Ectopic Pregnancy

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Disclosures

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Learning Objectives

After completing this presentation, the learner will be able to:

1. Identify the most common sonographic appearances of ectopic pregnancy.
2. Classify the various types of ectopic pregnancy and describe how to differentiate each type.
3. List a variety of sonographic techniques that can be used to assist in the diagnosis of ectopic pregnancy.

Outline

A. Background/Initial Evaluation
B. Sonographic Findings - Uterus:
C. Sonographic Findings - Adnexa:
   1. Tubal Ring
   2. Complex mass
   3. Tubal Ring vs Corpus Luteum
   4. Free Fluid
D. Diagnosing Tubal Rupture
E. Role of 3D imaging for Unusual Forms of EP

Background

Products of conception implanted outside of the endometrial cavity
1.5 to 2.0% pregnancies
Complications of EP are the leading cause of pregnancy related deaths during the first trimester in the U.S.

Barnhart KT. Ectopic Pregnancy NEJM 2009

Ectopic Pregnancy

>95% occur in fallopian tube
Ectopic Pregnancy

Risk Factors:
- Tubal scarring (PID, prev EP)
- IUD
- Assisted fertilization
- 25% of pregnancies occurring in pts w/ IUD or TL are ectopic
- 50% of pts with EP have no known risk factor

Ectopic Pregnancy

- Classic presentation: pain, vaginal bleeding, adnexal mass
- Positive pregnancy test
- Ultrasound

Pregnancy Test

- Trophoblastic tissue makes hCG 8 days after conception
- Normal pregnancy: sac typically seen by TVS with hCG of 1000 mIU/ml
- 17/51 (33%) patients with hCG > 2000, not treated for EP, had IUPs at follow-up

Pregnancy Test (BWH data)

- hCG within 24 hours of US (225 EPs)
- Range 7 – 107,949 mIU/ml
- Average 3256 mIU/ml
- Significantly higher with +FH in EP
  - 20,980 vs 1,901 (no FH)
- 77% had hCG <3000, 7% had hCG >10,000

Pregnancy Test

- BWH cautionary case
- hCG over 4000
  - Nothing in uterus, nothing in adnexa
  - followup ..........Nml IUP
- Do NOT dx and treat (for EP) a stable patient until certain
**PUL**

Pregnancy of Unknown Location

only 3 choices:
- very early IUP
- SAB / chemical
- EP

**Uterus**

- IUP
  - round, echogenic rim, contains YS, pole, FH
  - located within decidua
- Don’t be misled by fluid in the endometrial cavity

**US of the endometrium**

- Endometrial thickness can predict presence of IUP
- Is it any good?

- Moschos et al, 2008: no IUP had an endometrium <8 mm
- 4 EP’s had endometrium >25mm
US of the endometrium

- Trilaminar pattern more frequent in ectopic pregnancy
- Is it any good?
- sens 21%; spec 93%; ppv 50%

Col-Madendag et al, Arch Gyn Obst: 2010

Adnexa

- EP better diagnosed by presence of an adnexal mass rather than by absence of an IUP
- earlier identification of a mass allows earlier treatment

Prior EP 4.7 wks w/Pain

Follow up- Normal IUP

Adnexa

- Tubal ring (Gestational sac)
  - echogenic ring, anechoic center
  - 25% of patients with EP**
  - ring + YS (8%)
  - ring + YS + cardiac activity (7%)

**Study of 231 EPs @BWH
Frates et al JUM 2014; 33:697
Robles live 8 wk EP no pain just vag bleeding cor YS.jpg

Frates

Bernstein tiny EP L sag.jpg

Frates

Adnexa

- Complex mass
- poorly defined borders
- 55% EPs present with this**
- careful search may reveal a central ring or YS
- think hematosalpinx

**Study of 231 EPs @BWH Frates et al JUM 2014; 33:697

5.7 weeks

Frates
**Adnexa**

Meta-analysis of 10 studies

Most appropriate criteria for making diagnosis of EP:

- ANY noncystic extraovarian adnexal mass


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**Adnexa**

Noncystic adnexal mass:
- specificity 98.9%
- sensitivity 84.4%
- pos predictive value 96.3%
- neg predictive value 94.8%


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**Adnexa**

Noncystic nonovarian mass
- specificity 99.9%
- sensitivity 90.9%
- pos predictive value 93.5%
- neg predictive value 99.8%

Condous et al Human Reproduction 2005:1404-1409
Things to consider….

