Objectives

- Ectopic Pregnancy:
  - General Overview
  - Clinical Picture
  - Risk Factors
- Case Presentation
- Ultrasound and Diagnosis
- Medical and Surgical Management
Patient SV

- Patient SV is a 31 year-old woman, G1P0, who presents with right lower abdominal pain and vaginal bleeding.
- Positive home pregnancy test and 5 weeks Estimated Gestational Age (EGA) per last menstrual period.
- Transabdominal and transvaginal ultrasound examinations reveal no gestational sac in the endometrial cavity.
Differential Diagnosis:

Right Lower Quadrant Pain

- Appendicitis
- Ectopic Pregnancy
- Salpingitis
- Nephrolithiasis
- Inflammatory Bowel Disease
- Inguinal hernia
Differential Diagnosis in Women

When patient is a woman presenting with right lower quadrant pain, additional causes should be considered in the differential:

- Ectopic Pregnancy
- Ovarian Torsion
- Salpingitis
- Pelvic Inflammatory Disease
- Spontaneous Abortion
- Ruptured Ovarian Cysts
- Endometriosis
- Leiomyomas
Differential Diagnosis in Women

Classic Triad:
- Amenorrhea
- Abdominal Pain
- Vaginal bleeding

Suspect Ectopic Pregnancy
Ectopic Pregnancy

- Implantation of pregnancy outside of the uterine cavity
- 2% of all pregnancies
- #1 cause of maternal death in 1st trimester.

Photograph of ectopic pregnancy in Fallopian tube. White structure inferior to the embryo is the uterus.

http://jaapa.com/issues/j20050301/screen/belly0305_img_6.jpg
Ectopic Sites

- Majority of ectopic pregnancies occur in the Fallopian tubes, most commonly the ampulla.
- Isthmic ectopic pregnancies are more likely to rupture.
- Secondary implantation may occur as the result of partial disruption of the initial plantation site in the tube:
  - Tubo-ovarian
  - Tubo-abdominal
  - Broad ligament

http://www.images.md.ezp1.harvard.edu/users/image_show.asp
Unusual Sites

Embryo implantation into the liver. Color Doppler shows recruitment of hepatic vessels to support the growing embryo.

Implantation in the bladder wall following fistula formation of ruptured tubal pregnancy.


Risk Factors

- Previous tubal surgery
  - To restore patency or sterilization
- Pelvic Inflammatory Disease
- Previous ectopic pregnancy
- Adhesions from Previous pelvic surgery
- Intrauterine Device (IUD)
- In utero DES exposure
- In vitro fertilization
- Progestin-only contraceptive pills

Any injury that harms the integrity of the Fallopian tube can predispose patient to ectopic pregnancy.
Increasing Numbers

- Increase in sexually-transmitted tubal infections.
- Increase in assisted-reproductive practices.
- Earlier detection of ectopic pregnancies that may have otherwise been resorbed without clinical significance.
- Tubal sterilization.
- Contraception with high risk for ectopic.
  - Intrauterine Device
Clinical Presentation

- Vaginal Bleeding or Spotting
- History of Missed Menses
- Abdominal or pelvic pain, unilaterally
- Syncope, Vertigo
Abdominal tenderness
- Abdominal palpation
- Bimanual exam may also produce cervical motion tenderness

Tender, adnexal mass

Bulging posterior fornix
- secondary to blood in the cul-de-sac
Patient SV’s Course

- Because her $\beta$-hCG levels were below the discriminatory level, SV was managed conservatively.
- She returned for her two-week follow-up with increased level of $\beta$-hCG.
- Repeat ultrasound revealed no intrauterine pregnancy.
- However, echogenic area was found next to the right ovary. No free fluid is present within the cul-de-sac.
Patient SV’s Ultrasound Images

Complex mass in Right Adnexa

SV’s normal left ovary and adnexa for comparison.

Courtesy of Dr. David Graham, BIDMC
Diagnosis: \( \beta\text{-hCG} \)

- \( \beta\text{-hCG} \) levels
  - Intrauterine (IU) pregnancy should be observed by \( \beta\text{-hCG} \) level of 1500mIu/mL, the discriminatory level.
    - If <1500mIu/mL, patient must return for reevaluation.
    - If >1500mIu/mL and no IU gestational sac present on ultrasound, most likely non-viable IU pregnancy or ectopic.
  - \( \beta\text{-hCG} \) levels reliably double every 48hrs with normal intrauterine pregnancies.
  - If the \( \beta\text{-hCG} \) level rises inappropriately, plateaus, or exceeds the discriminatory level without evidence of IU pregnancy by vaginal sonography, a live uterine pregnancy can be excluded.
Other Non-Imaging Diagnosis

- **Progesterone levels**
  - $>25\text{ng/mL}$ excludes ectopic
  - $<5\text{ng/mL}$ suggestive of non-viable intrauterine pregnancy or ectopic
  - However, levels 5-25ng/mL are not conclusive.

