Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Ultrasonography of Ectopic Pregnancy

Radiology Presentation

Rachel Peragallo

September 15, 2003

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

One summer afternoon...

- S.M., a 35 y.o. female, presents to PCP with cramping and bleeding
- LMP: 5 weeks previous
- positive home pregnancy test
- **Differential?**

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Differential diagnosis

Primary:

- Threatened Abortion
- Inevitable Abortion
- Missed Abortion
- Ectopic pregnancy

Secondary:

- Dysmenorrhea
- Breakthrough bleeds (OCT)
- GU: stone, UTI
- GU tumor

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Workup…

- Vitals Stable
- Hematocrit:39
- β-HCG Level: 930mIU/mL
- Ultrasound
  - Transabdominal
  - Transvaginal

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Ultrasound basics

- US is a X-sectional, multiplanar imaging technique, which works by characterizing differences in sound transmission through tissues
- **Interfaces** between tissues with different characteristics are **bright** (echogenic) on ultrasound
- **Homogenous** tissues are **gray** (intermediate echogenicity)—multiple tiny echos from each individual cell membrane
- **Simple fluid** collections are **dark** (echolucent/anechoic) because there are no significant interfaces within them
- US **Doppler** can also be used to characterize **blood flow**

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

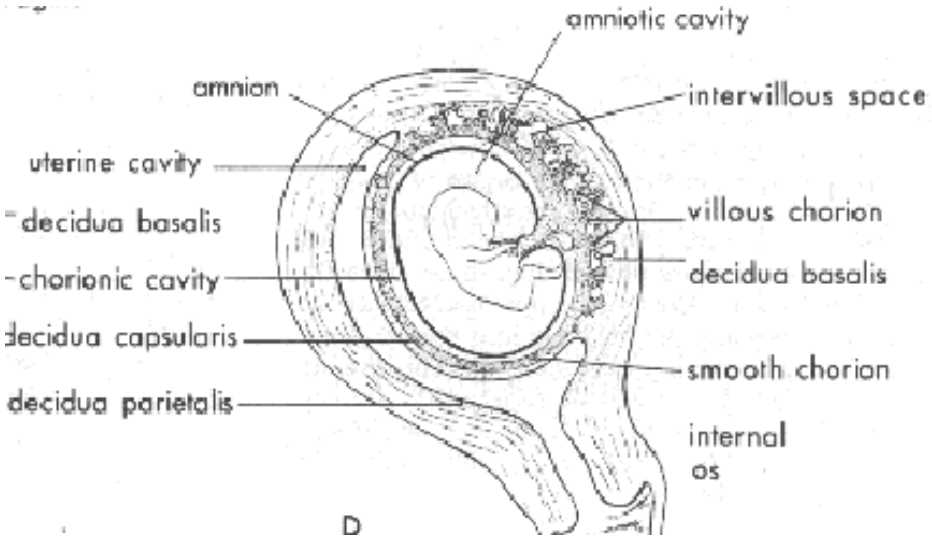
Pelvic ultrasound

Transvaginal ultrasound transducer
www.ob-ultrasound.net

Transvaginal (high frequency)	**Transabdominal** (low frequency)
Minimally invasive	Noninvasive
Empty Bladder	Full Bladder
Higher resolution: gestational sac seen days 35-37, HCG 1500-2000	**Lower resolution:** gestational sac seen day 42, HCG 6000-6500
Limited field of view to region of vagina	General abdominal view—appendicitis, renal stones