- Can the mass be separated from the ovary?
- What is the echotexture of the mass?

**Movement of Mass**

**No Movement of Mass**

**Movement of Adnexal Mass**

- 21/23 patients with EP showed movement of mass with palpation
- 6/49 patients without EP showed movement of mass with palpation
- NPV = 96.1%
- PPV = 77.8%

Blaivas et al JUM 2005; 24:599-603
Persistent pain, everything OK at OSH

26 patients with tubal ring (+ YS or FH)
- 88% rings more echogenic than ovary
- 13 patients w/empty ring
- 77% more echogenic than ovary
- 45 pts with IUP
- corpus luteum more echogenic than ovary in only 3%

Relative echogenicity of an adnexal ring is a useful differentiating characteristic between TR and CL (when can’t localize confidently)

Comparison of EP and CL to endometrial echogenicity
- wall more echogenic than endometrium: EP 32%; CL none
- wall less echogenic than endometrium: EP 31%; CL 84%
Tubal Ring vs Corpus Luteum

- Doppler characteristics can distinguish between EP and CL
- EP RI = 0.15 to 1.6
- CL RI = 0.39-0.7
- RI of >.7 was 100% specific and PPV of 100%, but only present in 31% of EPs

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Free Fluid: is it reliable?

- anechoic vs echogenic
  - echogenic fluid correlates with hemoperitoneum
  - suggests high risk for EP

Nyberg et al Radiology 1991

Echogenic Fluid

- 185 pts to OR for EP
- 125 pts echogenic fluid: 98%+ blood
- 30 anechoic fluid: 0% blood
- 30 no fluid: 0% blood
- Echogenic fluid correlates with hemoperitoneum
  - Sens 100%, Spec 95%, PPV 98%

Sickler et al, JUM 1998 17:431-435

Free Fluid: is it reliable?

- 38/523 PUL patients with isolated free fluid
- 42% of 38 had EP
  - 22% of those with moderate fluid
  - 73% of those with large fluid
- pts with isolated CDS fluid are at moderate risk for EP; risk increases if echogenic or large

5.4 weeks solid dates
hCG = 35

Negative Exam

- EP not seen: very early GA, high BMI, fibroids, inexperience, ovarian pathology
- 5% in the BWH series
- Stable patient: followup hCG and US
- Unstable patient: to the OR

Diagnosis of Tubal Rupture

Why?
- Increasing trend toward medical management
- Nonsurgical management requires intact tube
- So, can TVS characterize tubal status?

Retrospective Study
- Ectopic pregnancy proven at surgery
- TVS within 24 hours before surgery

Frates et al JUM 2014; 33:697
143 patients

Unruptured: 107 (75%)
Ruptured: 36 (25%)

Adnexal Mass vs. Rupture: NS

<table>
<thead>
<tr>
<th>Mass Type</th>
<th>Unruptured</th>
<th>Ruptured</th>
<th>Rupture Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass with cardiac activity</td>
<td>17</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Mass with yolk sac</td>
<td>14</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Mass with tubal ring</td>
<td>23</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>Nonspecific mass</td>
<td>81</td>
<td>23</td>
<td>58</td>
</tr>
<tr>
<td>No adnexal mass</td>
<td>8</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

Diagnosis of Tubal Rupture

- Rate of rupture significantly higher when fluid was mod/large (33%) compared to small-none (17%) \( p<0.05 \)
- But: mod/large fluid had poor sensitivity (67%) and PPV (33%)

hCG Levels vs Tubal Rupture

- 139 patients
- No cut-off level predicted rupture
- Approximately 10% of patients with hCG < 500 had tubal rupture

Diagnosis of Tubal Rupture

- Rupture is possible when no mass is seen, or when little or no free fluid is found
- No single appearance (including a tubal ring) excludes rupture
- No hCG level excludes rupture
Last but not least

- 3D imaging can help localize unusual ectopics
- Cornual vs tubal vs normal
- Cervical
- C section implantation

5.5 weeks ? C –section implantation

6.5 weeks ? C–section implantation

7.7 weeks Cornual Implantation
6.5 weeks Cornual Implantation

One last case---

To IR for UAE
Transvaginal sonography continues to be the optimal method for the evaluation of ectopic pregnancy. Early dx allows less invasive treatment options.

- Close evaluation of endometrium
- Close evaluation of adnexa
- Palpation, 3D

Follow up is best for stable patient with PUL

Key References


