Ectopic Pregnancy:

Radiologic Diagnosis and Intervention

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Objectives

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

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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.

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Differential Diagnosis:

Right Lower Quadrant Pain

- Appendicitis
- Ectopic Pregnancy
- Salpingitis
- Nephrolithiasis
- Inflammatory Bowel Disease
- Inguinal hernia

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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

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Differential Diagnosis in Women

Classic Triad:
Amenorrhea
Abdominal Pain
Vaginal bleeding

Suspect Ectopic Pregnancy

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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.

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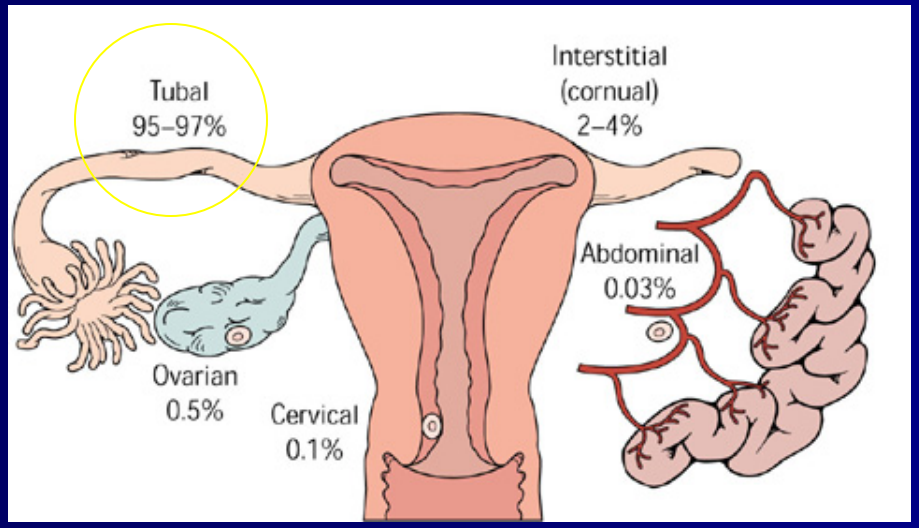
Ectopic Sites



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- 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

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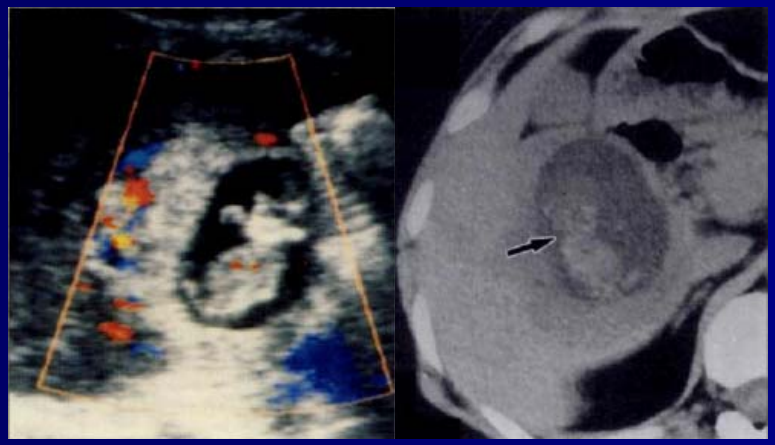
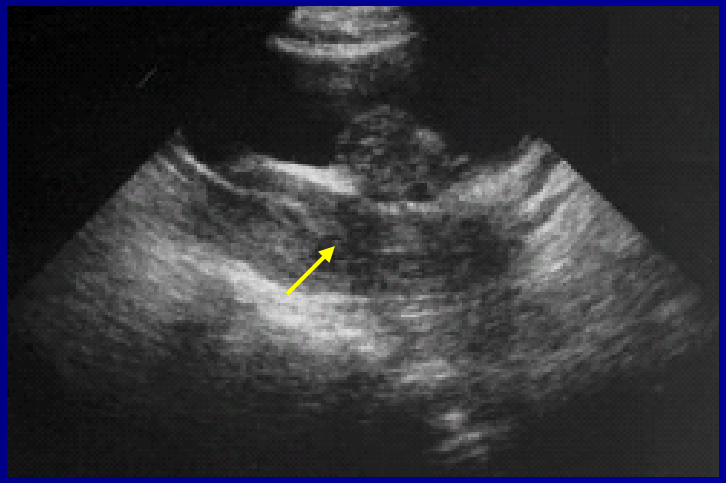
Unusual Sites



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

Adapted from Delabrousse et al: Intrahepatic pregnancy: sonography and CT findings. AJR 173: 1377-78, 1999.