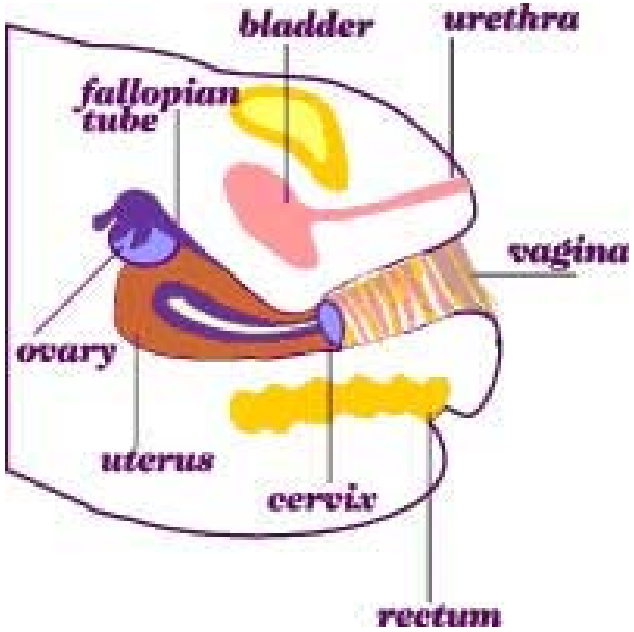
Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Embryology and anatomy…



Layers of tissue and fluid in endometrium

http://www.radiology.creighton.edu/_ultraofearlypreg.html



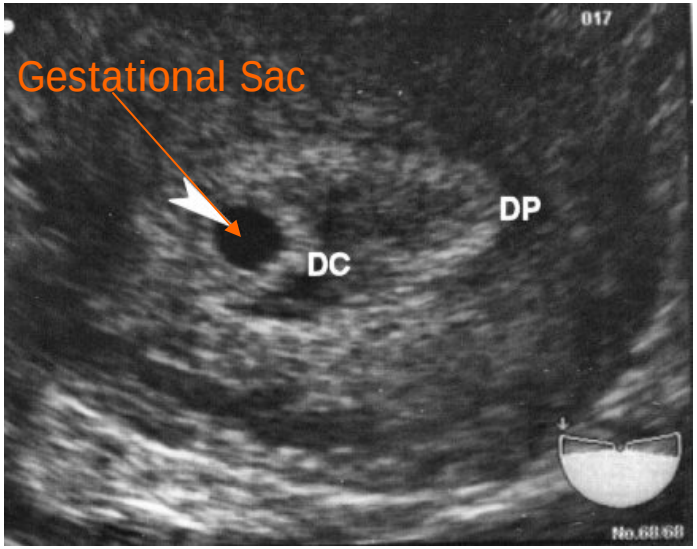
Basic Uterine Anatomy

www.bidmc.harvard.edu/_obgyn/problems.asp

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Ultrasound of 4-6 week normal IUP

4.5 weeks



www.obgyn.ufl.edu

5.5 weeks

www.advancedfertility.com

Double echogenic sac sign
-decidua capsularis (DC)
-decidua parietalis (DP)
-uterine cavity in between

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Diagnosis of ectopic pregnancy

- HCG: must be positive, use serial levels to try and distinguish between SAB, EP, molar, or normal pregnancy
  - Normal: doubles every 48 hours
  - Ectopic: less than doubles every 48 hours

- Ultrasound+HCG: sensitivity 87% specificity 93%
  - Therefore, Ectopic Pregnancy may **not** be ruled out with a negative pelvic US
  - High CLINICAL SUSPICION—send patient to laparoscopy (gold standard)

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Specificity of US

Direct (specific) US finding:

Presence of extrauterine gestational sac (+/- fetal pole, yolk sac)

Absence of intrauterine gestational sac at a cutoff HCG level (>2000mIU/ml)

Indirect (less specific) US finding:

Absence of intrauterine sac (<2000HCG)

