, HCG 2100, no uterine sac

- 1. Miscarriage**
- 2. Ectopic pregnancy**
- 3. Normal pregnancy ultrasound in spite of bleeding—threatened abortion**
- 4. Gestational trophoblastic disease**

Diagnosis of Ectopic Pregnancy

- Different β -HCG levels in different labs
- >1800 mIU/mL—sac visible if normal IUP
- Progression/trend for normal pregnancy
 - 66% increase in 48 hours*
 - 53% increase in 48 hours**
- β -HCG in ectopic pregnancy
 - Lower than normal for gestational age
 - Slower progression

*Kadar N. Obstet Gynecol 1981

** Barnhart K. Obstet Gynecol 2004

Diagnosis of Ectopic Pregnancy

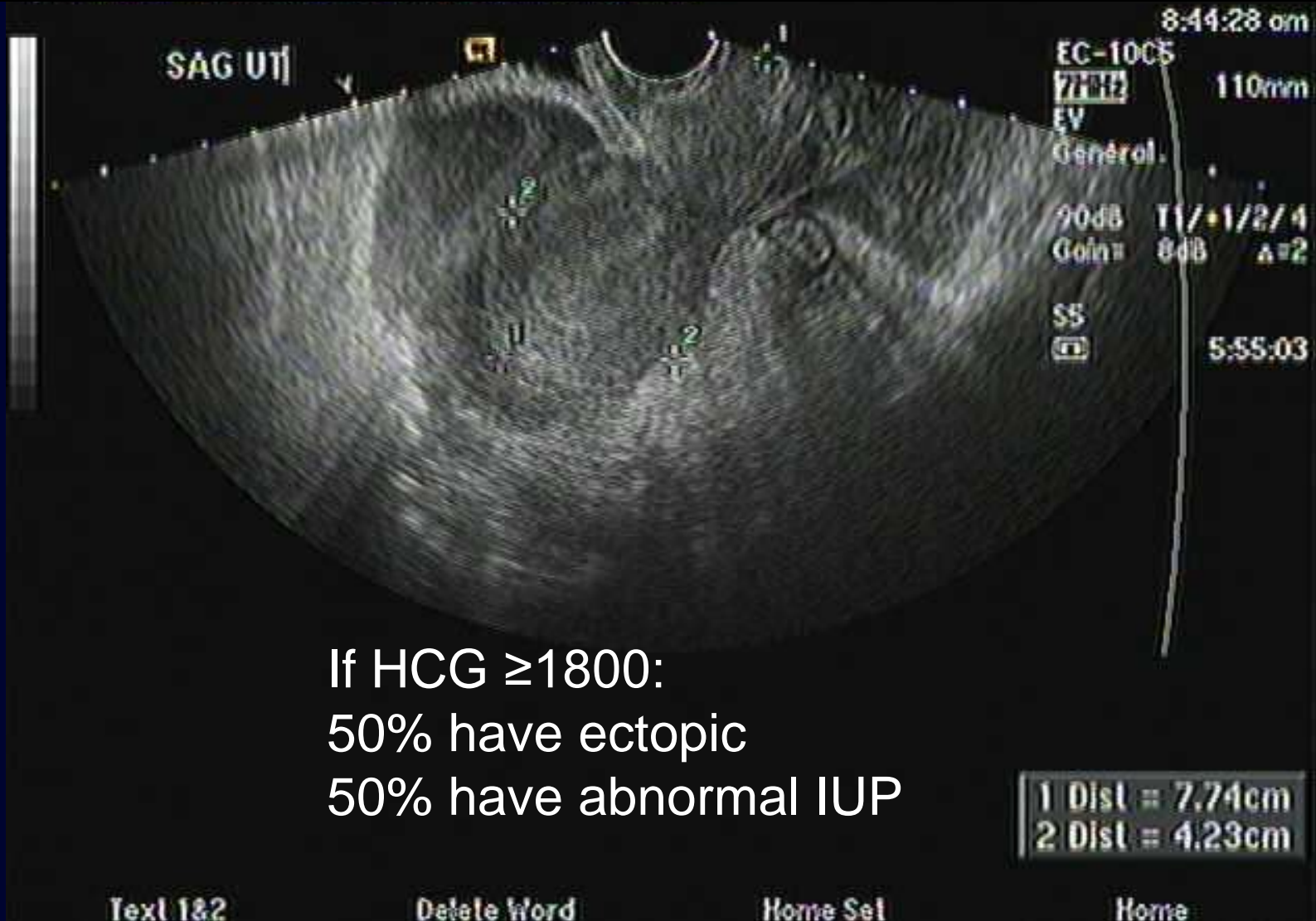
- **50% with HCG ≥ 1800 and no visible gestational sac have ectopic pregnancy**
 - The other half have an abnormal IUP
- **D&C required to diagnose abnormal IUP**
 - Pipelle biopsy: not sufficient to diagnose IUP (villi) with accuracy
- **HCG declines 20%–35% after spontaneous abortion***

