



Rachel Peragallo, HMS 3  
Gillian Lieberman, MD

# Ultrasonography of Ectopic Pregnancy

---

Radiology Presentation  
Rachel Peragallo  
September 15, 2003



# 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?**



# Differential diagnosis

## Primary:

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

## Secondary:

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



# Workup...



⌘ Vitals Stable

⌘ Hematocrit: 39

⌘  $\beta$ -HCG Level: 930mIU/mL

⌘ Ultrasound

Transabdominal

Transvaginal



# 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**



# Pelvic ultrasound

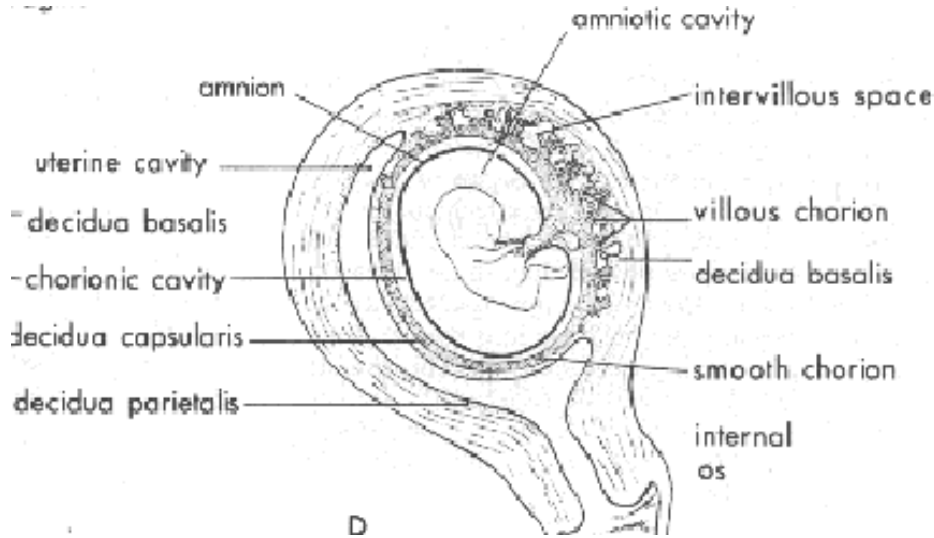


| <b>Transvaginal</b><br>(high frequency)  | <b>Transabdominal</b><br>(low frequency)                                  |
|--|---|
| Minimally invasive   | Noninvasive   |
| Empty Bladder  | Full Bladder  |
| <b>Higher resolution:</b><br>gestational sac seen days<br>35-37, HCG 1500-2000 | <b>Lower resolution: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

Transvaginal ultrasound transducer  
[www.ob-ultrasound.net](http://www.ob-ultrasound.net)