Presence of complex adnexal mass

Echogenic or large volume cul-de-sac fluid

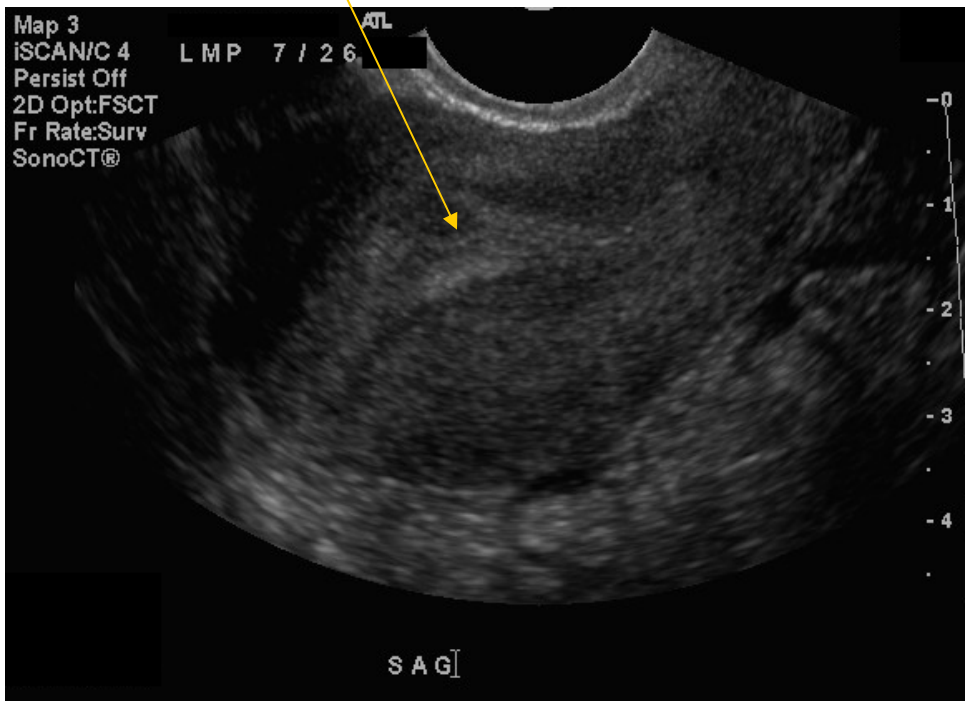
Ring of fire (Doppler)/Tubal ring

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Ultrasound #1 findings (S.M.)

- Normal Uterus
  - Pseudosac (not present)—fluid in uterus due to rupture but without double ring may be a fakeout
- Negative fluid in cul-de-sac

