Early First Trimester Ultrasound

- Is the pregnancy intrauterine?
  OR
- Is the pregnancy ectopic?
- Is the pregnancy viable*?
  OR
- Is the pregnancy a miscarriage

*Has potential to result in live born infant

Terminology & Definitions
- Intrauterine Pregnancy of Unknown Viability (IPUV)
  Ultrasound findings:
  Intrauterine gestational sac with no embryonic heartbeat
- Pregnancy of Unknown Location (PUL)
  @hCG & Ultrasound findings:
  No intrauterine gestational sac or adnexal mass
- Early pregnancy failure
  Not: Miscarriage, spontaneous abortion...

Intrauterine Sac-Like Structure 1st Sign of Pregnancy
- Usually seen TV by 5.0 weeks
- Usually seen TA by 5.5 weeks
- Usually when hCG > 1000 mIU/ml (1st or 3rd IRP)

Published Ultrasound Signs of Early Pregnancy
- Double sac sign* (reported 1982)
- Intradecidual sign* (reported 1984)

*If present, diagnosis = IUP
*If absent, does not mean no IUP
Ultrasound Signs of Early Pregnancy

Double Sac Sign

Intradecidual Sign

Intradecidual sign

Double sac sign

Ultrasound of Early Pregnancy

Often the only finding is . . .
Nonspecific fluid collection in central echogenic portion of uterus (decidua)

Early Pregnancy

5.0 weeks

18.0 weeks

Early Pregnancy

5.0 weeks

2 weeks later
Problem

If nonspecific fluid collection in central echogenic portion of uterus reported as no intrauterine pregnancy and instead called a “pseudogestational sac” ↓
Clinician concludes ectopic pregnancy ↓
Patient treated with MTX or D & C

Problem

When early intrauterine pregnancy is exposed to MTX ↓
Follow up: intrauterine pregnancy with heartbeat ↓
Miscarriage or fetal malformations

Study of Ultrasound Signs of Early Pregnancy

Two readers assessed
199 proven intrauterine gestations
- fluid in uterus, no YS or embryo
- embryonic heartbeat on follow up

First trimester outcome
148 (74.4%) live
51 (25.6%) miscarriage

Study of Ultrasound Signs of Early Pregnancy

<table>
<thead>
<tr>
<th>Reader 1</th>
<th>Reader 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSS present*</td>
<td>32%</td>
</tr>
<tr>
<td>IDS present**</td>
<td>23%</td>
</tr>
<tr>
<td>Neither sign</td>
<td>57%</td>
</tr>
</tbody>
</table>

Kappa = *0.24 & **0.23 (poor inter-observer agreement)
No relationship between outcome and presence/absence of DSS & IDS (p > 0.10, Fisher exact test)

Early Intrauterine Gestation

- Early intrauterine gestations often have a nonspecific appearance (>50% in our study)
- Even in the absence of an intradecidual sign or a double sac sign, it’s most likely an early intrauterine gestation
Early Intrauterine Gestation

How should one report an Intrauterine fluid collection with no yolk sac or embryo and normal adnexa?

“Intrauterine sac-like structure that is almost certainly an intrauterine gestational sac”

OR

“Probable early intrauterine gestation. Follow up ultrasound suggested for definitive confirmation”

“Pseudogestational Sac”

Definition:
Fluid in the uterine cavity mimicking a gestational sac with ectopic pregnancy

Intrauterine Fluid in Ectopic Pregnancy: A Reappraisal

All proven ectopic pregnancies July 2008 to August 2011 = 229 cases

Fluid, when present, characterized by

Shape: pointy-edged or smooth
Location: clearly in cavity or uncertain
Fluid contents: echoes & debris or anechoic

Intrauterine Fluid in Ectopic Pregnancy: Fluid Characterization

Fluid inconsistent with gestational sac
pointy-edged clearly within uterine cavity (not the decidua) containing echoes or debris

Fluid similar to a gestational sac
smooth margins not clearly within uterine cavity anechoic

38 ectopics (16.6%) had fluid in cavity

Intrauterine Fluid in Ectopic Pregnancy: Inconsistent with Gestational sac

Pointy-edged 30/38
Internal echoes or debris 28/38
Within cavity not decidua 7/38

