Ectopic Pregnancy Pearls and pitfalls
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- Ectopic Pregnancy has been transformed from an almost invariably fatal condition until the end of the 19th century to a condition commonly diagnosed in nearly asymptomatic women often amenable to medical treatment
- Introduction of endovaginal sonography (EVS) and βHCG in the late 1980s
- Still a significant cause of maternal morbidity and mortality (3.8 to 6% of pregnancy related death)
- Increase in incidence of EP, currently 2% of all pregnancies
  - Improved detection due to better imaging and diagnosis
  - Increase in risk factors
Tubal EP

- At least 90% of EP implant in the Fallopian Tube (FT), usually in the ampullary portion
- 4 US appearances: adnexal mass separate from the ovary
  - GS with embryo (± cardiac activity) or yolk sac in 20% cases
  - Tubal ring (GS=small fluid collection with echogenic rim) in 20% cases
  - Heterogeneous adnexal mass in 60% cases.
- Teaching point: look for small gestational sac within adnexal mass
Objectives

- Avoid a false positive diagnosis of EP
  - Recognition of very early IUP
  - Concept of Pregnancy of Unknown Location (PUL)
  - Risk of administering methotrexate to a potential IUP

- Discuss unusual locations of EP
  - Risk factors
  - Sonographic appearance
  - Differential Diagnosis
  - Role of MR
Avoid False Positive Dg of EP

- Positively identify the adnexal EP
- Absence of IUP does NOT imply EP
- Differentiate true small GS from pseudoGS

Pseudo GS: fluid in endometrial cavity
With right EP

Tiny IUP: Note it is eccentrically placed in the decidua and has a subtle echogenic rim
Patient with positive HCG

- EVS shows nothing: no IUP no adnexal mass
  - Pregnancy of unknown location; follow up
- EVS shows a tiny eccentric fluid collection in uterus
  - Favor early IUP, cannot completely rule out but doubt EP; follow up
- EVS shows adnexal mass separate from ovary
  - Highly suspicious or consistent with an EP
- Serial HCG and serial US
  - Avoid rush to treatment based on single exam in stable, relatively asymptomatic patient
Unusual forms of EP

- In approximately 5% of EP, implantation occurs in an unusual location
- Some risk factors are common to all EP
  - Pelvic inflammatory disease, previous tubal surgery, previous EP, implanted progestin contraceptive device, IUD < smoking
- Some conditions predispose to unusual EP.
  - Previous D and C, Cesarean section
  - Treatment for infertility including ovarian stimulation and assisted reproduction techniques (heterotopic pregnancies)
    - Many of these women have scarring of the fallopian tubes
    - Incidence of EP and heterotopic pregnancy seems to increase with higher number of embryos transferred.
Imaging of unusual EP

- Ultrasound first imaging modality, MR for difficult cases
- Advantages of MR
  - Larger field of view
  - Alternative diagnoses in pregnant patient with pain (appendicitis)
  - Not operator dependant
- Imaging protocol
  - 1.5T no IV contrast
  - T2 weighted HASTE, fat suppressed HASTE, T1 weighted spoiled gradient echo (blood products)

Parker & al Radiographics 2012; 32:1445
Interstitial EP

- Accounts for 2 to 4% of all EP
- Implantation in the intramural portion of the FT
- This portion of the FT is more distensible and allows longer survival of the EP and potential presentation at later gestational age
- Greater risk of rupture and catastrophic hemorrhage due to presence of large blood vessels in that location
- Greater morbidity and mortality
  - 20% of interstitial EP advancing to 12 wks
  - High index of suspicion allows early Dg
  - Methotrexate for small interstitial EP
Interstitial (cornual) EP

- Somewhat confusing terminology
- Interstitial and cornual used interchangeably in some papers
- Specific terminology in some OB literature
  - Interstitial EP remains confined to the FT
  - Angular EP implants in the lateral angle of the uterus
  - Cornual pregnancy occurs in cornua of a bicornuate or septate uterus
- May be difficult to differentiate IUP in uterine cornu from interstitial EP on ultrasound
  - Use 3D ultrasound to obtain true coronal plane
  - MR for clarification
Interstitial EP: findings