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

Adapted from Truzzi J et al: Rupture of ectopic pregnancy implanted in the bladder. Journal of International Urology 13: 1007-08, 2006.

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Risk Factors

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

- 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

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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

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Clinical Presentation

- Vaginal Bleeding or Spotting
- History of Missed Menses
- Abdominal or pelvic pain, unilaterally
- Syncope, Vertigo

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Physical Exam

- 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

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Patient SV's Course

- Because her β-hCG levels were below the discriminatory level, SV was managed conservatively.
- She returned for her two-week follow-up with increased level of β-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.

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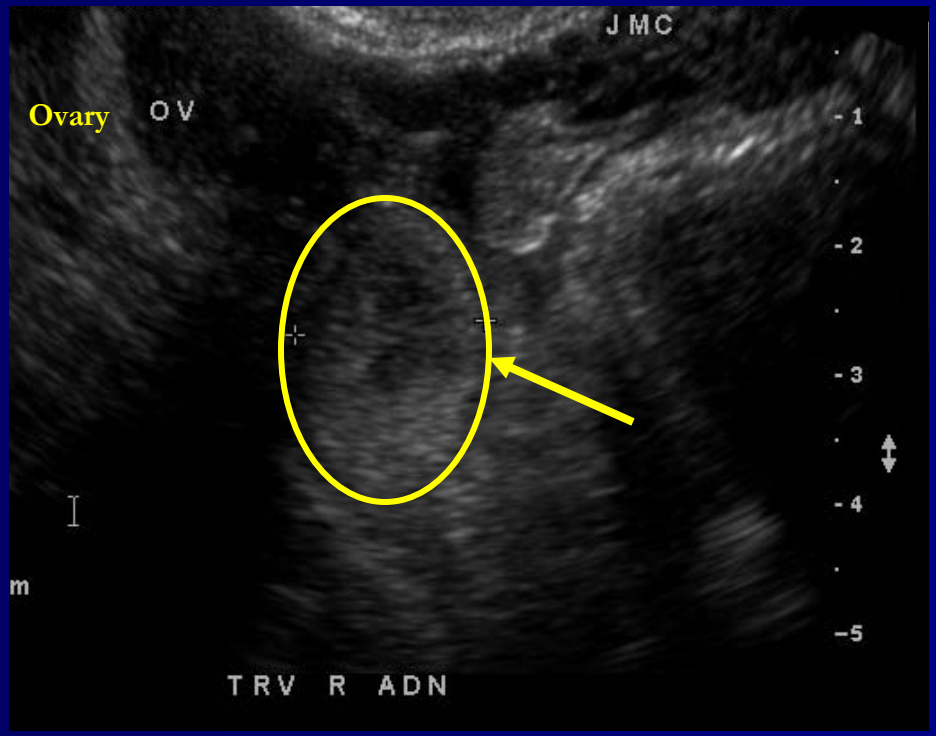
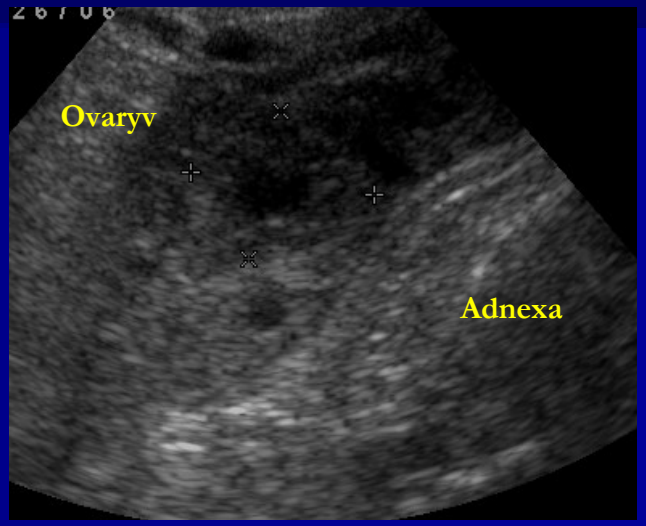
Patient SV's Ultrasound Images