Echogenic endometrium



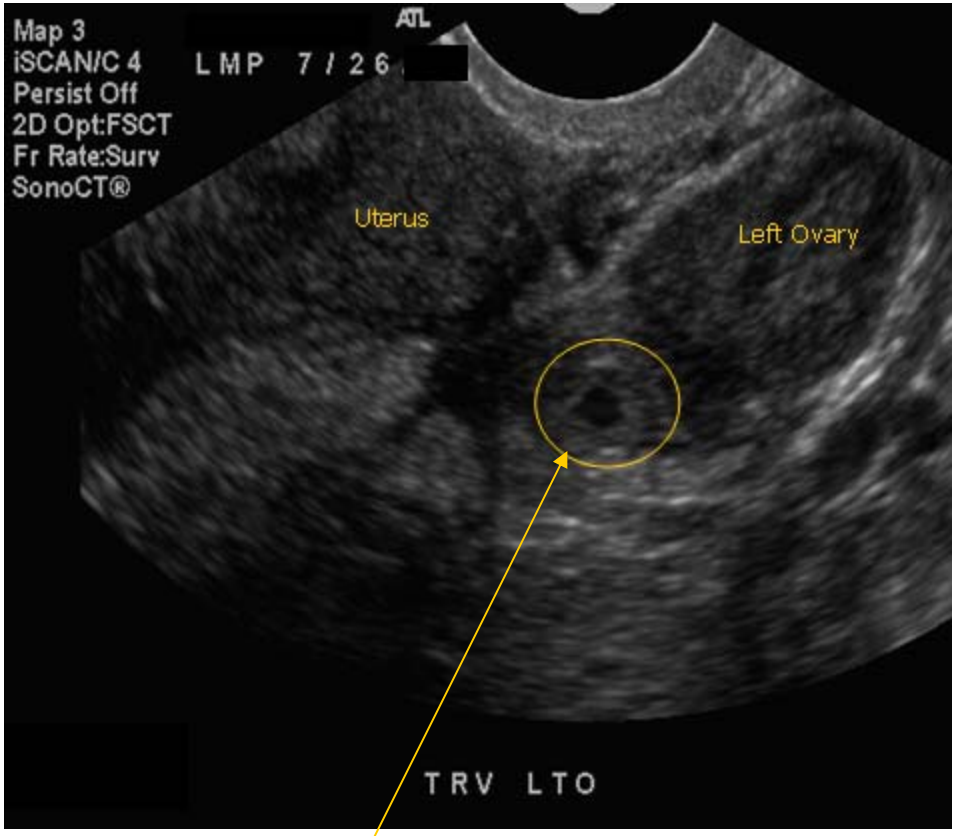
BIDMC PACS

Sagital Uterus

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Ultrasound #1 continued (S.M.)

- Normal right Ovary
- Left Adnexa
  - echogenic area with hypoechoic center
  - no increased vascularity (Doppler)
  - no tenderness



PACS, BIDMC

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Impression and Follow-up

- Differential:
  - Ectopic pregnancy
  - Cyst
  - Tumor
  - Normal Corpus Luteum—too early to rule out intrauterine pregnancy
- Plan: follow-up with US in several days

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

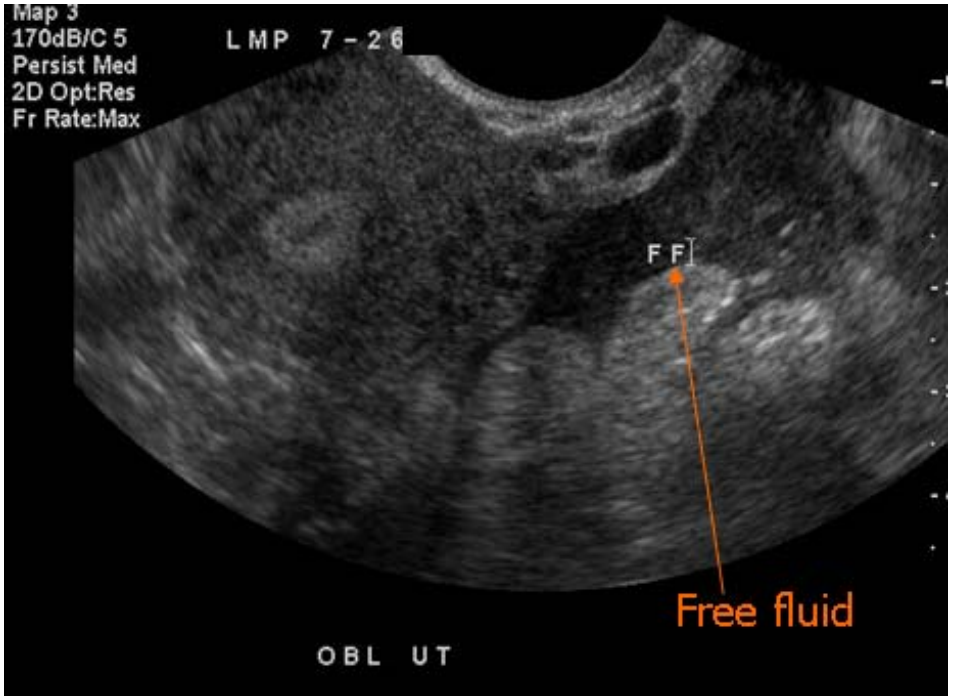
One day later...

- Patient returns with worsened LLQ pain
- β-HCG: 411 mIU/ml
- Hematocrit: 37 (39 yesterday)
- **Clinical Differential**
  - Ectopic pregnancy
  - Kidney stone

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Ultrasound #2

- Normal uterus—still no gestational sac
- Free echogenic pelvic fluid (i.e. hemorrhage) in cul-de-sac