- Eccentric GS with absent or thin (<5mm) myometrial mantle along its superolateral aspect
- The interstitial line refers to an echogenic line extending from the endometrial cavity to the uterine cornua and abutting the GS. In one study this sign had a reported sensitivity of 80% and specificity of 98%

Coronal EVS shows interstitial line leading to eccentric GS

Coronal EVS with color doppler shows large vessels near the ectopic GS
Diagnosis of interstitial pregnancy can be suspected on TAUS

- Eccentric location of GS either at lateral or superior aspect of the uterus should lead the radiologist to consider this diagnosis
- More advanced interstitial EP tend to be superior rather then lateral
Interstitial EP: differential diagnosis

- Eccentric location of an intrauterine pregnancy in didelphys, bicornuate or septate uterus or GS displaced by myoma.
- In eccentric IUP normal thickness myometrial mantle should be visible around the entire GS
- If the diagnosis is unclear, recommend pelvic MR or careful follow up

Transverse midline TAUS shows an IUP in the right horn of a didelphys uterus

Note presence of myometrium lateral to GS

Sagittal TAUS of uterine horn is empty. Pelvic MR confirmed the diagnosis of didelphys uterus
Angular Pregnancy

- Implantation in the lateral angle of the uterus, medial to the tubo-uterine junction
- Technically intra-uterine, fraught with complications
  - High risk of uterine rupture, placenta accreta and spontaneous abortion (up to 38% of cases)
- US: GS in the lateral angle of the uterus
  - Surrounded by myometrium
  - Focal thinning of myometrium
  - Look for myometrial hematoma
  - Look for placenta accreta

Coronal EVUS shows GS in the left uterine angle
Patient was treated with Methotrexate
Cervical EP

- Accounts for less than 1% of all EP
- Implantation below closed internal os
- Risk factors: previous curettage, C-section, in vitro fertilization
- Patients present with vaginal bleeding without or with abdominal cramping
- High index of suspicion needed to
  - Avoid misdiagnosis and confusion with spontaneous abortion
  - Offer conservative management to maintain fertility
  - Avoid potentially catastrophic hemorrhage
Cervical EP: US findings

- No IUP in usual position
- GS in the cervix below internal os with ballooned cervix and hourglass uterus
- Ovoid regular shape of GS with yolk sac and/or fetal pole
- Increased vascularity around GS
- GS does NOT slide with gentle pressure from vaginal probe

Sagittal TAUS shows low position of the GS. Note hourglass shape of the uterus.
Cervical EP: findings

Sagittal TAUS shows low position of the GS & hourglass uterus

Sagittal EVS of the cervix shows GS with yolk sac and fetal pole. Cardiac activity was seen

There is increased flow around the cervical GS. This patient was treated with careful D&C and cervical tamponade with Foley balloon.

Note hourglass uterus best seen on Transabdominal US
The main differential diagnosis of cervical EP is a spontaneous abortion (SAB) in progress, a far more common condition.

US findings helpful in differentiating SAB from cervical EP include:

- Deformed GS, lack of blood flow around the GS, sliding of the aborting sac in the cervix with gentle pressure from the transducer.
- Repeat US in 24 hours, serial β HCG may be helpful as rapid change is expected in SAB.

Sagittal midline TAUS shows a GS with embryo in the cervix, There was NO fetal heart motion. At repeat US, GS was gone.

Sagittal EVS with color doppler shows GS with embryo in the cervix. There is NO vascularity around the GS.
Cervical EP vs SAB: role of MR

Sagittal EVS shows GS with yolk sac and embryo in the cervix

Sagittal EVS 24 hours later shows the location of the GS is unchanged. There is a new periGS bleed

Sagittal T2 weighted MR confirms the diagnosis of cervical EP.
In this patient, the diagnosis of cervical EP that was raised at initial EVS was confirmed by repeat US 24 hour later and MR
Cesarean section (CS) scar EP

- Rare but growing location for EP (increase rate of CS)
- Implantation into the CS defect in the anterior lower uterine segment
- Small defect in anterior myometrium from suboptimal healing of CS incision allows abnormal implantation
- Up to 40% of patients may be asymptomatic in early stage