Adnexal Mass Mobility

- **Attempt to distinguish corpus luteum from ectopic pregnancy**
- **Retrospective, n = 78**
- **27 could separate the mass from the ovary**
 - **21/23 ectopic pregnancies could be separated**

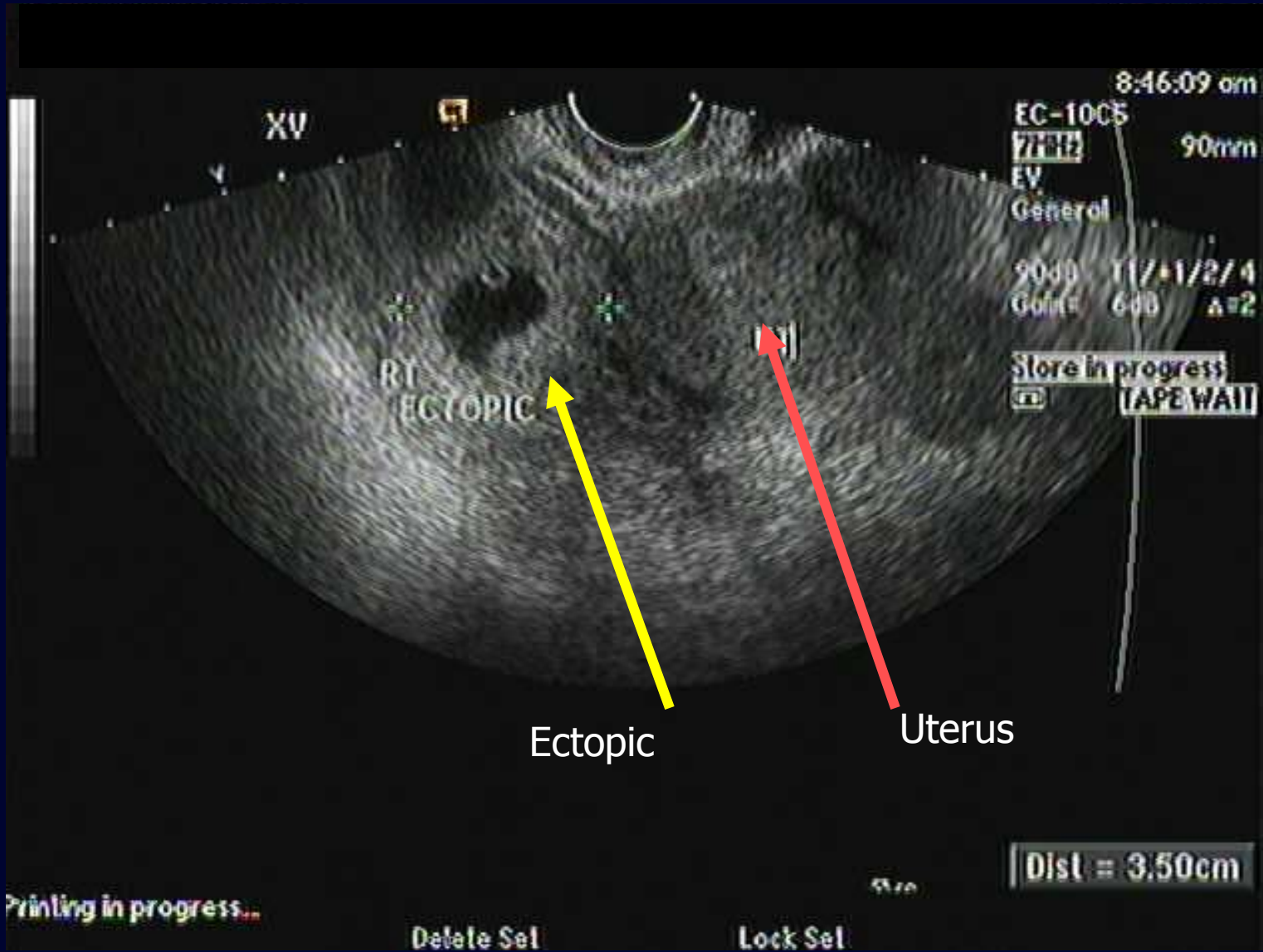
Blaivis M, et al. J Ultrasound Med 2005; 24:598-603