Complex mass in Right Adnexa



SV's normal left ovary and adnexa for comparison.

Courtesy of Dr. David Graham, BIDMC

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Diagnosis: β-hCG

- β-hCG levels
  - Intrauterine (IU) pregnancy should be observed by β-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.
  - β-hCG levels reliably double every 48hrs with normal intrauterine pregnancies.
  - If the β-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.

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Other Non-Imaging Diagnosis

- Progesterone levels
  - >25ng/mL excludes ectopic
  - <5ng/mL suggestive of non-viable intrauterine pregnancy or ectopic
  - However, levels 5-25ng/mL are not conclusive.
- Endometrial Curettage
  - Endometrial currettage 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.

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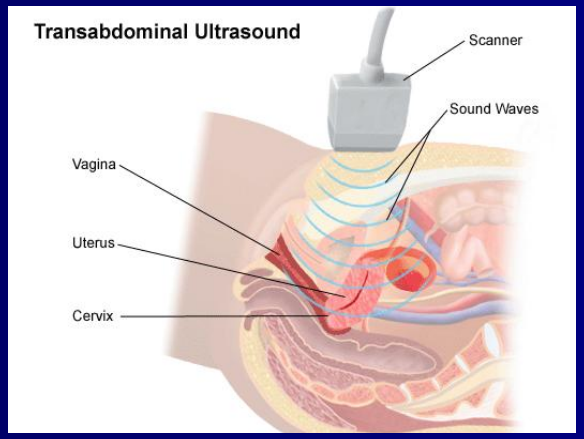
Imaging Diagnosis

Transabdominal vs. Transvaginal Ultrasound



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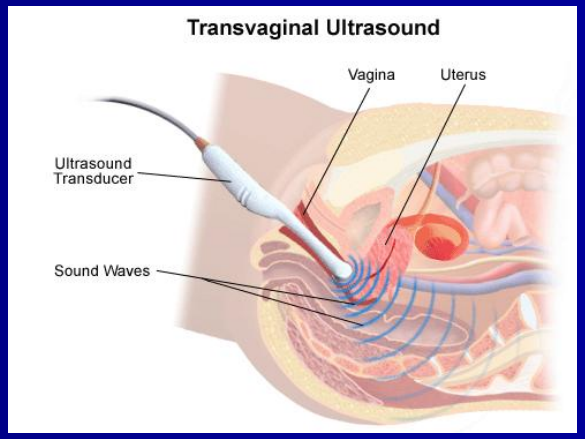
- Allows deeper tissue penetration but less detail
- Requires full bladder
- Imaging of uterine fibroids, cysts, blood clots

Benefits: No radiation, inexpensive, bedside exam



http://www.ukhealthcare.uky.edu/web/greystone/images/ei_1992.gif

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

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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