Intrauterine Fluid in Ectopic Pregnancy: Similar to Gestational sac

Smooth, anechoic, not clearly within cavity 7/38
Intrauterine Fluid in Patients With Ectopic Pregnancy

- No fluid: 83.4%
- Fluid: Inconsistent with gestational sac: 13.5%
- Fluid: Similar to gestational sac: 3.1%

Calculations

- Intrauterine gestations: 98%
- Nonspecific fluid: 50%
- Ectopic pregnancies (per CDC): 2%
- Nonspecific fluid & no mass: 1%

For nonspecific fluid collection in cavity & no adnexal mass

Do the math...

99.9% likelihood of intrauterine pregnancy (>1000 to 1)

With transvaginal scanning diagnosis of ectopic pregnancy is made earlier than in the past

In absence of adnexal mass, fluid in uterus much more likely an intrauterine gestation (99.9%) than a “pseudogestational sac”
**Yolk Sac**
- Usually seen on transvaginal ultrasound by 5.5 weeks
- Usually seen when mean sac diameter > 10 mm
- Visualization of yolk sac confirms gestational sac is a pregnancy

**Fetal Cardiac Activity**
- Usually seen on transvaginal ultrasound by 6.0 weeks
- Visualization of embryonic heartbeat confirms viability

**Pregnancy Failure**
- Most frequent early in pregnancy:
  - 6 - 8 weeks with heartbeat: 10 - 17% will be lost
  - After 8 weeks with heartbeat: < 4% will be lost

**Increased loss rates**
- Prior miscarriages
- Uterine duplication anomalies
- Fibroids
- Advanced maternal age
Increased loss rates once pregnant:
- Bleeding
- Slow fetal heart rate
- Subchorionic hematoma

Definitive diagnosis:
- Embryo ≥ 7 mm* with no heartbeat
- Mean sac diameter ≥ 25 mm* with no heartbeat
- No heartbeat & gestational age 2 wks after gestational sac seen* (GA >7 wks by prior ultrasound)
- Sliding sac

*RDU Consensus Panel on Dx of Early Pregnancy Failure 2012

Rationale for ≥ 7 mm cutoff:
- Set value to virtually eliminate any false positive diagnoses (100% specificity)
- Prior criteria not stringent enough
- Based on small numbers of cases
- Need to account for interobserver variability (± 15%)

Pregnancy Failure by Crown-Rump Length (CRL):

<table>
<thead>
<tr>
<th>CRL (mm)</th>
<th>2.5 mm</th>
<th>6 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embryo</td>
<td>2.5 mm</td>
<td>6 weeks</td>
</tr>
<tr>
<td>7.5 mm</td>
<td>7.5 mm</td>
<td>6 weeks</td>
</tr>
</tbody>
</table>

One week later (7 weeks):

7.5 mm embryo
**Rationale for ≥ 25 mm cutoff**

- Set value to virtually eliminate any false positive diagnoses (100% specificity)
- Prior criteria not stringent enough
  - Based on small numbers of cases
- Need to account for interobserver variability (± 19%)

**Pregnancy Failure by Mean Sac Diameter (MSD)**

**Failed pregnancy**

Mean sac diameter (MSD)

\[(35 + 20 + 28) ÷ 3 = 28 \text{ mm}\]

**Empty Gestational Sac 16 days (2.3 weeks) After Small Gestational Sac Seen**

MSD = 14.1 mm

**Findings on follow up ultrasound**

<table>
<thead>
<tr>
<th>Current U/S Finding</th>
<th>Definite failed pregnancy if:</th>
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<tbody>
<tr>
<td>Gestational sac with no embryo</td>
<td>≥2 wks since gestational sac without yolk sac</td>
</tr>
<tr>
<td>Gestational sac with no embryo</td>
<td>≥11 days since gestational sac with yolk sac</td>
</tr>
</tbody>
</table>

*SRU Consensus Panel on Dx of Early Pregnancy Failure 2012*

**Sliding Intrauterine Gestational Sac**

- Gestational sac within uterine cavity, not embedded in decidua
- Shifts position within uterine cavity on realtime scanning