Midplane Uterus: No Gestational Sac



If HCG ≥ 1800 :
50% have ectopic
50% have abnormal IUP

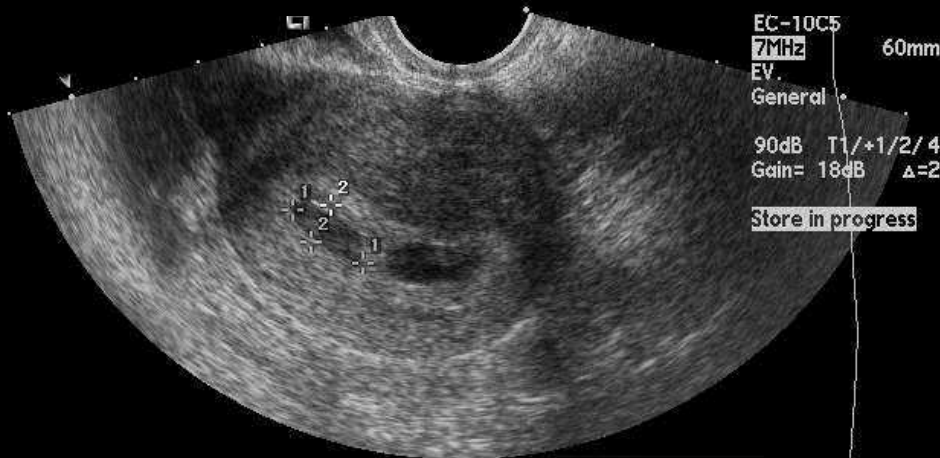
Ectopic Implantation: Right Adnexa



IUP With Corpus Luteum



Twin IUP With Heterotopic Pregnancy



1 Dist = 1.34cm
2 Dist = 0.63cm

Delete Set Lock Set Select Set



1 Dist = 1.70cm
2 Dist = 1.49cm

Delete Set Lock Set Select Set

Important point: Always look for potential disasters!!!

Visualization of Yolk Sac Predicts MTX failure

- Retrospective, n = 62 ectopic pregnancies
- 27% single-dose MTX failures
- Yolk sac seen in 88% of failures and none of successes
- Characteristics of single-dose MTX failures:
 - Size >3.5 cm
 - Fetal cardiac activity
 - Visualization of the yolk sac