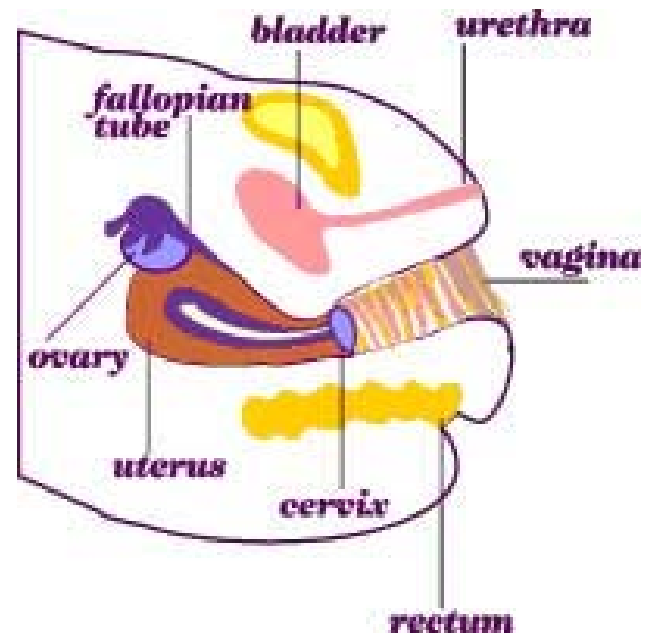


# Embryology and anatomy...



Layers of tissue and fluid in endometrium

<http://www.radiology.creighton.edu/ultraofearlypreg.html>



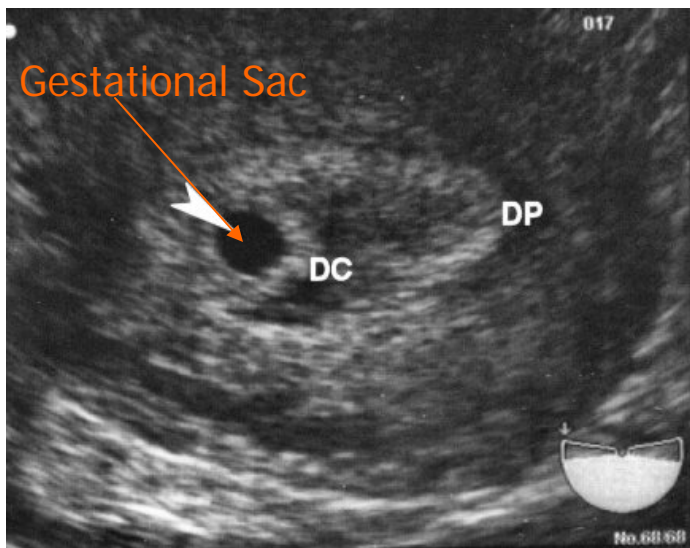
Basic Uterine Anatomy

[www.bidmc.harvard.edu/obgyn/problems.asp](http://www.bidmc.harvard.edu/obgyn/problems.asp)



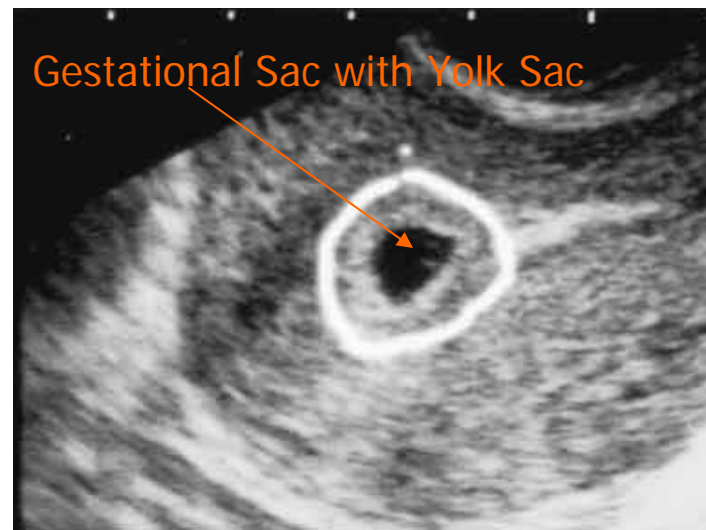
# Ultrasound of 4-6 week normal IUP

4.5 weeks



[www.obgyn.ufl.edu](http://www.obgyn.ufl.edu)

5.5 weeks



[www.advancedfertility.com](http://www.advancedfertility.com)

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





# 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)



# 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 ( $>2000\text{mIU/ml}$ )

Indirect (less specific) US finding:

Absence of intrauterine sac ( $<2000\text{HCG}$ )