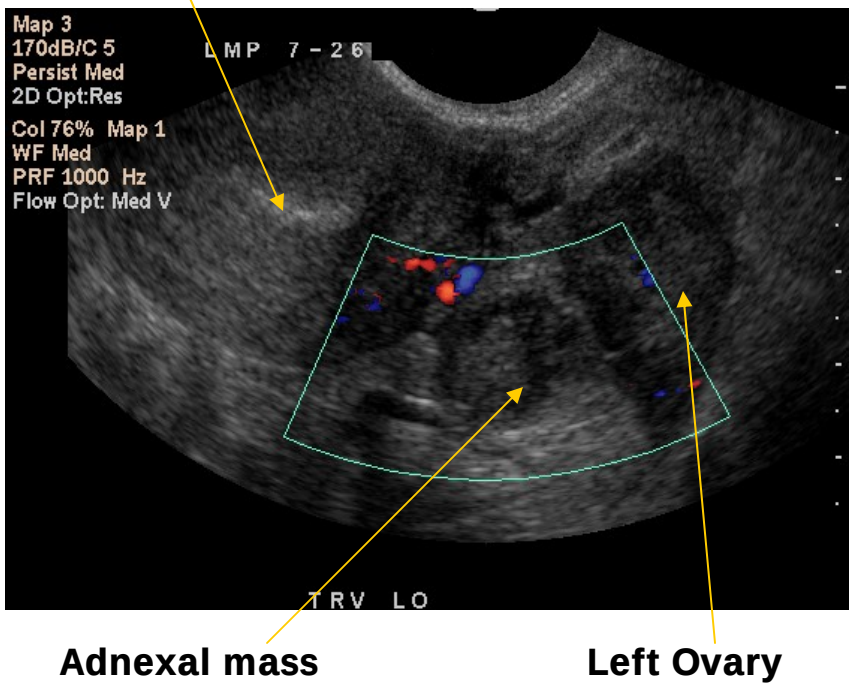


PACS, BIDMC

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Ultrasound #2 continued…

- Enlarged left ovary
- Adjacent heterogeneous focus (hypoechoic center has disappeared)
- Doppler is negative for increased flow



PACS, BIDMC

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Reminder: EP findings on US

Direct (specific) US finding:

Presence of extrauterine gestational sac (+/- fetal pole, yolk sac)

Absence of intrauterine gestational sac at a cutoff HCG level (>2000mIU/ml)

Indirect (less specific) US finding:

- ★ Absence of intrauterine sac (<2000HCG)
- ★ Presence of adnexal mass
- ★ Echogenic or large volume cul-de-sac fluid

Ring of fire (Doppler)/Tubal ring

Diagnosis: ruptured ectopic pregnancy

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Impression and Follow-up

- Diagnosis: ruptured ectopic pregnancy with partially contained hemorrhage
- Laparoscopic surgery performed emergently with the following findings:
  - 200cc pelvic blood clot
  - enlarged, ruptured left fallopian tube
  - bilateral normal-appearing ovaries

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

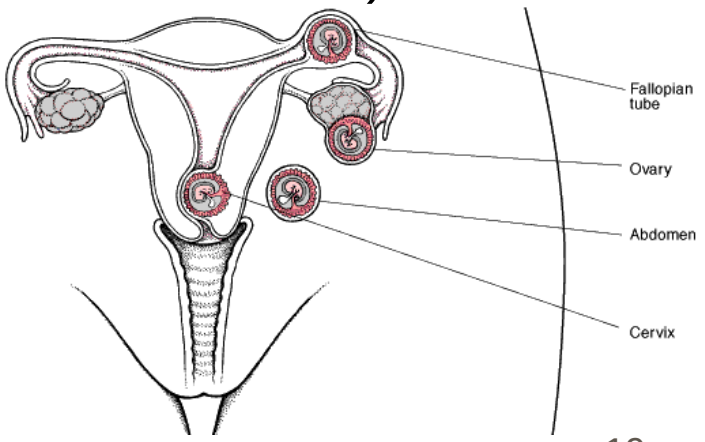
Ectopic Pregnancy Facts

Risk Factors:

Previous ectopic pregnancy
Previous tubal surgery
Tubal pathology
In utero DES exposure
Previous genital infection
Infertility
Multiple sexual partners
Previous pelvic surgery
Smoking
Vaginal douching
Early age of first intercourse

Adapted from Uptodate, www.uptodateonline.com

- US incidence: 2/100 reported pregnancies (increase)
- Responsible for 10% of maternal deaths (decrease)
- Complications: uterine rupture, tubal rupture, tubal scar
- 95% tubal (also abdominal, cervical, ovarian)



Merck Manual, www.merck.com/pubs/mmanual

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Transvaginal US can help to determine treatment...