**Pregnancy Failure**

**Definitive diagnosis**
- Multiple suspicious findings (e.g., CRL 4 mm, no heartbeat, & enlarged amnion)
- Clinical judgment applies
- Cannot definitively diagnose pregnancy failure based on LMP

**Pregnancy Failure**

**Suspicious by not definitive**
- Embryo < 7 mm with no heartbeat
  - Larger the embryo, higher the risk
- Mean sac diameter 16 - 24 mm with no heartbeat
- > 6 weeks gestation by LMP with gestational sac, but no embryo

**Findings on follow up ultrasound**

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<td>Gestational sac with no embryo</td>
<td>7-10 days since gestational sac with yolk sac</td>
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</tbody>
</table>

*SRU Consensus Panel on Dx of Early Pregnancy Failure 2012*

**6.2 mm embryo**

**Enlarged empty gestational sac (MSD = 16.8 mm)**
Recommended follow up of Suspicious by not definitive findings (IPUV*)

- Ultrasound, not hCG
- 7-10 days (in most cases)

hCG & Pregnancy Failure*

<table>
<thead>
<tr>
<th>US Finding</th>
<th>Key Points</th>
</tr>
</thead>
</table>
| No intrauterine fluid collection | • A single hCG in a woman with an "empty" uterus on U/S:
  • DOES NOT reliably distinguish between ectopic and intrauterine pregnancy
  • DOES NOT definitively exclude a potentially normal IUP (though normal IUP is unlikely if >3000 mIU/ml)
  • DOES NOT exclude an ectopic pregnancy (even if <1000 mIU/ml)
  • DOES NOT justify presumptive treatment for ectopic pregnancy, using methotrexate or other medical/surgical means
  • The concept of a "discriminatory" hCG level – an hCG value for ruling in or ruling out ectopic pregnancy at a single point in time – should not be used to guide management decisions |
| Normal adnexa |

*SRU Consensus Panel on Dx of Early Pregnancy Failure 2012

Pregnancy Failure

High likelihood of subsequent miscarriage

- Small sac size (MSD – CRL < 5 mm) even with heartbeat
- Embryonic bradycardia (the slower the rate, the greater the risk)
- Large subchorionic hematoma around > 50% of gestational sac

Suspicious for Failing Pregnancy

Small sac size

6 weeks

Fetal Heart Rate

- 100–113 bpm at 6 weeks gradually increases
- 144–170 bpm at 9 weeks

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Normal Embryonic Heart Rate

Gestational age ≤ 6.2 weeks
≥ 100 bpm

Gestational age 6.3-7.0 weeks
≥ 120 bpm

Slow Fetal Heart Rate

Associated with first trimester pregnancy loss

Especially for FHR < 90 bpm

Slow Fetal Heart Rate

Gestational age ≤ 6.2 weeks

<table>
<thead>
<tr>
<th>FHR</th>
<th>Miscarriage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;80</td>
<td>~100%</td>
</tr>
<tr>
<td>80-89</td>
<td>69%</td>
</tr>
<tr>
<td>90-99</td>
<td>32%</td>
</tr>
<tr>
<td>≥100</td>
<td>11%</td>
</tr>
</tbody>
</table>

Slow Fetal Heart Rate

Gestational age 6.3 - 7.0 weeks

<table>
<thead>
<tr>
<th>FHR</th>
<th>Miscarriage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100</td>
<td>93%</td>
</tr>
<tr>
<td>100-109</td>
<td>44%</td>
</tr>
<tr>
<td>110-119</td>
<td>14%</td>
</tr>
<tr>
<td>≥ 120</td>
<td>6%</td>
</tr>
</tbody>
</table>
Ongoing Pregnancy with Bleeding

With living embryo

- Risk of subsequent loss
- Subchorionic hematoma
  - Loss rate with increasing hematoma size

Subchorionic Hematoma

- Prognosis is related to size
- Loss rate:
  - Small: 6.5%
  - Moderate: 20.5%
  - Large: 38.7%

Subchorionic hematoma

- Resolved