Presence of complex adnexal mass

Echogenic or large volume cul-de-sac fluid

Ring of fire (Doppler)/Tubal ring



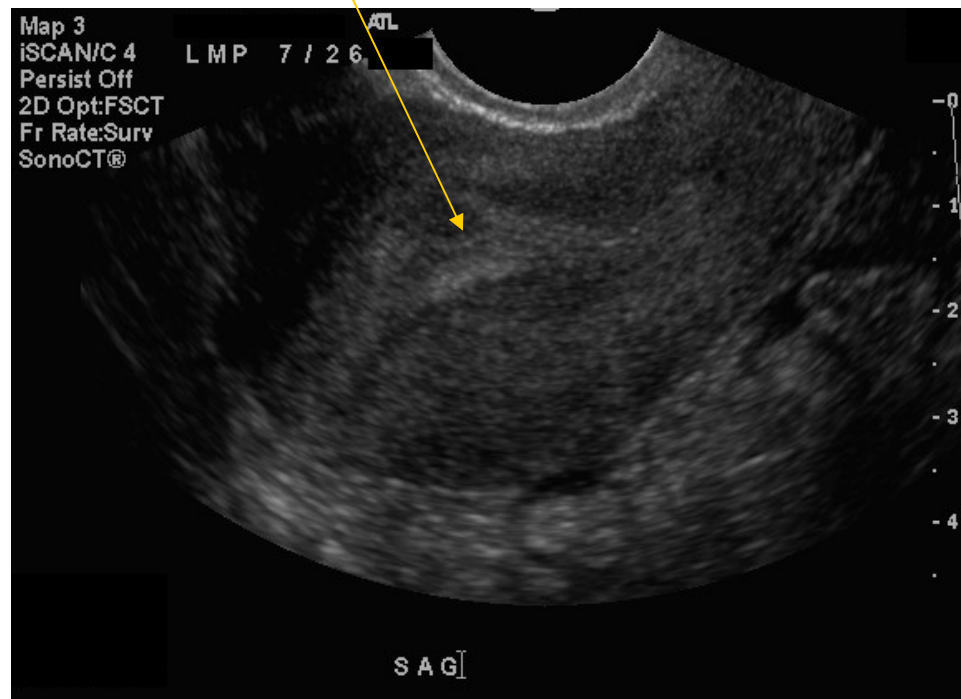
# Ultrasound #1 findings (S.M.)

## ⌘ 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



Sagittal Uterus

BIDMC PACS

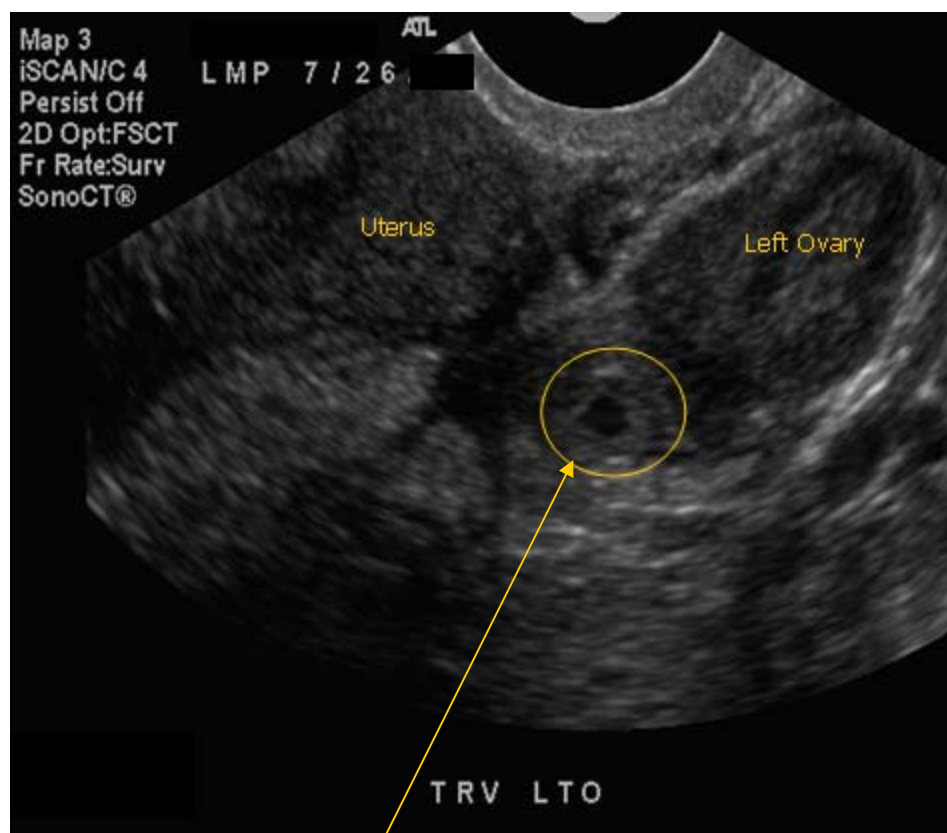


# Ultrasound #1 continued (S.M.)

⌘ Normal right Ovary

⌘ Left Adnexa

- ☑ echogenic area with hypoechoic center
- ☑ no increased vascularity (Doppler)
- ☑ no tenderness



Echogenic area

PACS, BIDMC



# 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



# One day later...



⌘ Patient returns with worsened LLQ pain

⌘  $\beta$ -HCG: 411 mIU/ml

⌘ Hematocrit: 37 (39 yesterday)