- Presence of blood in cul-de-sac is always treated surgically (with or without hemodynamic collapse)
- Presence of an adnexal gestational mass >4cm or fetal heart always treated surgically
- Other ectopic pregnancies may be treated with methotrexate
- Some clinicians advocate treating women with <2cm adnexal mass and no free fluid expectantly since about 1/3 of ectopic pregnancies are estimated to regress without complication

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

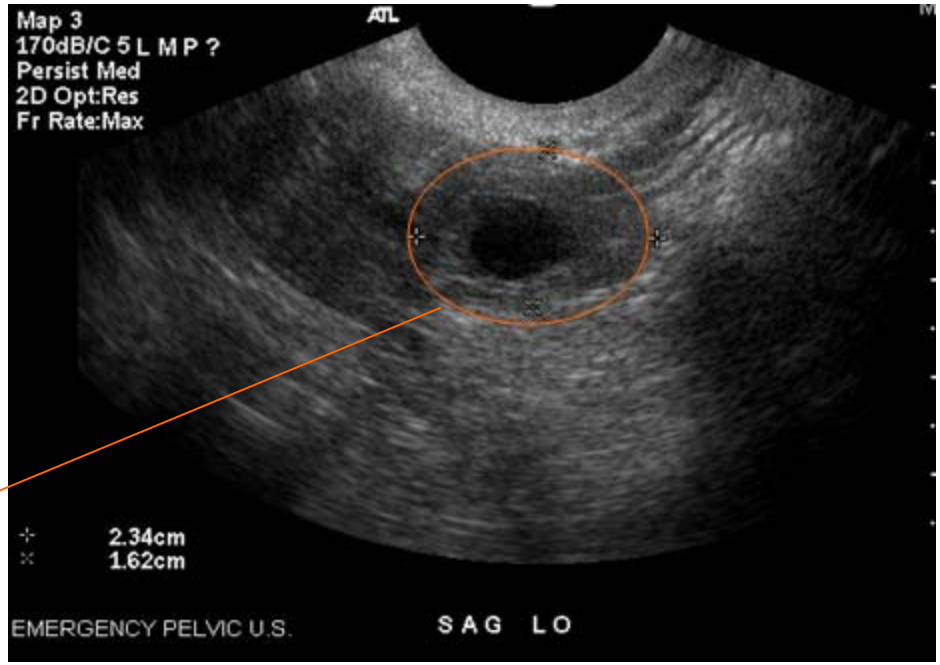
Why is this important?

- Methotrexate: non-invasive, inexpensive, treatment failure possible, follow-up HCG needed, increased abdominal pain and bleeding over longer time period
- Laparoscopic surgery: allows for simultaneous diagnosis and treatment, invasive, expensive
- Expectant: decreases overuse of treatment, risk of rupture and shock

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Presentation of T.R...

- History
  - 25yo G5P2
  - LMP: 8wk, 4d
  - Vaginal bleed/spot x5d with cramping—worse today
  - Previous chlamydial infxn
  - HCG: 1126mIU/ml
  - Vitals stable
- US findings day1
  - Absence of intrauterine gestational sac
  - 1cm fluid filled area (anechoic) within the left adnexa
- Diagnosis: SAB
- Plan: send home