Sagittal EVS shows CS defect in anterior lower uterine segment in patient with history of 2 CS scar EP
CS scar EP: findings

- GS in the anterior lower uterine segment with ballooned lower uterine segment. GS low & anterior to endometrial complex
- Very thin or absent myometrium between the GS and the bladder, best seen on TAUS
- Trophoblastic flow around GS on color doppler

Sagittal TAUS shows NO myometrium between the GS and the bladder

Sagittal EVS of the shows ballooning of lower uterine segment and a regular ovoid GS with a yolk sac. Note the closed cervix
CS scar EP: role of MR

- **Differential Diagnosis**
  - Cervical EP
  - Spontaneous Abortion
  - MR may be very helpful for differentiating scar EP from these conditions

*Case courtesy of Dr Serena McLean*

Sagittal T2 weighted MR in a different patient shows an eccentrically placed GS in the lower uterine segment with no myometrium between the GS and the bladder. Note the cervix is normal excluding a cervical EP.
Abdominal EP

- Extremely rare form of EP
- Implantation into the peritoneal cavity
  - Either primary implantation in the peritoneal cavity
  - Or secondary implantation after focal rupture of a tubal or interstitial EP
- Very high maternal mortality and morbidity
- Abdominal EP may be more common in developing countries
- Patients tend to present later in gestation
- Traditional management: exploratory laparotomy although case reports of US guided feticide with spontaneous resorption of the pregnancy have been reported
Abdominal EP: findings

- Empty uterus adjacent to bladder
- NO myometrium surrounding the fetus
- Unusual fetal lie, poorly defined placenta, oligohydramnios

Sagittal TAUS shows an empty uterus.

Sagittal TAUS shows a fetus and placenta ABOVE the fundus. There is oligohydramnios and no fetal heart motion was detected.
Heterotopic pregnancies

- Concomitant IUP and EP
- Incidence is rising, mainly due to increasing use of fertility treatment and assisted reproduction techniques
  - 1/30,000 in population at large to up to 1/100 if assisted reproduction techniques are used
  - 20% to 27% occur after spontaneous conception
- Location of concomitant EP reported in the literature include tubal, interstitial, C section scar and cervical location
- Need to maintain high index of suspicion despite the presence of an IUP
- Management challenge to preserve the healthy IUP and treat with EP
Heterotopic pregnancy: findings

- Intrauterine pregnancy
- Adnexal mass separate from the ovary in classic tubal ectopic in 60% cases.
- Unusual locations of EP also reported
- Rupture with hemoperitoneum requiring blood transfusion in a significant number of patients

Midline sagittal EVS shows a 6 weeks 4 days line intrauterine pregnancy

Sagittal EVS shows moderate amount of clots in the cul de sac. This should raise a red flag

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Heterotopic pregnancy: findings

Right coronal EVS shows a small adnexal mass adjacent to the right ovary compatible with a tubal EP

Sagittal EVS of the right adnexa shows moderate amount of clots surrounding the EP
Teaching points

- Early diagnosis of EP allows conservative management with methotrexate
  - Allows better preservation of fertility
  - Less costly and less morbidity compared to surgery
- “First do no harm” to a potential IUP
  - Avoid use of methotrexate in PUL
  - Recognize very early IUP
  - US report should be clear and unequivocal
  - Follow up in indeterminate cases

Teaching points

- **Incidence of EP in unusual location is rising**
  - Think about it (specific risk factors)
  - Associated with increased maternal morbidity and mortality (catastrophic hemorrhage or uterine rupture)
  - Imaging plays a critical role for early diagnosis
  - Although EVS offers the best resolution to evaluate the pelvis, transabdominal ultrasound with its larger field of view may allow more confident diagnosis
  - 3D ultrasound or pelvic MR should be considered in equivocal cases for confirmation or clarification.
  - Conservative management for preservation of fertility
  - Methotrexate, systemic or injected into ectopic GS
  - Injection of KCl for live EP
  - Uterine artery embolization
References