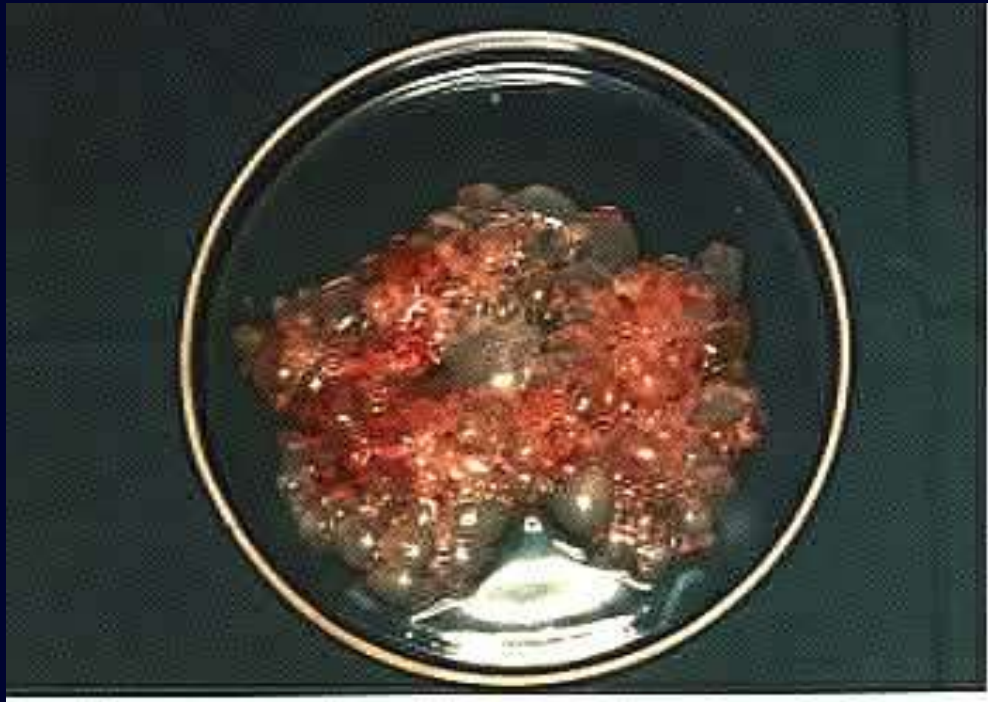
Gestational Trophoblastic Disease

Gestational Trophoblastic Disease

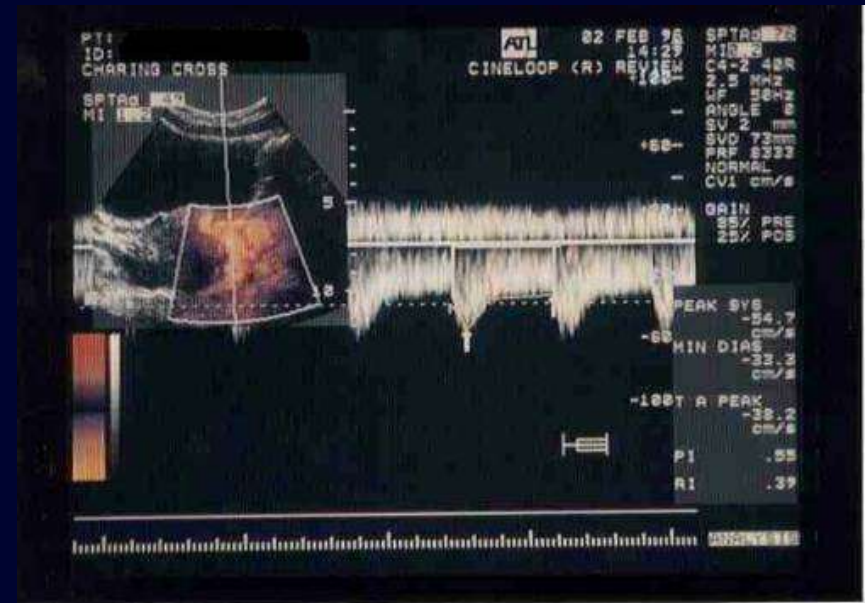
(Sonographic Characteristics)

- **Irregular gestational sac**
- **Multicystic intrauterine echoes (“Swiss cheese”)**
- **Thickened placenta (triploidy)**
- **Intrauterine complex mass (solid/cystic)**
 - **“Chorioadenoma destruens”**
- **Theca lutein cysts**