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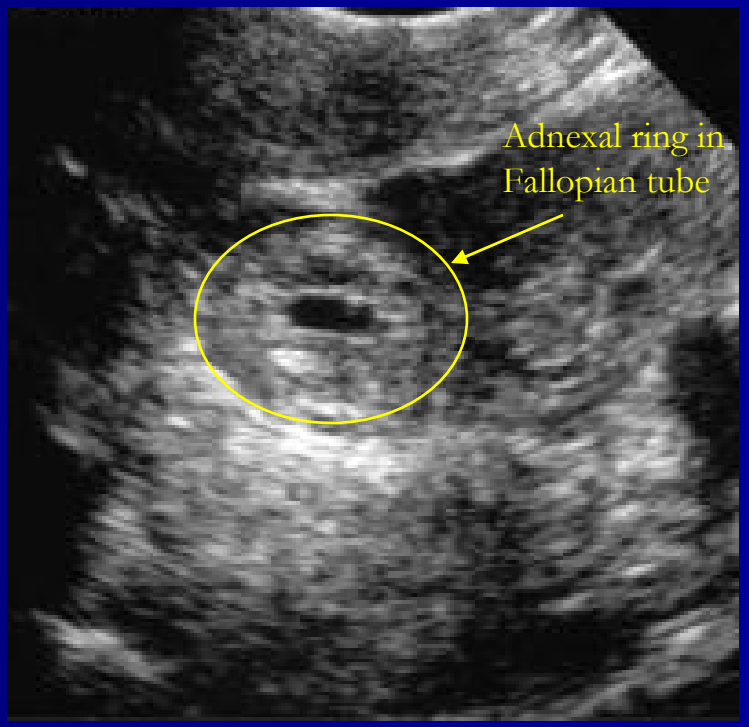
Adnexal Ring Sign

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



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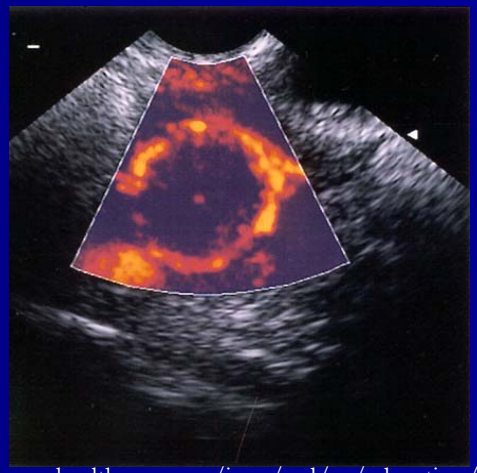
Ring of Fire

- 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 intesity of the Doppler tracing.



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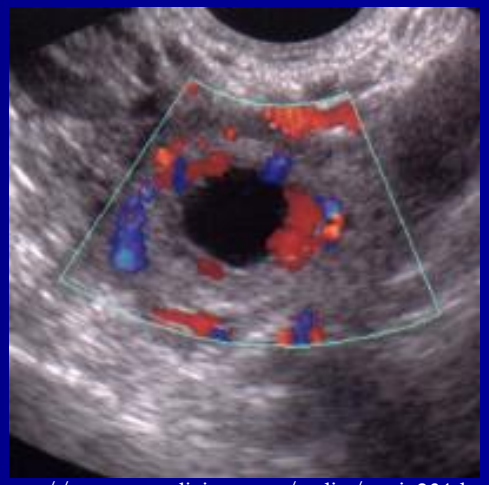

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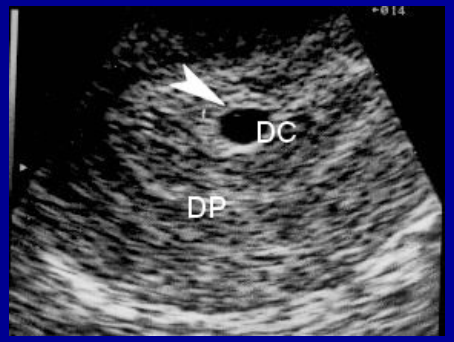
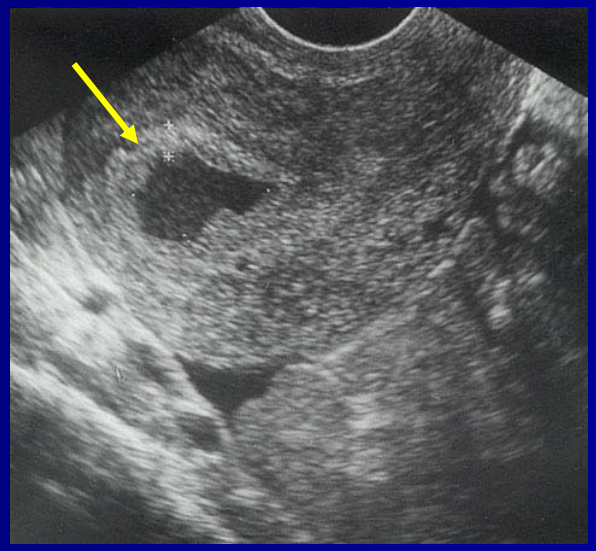
Pseudogestational Sac

- 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.