- **Endometrial Curettage**
  - Endometrial curettage of a pregnant uterus will reveal chorionic villi and products of conception.
    - If no products of conception retrieved, pregnancy is extrauterine.
  - Termination of pregnancy must be desired.
Imaging Diagnosis
Transabdominal vs. Transvaginal Ultrasound

- Allows deeper tissue penetration but less detail
- Requires full bladder
- Imaging of uterine fibroids, cysts, blood clots

Benefits: No radiation, inexpensive, bedside exam

- Allows detailed exploration of ovaries, adnexa, and uterus.
- Detection of early pregnancies; ~5wks
- Empty Bladder
- Less bowel gas
Radiologic Findings

- Absence of IU gestational sac
- Adnexal mass
- Free fluid in pelvis or peritoneum
- Adnexal ring and “ring of fire” on Doppler
- Pseudogestational sac
Adnexal Ring Sign

- Rounded hypoechoic center surrounded by a thick echogenic ring.
- Present in 40-68% of tubal pregnancies.

http://www.emedicine.com/radio/images/78107810SMFIGURE_1C.JPG

Adnexal ring in Fallopian tube
Ring of Fire

- Represents the vascular flow around the ectopic pregnancy.
- Directly related to the amount of viable trophoblastic tissue.
- Useful in following medically treated ectopic pregnancies.
  - Successful treatment will lower the intensity of the Doppler tracing.

http://www.emedicine.com/radio/topic231.htm
Pseudogestational Sac

- Decidual cast and anechoic fluid collection of blood in the endometrial cavity
- 10-20% of ectopic pregnancies
- Central location, irregular borders, no blood flow, which differentiates it from intrauterine gestation.

Surgical Diagnosis

- **Exploratory Laparoscopy**
  - Can convert to surgical treatment
  - Laparotomy should not be delayed in patients who are hemodynamically unstable or there is evidence of abdominal hemorrhage.
Medical Management

- **IM Methotrexate**
  - Inhibits DNA synthesis of the trophoblast
  - Requires follow-up of β-hCG levels on days 4, 7
  - 67-100% effective
  - Greater success:
    - < 6 weeks
    - the tubal mass is not more than 3.5 cm in diameter
    - non-viable embryo
    - hCG is less than 15,000mIU/mL

- **Anti-D Immunoglobulin (RhoGAM)**
  - Given to all woman who are Rh- to prevent Rh sensitization
Patient SV Returns

- After 1 course of methotrexate, SV returned 2 days later with severe right lower quadrant pain and was admitted for observation.
- Repeat ultrasound evaluation revealed increase in size of right adnexal mass and free peritoneal fluid.
Signs of Rupture

Sudden Onset Pain + Free Fluid = ECTOPIC RUPTURE until proven otherwise

Must be treated as Surgical Emergency!
Patient SV’s Follow-up Images

Larger right adnexal mass

New finding of free fluid in the peritoneum.

Courtesy of Dr. David Graham, BIDMC
Ruptured Ectopic Pregnancy

- Signs of Rupture:
  - Increased abdominal pain
  - Hypotension, Shock
  - Shoulder pain

- Diaphragmatic irritation from intraperitoneal blood causes phrenic nerve irritation which refers to the ipsilateral shoulder.
Why do we care?

- Ruptured ectopic pregnancy can lead to...
  - Secondary implantation into abdominal organs
  - Severe hemorrhage
  - Death from insanguination
Surgical Management

- **Surgical Management (Laparoscopic)**
  - Salpingostomy
    - Linear incision made in the involved tube without closure
  - Salpingotomy
    - Linear incision made in the involved tube with suture closure
  - Salpingectomy
    - Full tubal resection

Surgery is always indicated when rupture is suspected. Laparotomy should NOT be delayed in hemodynamically unstable patients.
Companion Patient

Intraoperative photograph of a 14-week tubal ectopic pregnancy

http://www.images.md.ezp1.harvard.edu/users/image_show.asp?imgid=AGY0201-07-033A
Future of Treatment

Ultrasound-Guided Local Injection

- **Method**
  - Injection of potassium chloride or methotrexate directly into the ectopic pregnancy

- **Benefits**
  - Lowers systematic chemotherapeutic exposure
  - Difficult sites can be treated with risk of surgery

- **Limitations**
  - Successful with earlier pregnancies, low hCG levels
  - No way to predict complications
  - Requires experience in invasive ultrasound technique
Summary

- Ectopic pregnancy is most common cause of maternal mortality in 1st trimester.
- Women of childbearing age with vaginal bleeding and abdominal pain…β-hCG.
- Transvaginal ultrasound is gold standard for evaluating ectopic pregnancy.
- Rupture may cause death and should receive immediate surgical attention.
References

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