Hydatidiform Mole



Hydatidiform Mole



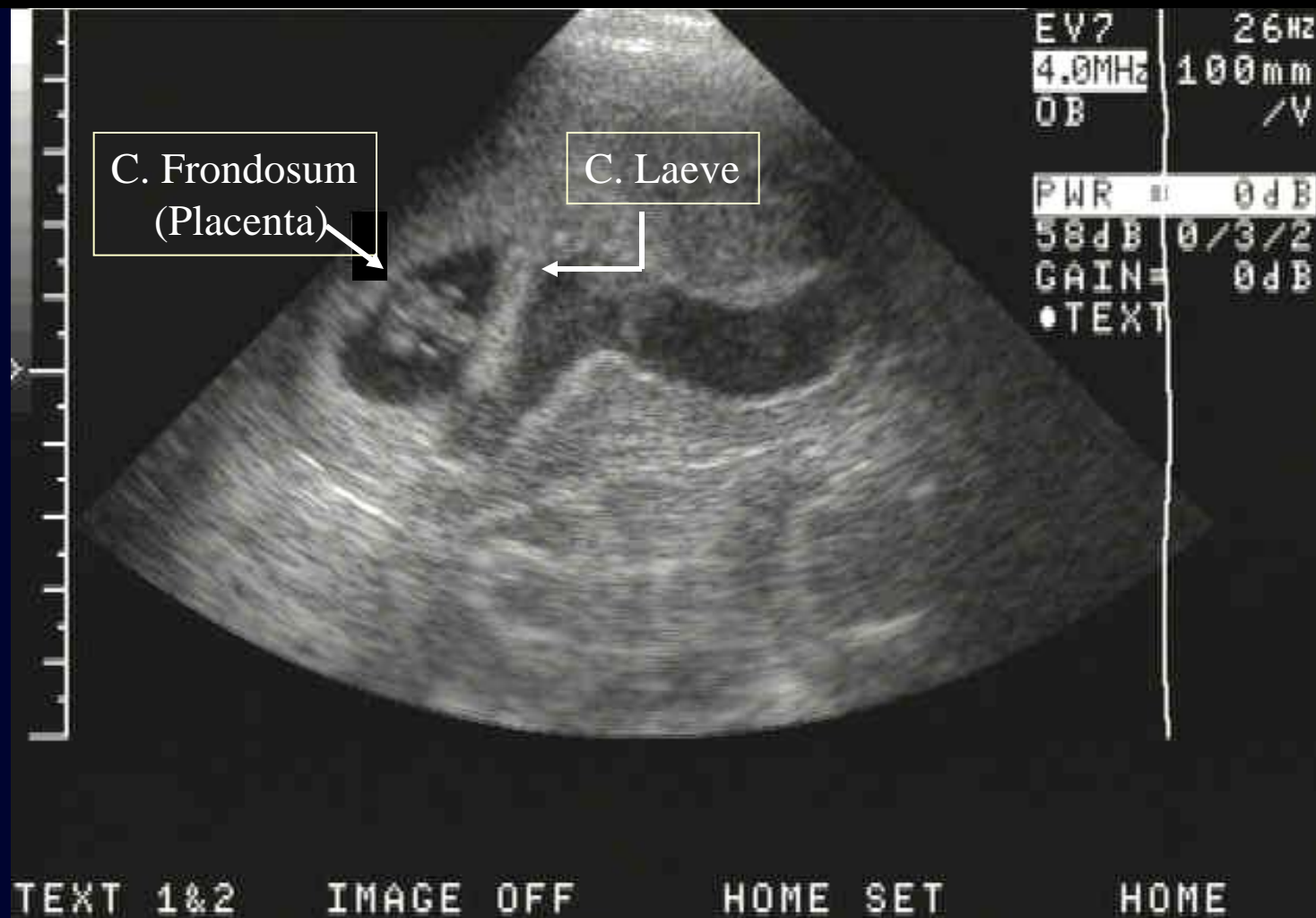
Theca Lutein Cyst



Consequences of First-Trimester Hematoma



Intrauterine Hematoma



Significance of First-Trimester Intrauterine Hematoma

- **First-trimester ultrasound; patients followed through second trimester**
- **Hematoma: 187 women**
- **No hematoma: 6488 women**
- **SAB <24 weeks:**
 - **Hematoma: 18.7%**
 - **No hematoma: 9.5%**

Significance of First-Trimester Intrauterine Hematoma

• <i>Increased Maternal</i>	<u>Risk</u>	RR (CI)
– Operative delivery	1.9	(1.1,3.2)
– Cesarean section	1.4	(1.1,1.8)
– PIH	2.1	(1.5,2.9)
– Retained placenta	3.2	(2.2,4.7)
– Preeclampsia	4.0	(2.4,6.7)
– Abruption	5.6	(2.8,11.1)

Significance of First-Trimester Intrauterine Hematoma

• <i>Increased Perinatal</i>	<u>Risk:</u>	RR (CI)
– Preterm delivery	2.3	(1.6,3.2)
– IUFG	2.4	(6.4,4.1)
– Meconium fluid	2.2	(1.7,2.9)
– Fetal distress	2.6	(1.9,3.5)
– NICU	5.6	(4.1,7.6)

Significance of First-Trimester Intrauterine Hematoma

- **No Increase in** **Risk:** **RR (CI)**
 - Congenital anomalies **1.6** **(0.5,5.0)**
 - IUFD **1.4** **(0.3,5.9)**
 - Perinatal mortality **1.8** **(0.7,4.8)**
- Hematoma size (% of the gestational sac or volume, mL) not a factor

Significance of First-Trimester Intrauterine Hematoma

- Retroplacental location is significant:

	<i>P</i>
– Fetal distress	<.001
– Meconium	<.001
– NICU	<.001
– Preterm delivery	.001
– Preeclampsia	.007
– IUFG	.04

First-Trimester Hematoma and Outcome (n = 248)

- **182 study cases**
 - SAB 14%
 - IUGR 7.7%
 - PTL 6.6%
- **Risks significantly increased with hematoma <9 weeks**
- **Gestational age was only significant predictive factor (earlier = worse)**

Key Points

- 1. New ASRM/AIUM guidelines for early pregnancy ultrasonography**
- 2. Early pregnancy**
 - Measure CRL, FHR, yolk sac, gestational sac, hematoma
- 3. Recognize abnormal intrauterine and ectopic pregnancy**
 - Serial HCG; D&C may be required
- 4. First-trimester bleeding ≠ SAB**
 - But increased pregnancy complications