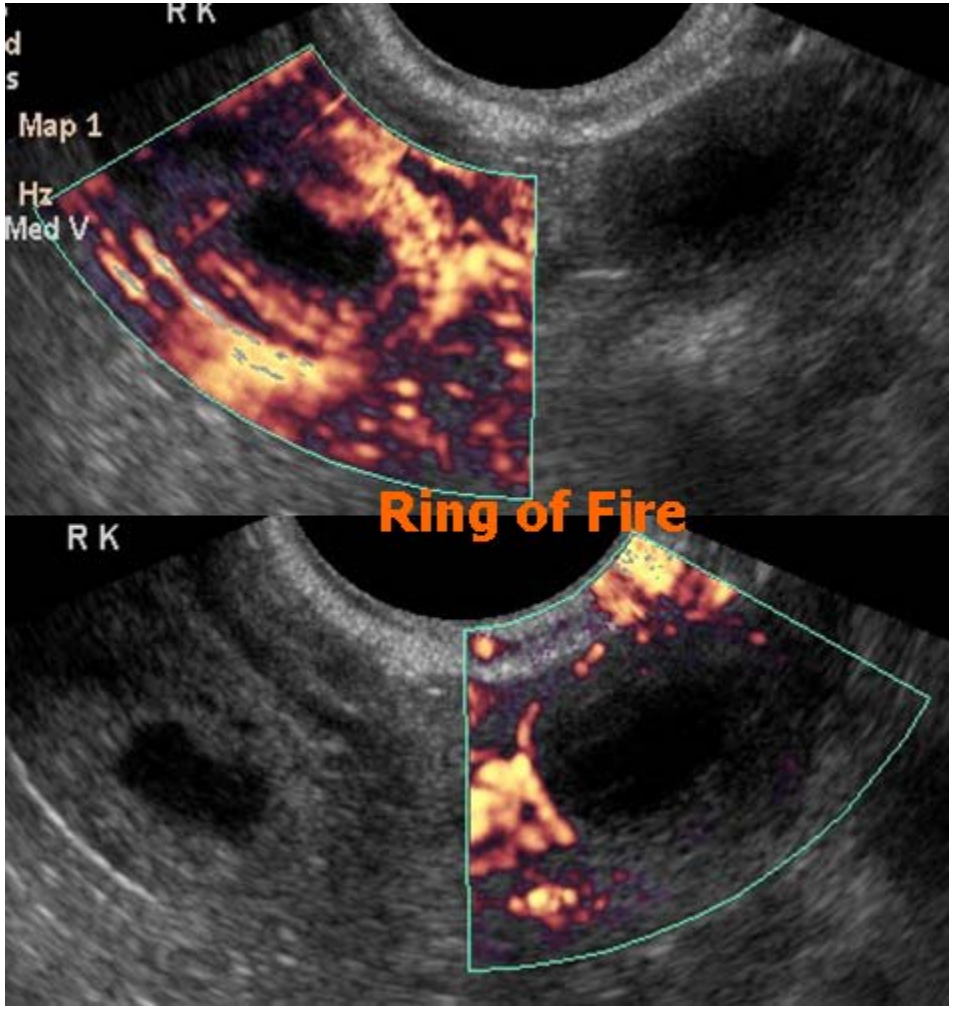


PACS, BIDMC

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Two days later…missed ectopic?

- Presentation to ED—continued bleeding
  - HCG: 931mIU/ml
- Ultrasound #2 for T.R.
  - No intrauterine pregnancy
  - Left ovarian cyst **AND**
  - **Left tubal adnexal mass with central sac, yolk sac, and ring of fire**
- Diagnosis: tubal pregnancy
- Plan: Methotrexate