Double ring sign
Normal IU Pregnancy



http://www.gehealthcare.com/inen/rad/us/education/cmeep2.html

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Surgical Diagnosis

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

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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

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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.

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Signs of Rupture

Sudden Onset Pain + Free Fluid=

ECTOPIC RUPTURE

until proven otherwise

Must be treated as Surgical Emergency!

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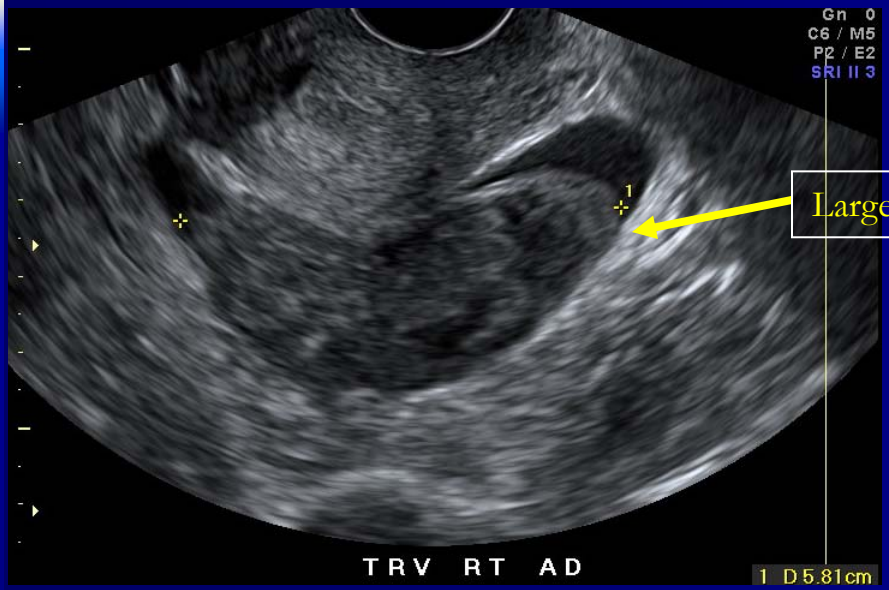
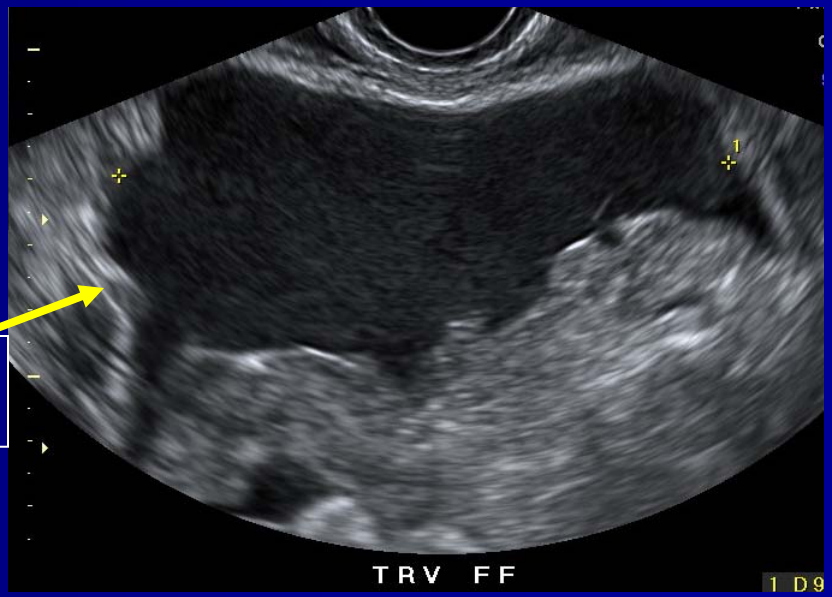
Patient SV's Follow-up Images



Larger right adnexal mass

New finding of free fluid in the peritoneum.