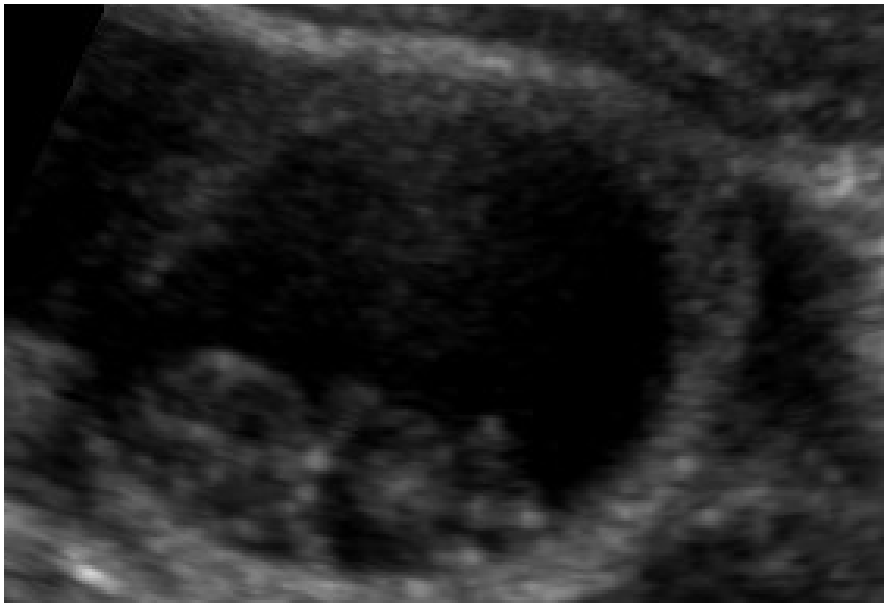


PACS, BIDMC

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Ectopic pregnancy at 9 weeks

- History 36yo G6P3
  - LMP: 9wks
  - Abdominal pain
  - Previous study: no fetal pole in uterus
  - HCG: 7350 mIU/ml
- **Transabdominal** US findings
  - Uterine fibroids—no intrauterine pregnancy
  - Gestational Sac in right adnexa with fetal pole aged 9weeks and yolk sac
  - Fluid in both upper quadrants
- Diagnosis: Ectopic Pregnancy
- Plan: laparoscopic salpingectomy



PACS, BIDMC

Rachel Peragallo, HMS 3
Gillian Lieberman, MD

Free fluid in 9 week ectopic

PACS, BIDMC

PACS, BIDMC

Summary points…

- Transvaginal Ultrasound is the only imaging modality available for use in diagnosing ectopic pregnancies and has increased the detection rate
- Several specific pelvic findings are highly specific for ectopic pregnancy; however, a negative study is not equivalent to a negative ectopic
- Ultrasound is most useful when correlated with HCG levels and clinical symptoms

References

- Ankrum, Willem M, Diagnosing suspected ectopic pregnancy: HCG monitoring and transvaginal ultrasound lead the way. BMJ 321(7271), 2000.
- Levgur, Michael M.D., Tsai, Tony M.D., Kang, Katherine M.D., Feldman, Joseph, Dr.P.H., Korky ,Leslie A. M.D., Endometrial stripe thickness in tubal and intrauterine pregnancies, Fertility and Sterility, 74(5), 2000.
- Lipscomb, Gary H., Stovall, Thomas G., Ling, Frank W., Primary Care: Nonsurgical Treatment of Ectopic Pregnancy, NEJM, 343(18), 2000.
- Shalev, Eliezer MD, Yarom, Ilan MD, Bustan, Moshe MD, Weiner, Ehud MD, Ben-Schlomo, Ishar MD, Transvaginal sonongraphy as the ultimate diagnostic tool for the management of ectopic pregnancy: expereince with 840 cases
- Society of Diagnostic Medical Sonography, Guidelines for Performing Endovaginal/Transvaginal Procedures, http://www.sdms.org/positions/endovaginal.asp
- Sepilian, Vicken MD, Ectopic Pregnancy, emedicine, www.emedicine.com, 2002.
- Valley, Verena T, Pregnancy, Ectopic, emedicine, www.emedicine.com, 2002.
- Tulandi, Togas MD, Clinical manifestations and diagnosis of ectopic pregnancy, UpToDate, http://uptodateonline.com, 2003.

Acknowledgements

Many, many thanks to:

Michelle Swire, MD
Jessi Wei, MD
Shan Liu, MD
Pamela Lepkowski
Gillian Lieberman, MD
Larry Barbaras
Monique Anderson
Hannah Galvin
Tara Benjamin
Sherry Farzan