Courtesy of Dr. David Graham, BIDMC

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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.

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Why do we care?

- Ruptured ectopic pregnancy can lead to…
  - Secondary implantation into abdominal organs
  - Severe hemorrhage
  - **Death from insanguanation**

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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.

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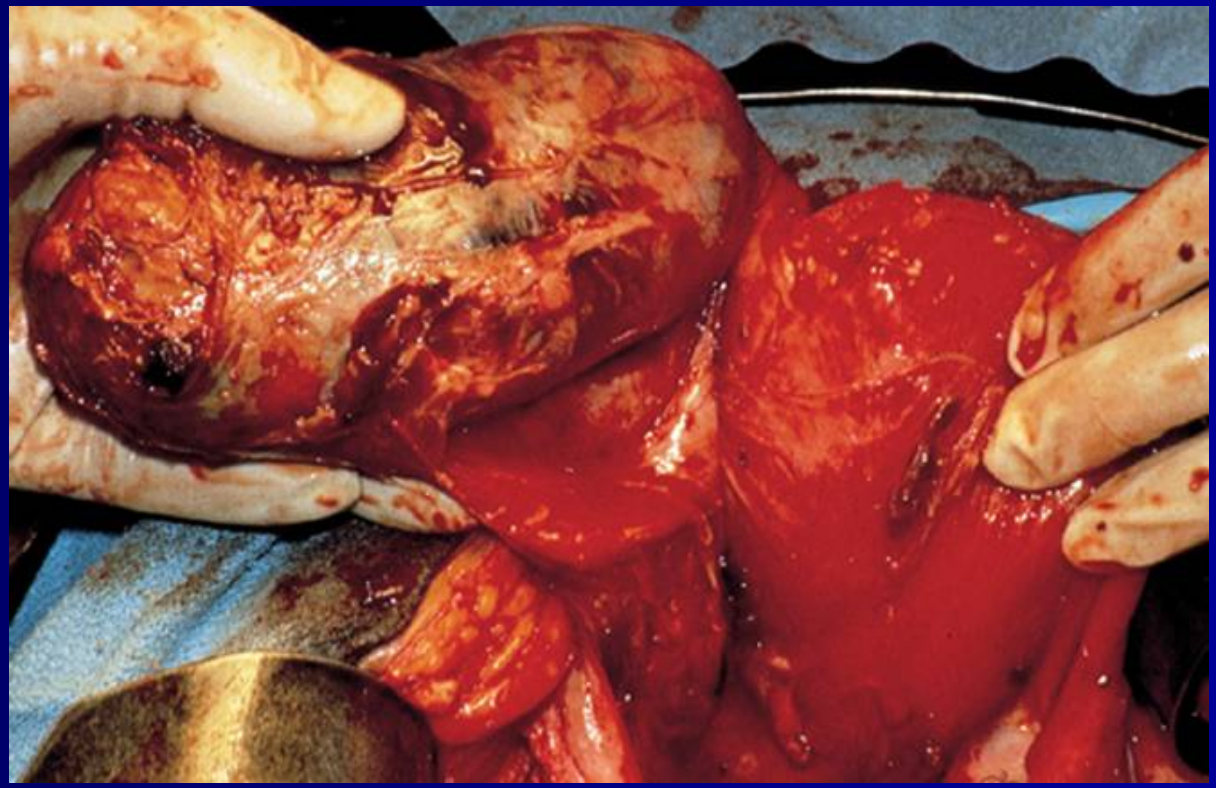
Companion Patient



Intraoperative photograph of a 14-week tubal ectopic pregnancy

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

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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

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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.

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References (Cont'd)

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- Slide 20:
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  http://www.obgyn.ufl.edu/ultrasound/4Gyn/1First%20TM/2Gest%20sac.html
- Slide 31:
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