## ⌘ **Clinical Differential**

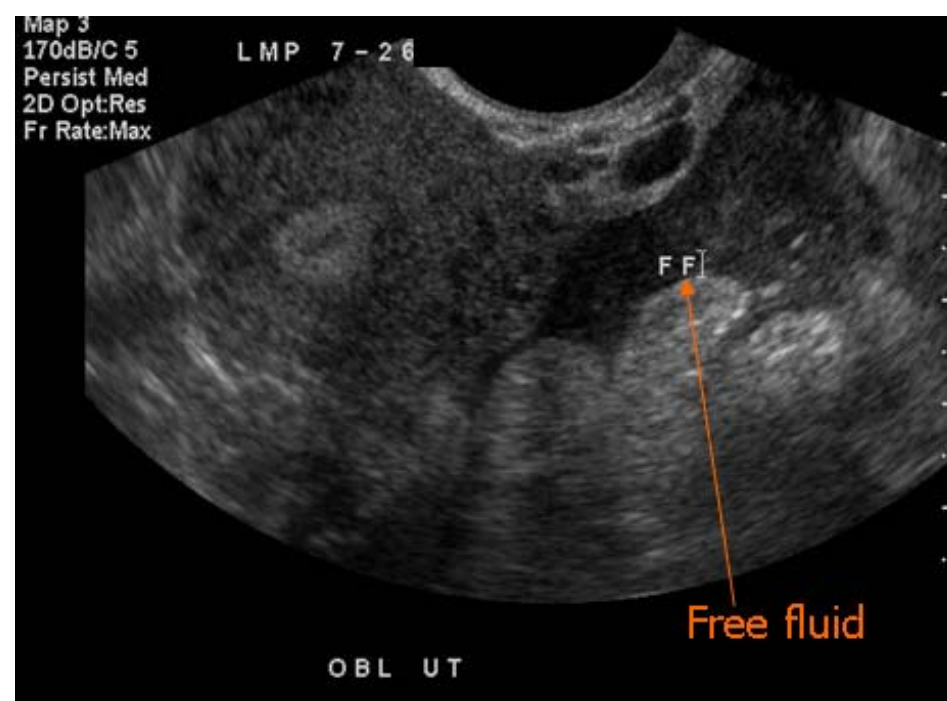
☑ Ectopic pregnancy

☑ Kidney stone



# Ultrasound #2

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



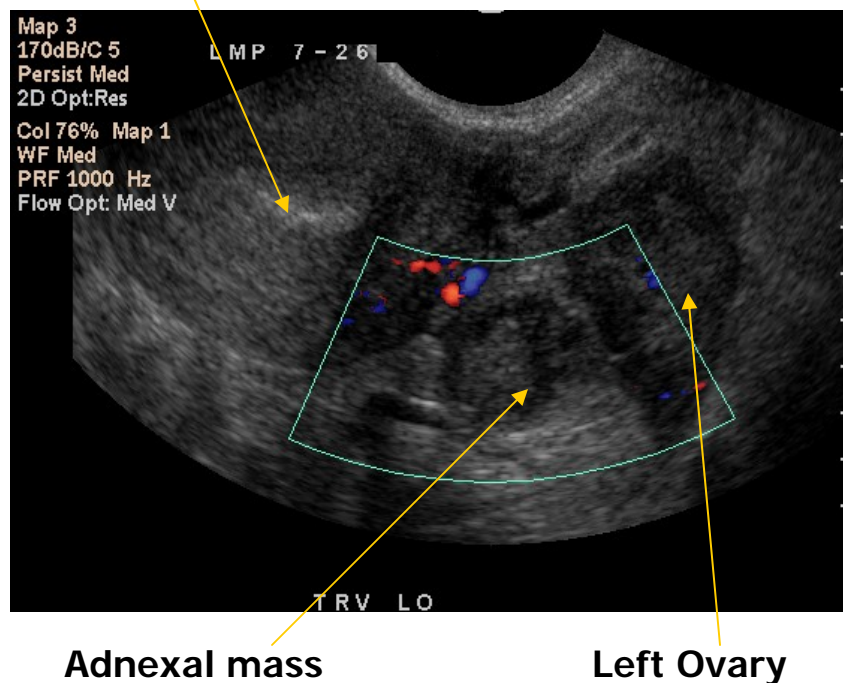
PACS, BIDMC



# Ultrasound #2 continued...

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

Uterus with echogenic endometrium



PACS, BIDMC





# 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 ( $>2000\text{mIU/ml}$ )

Indirect (less specific) US finding:

★ Absence of intrauterine sac ( $<2000\text{HCG}$ )

★ Presence of adnexal mass

★ Echogenic or large volume cul-de-sac fluid

Ring of fire (Doppler)/Tubal ring

**Diagnosis: ruptured ectopic pregnancy**



# 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



# Ectopic Pregnancy Facts

## Risk Factors:

Previous ectopic pregnancy

Previous tubal surgery

Tubal pathology

In utero DES exposure

Previous genital infection

Infertility

Multiple sexual partners

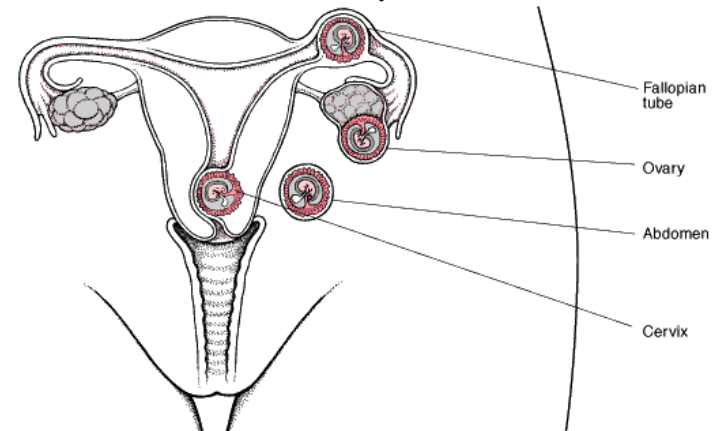
Previous pelvic surgery

Smoking

Vaginal douching

Early age of first intercourse

- ⌘ 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)



Adapted from Uptodate, [www.uptodateonline.com](http://www.uptodateonline.com)



# 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



# 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



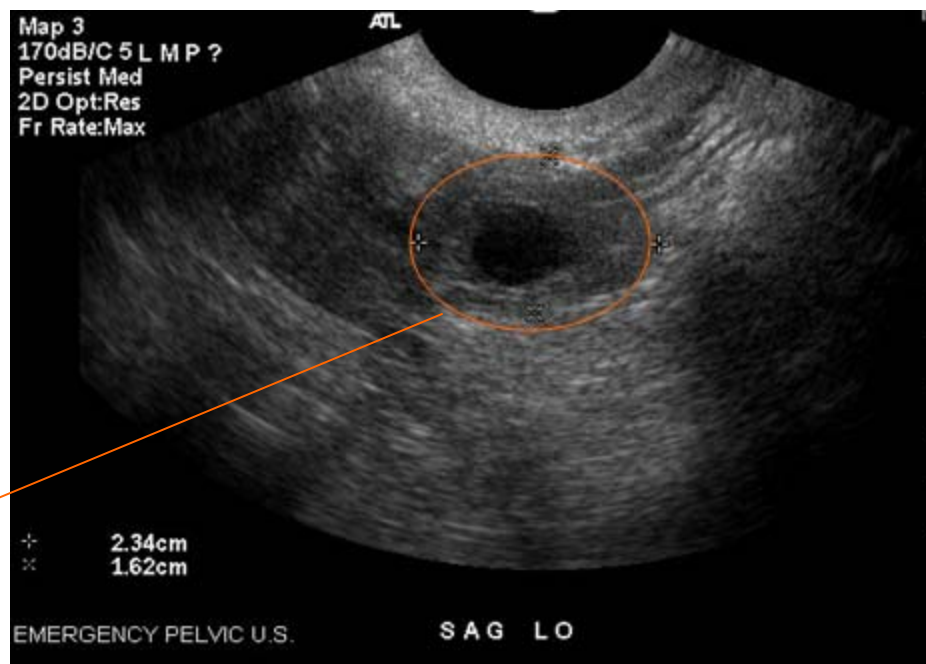
# Presentation of T.R...

## ⌘ 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



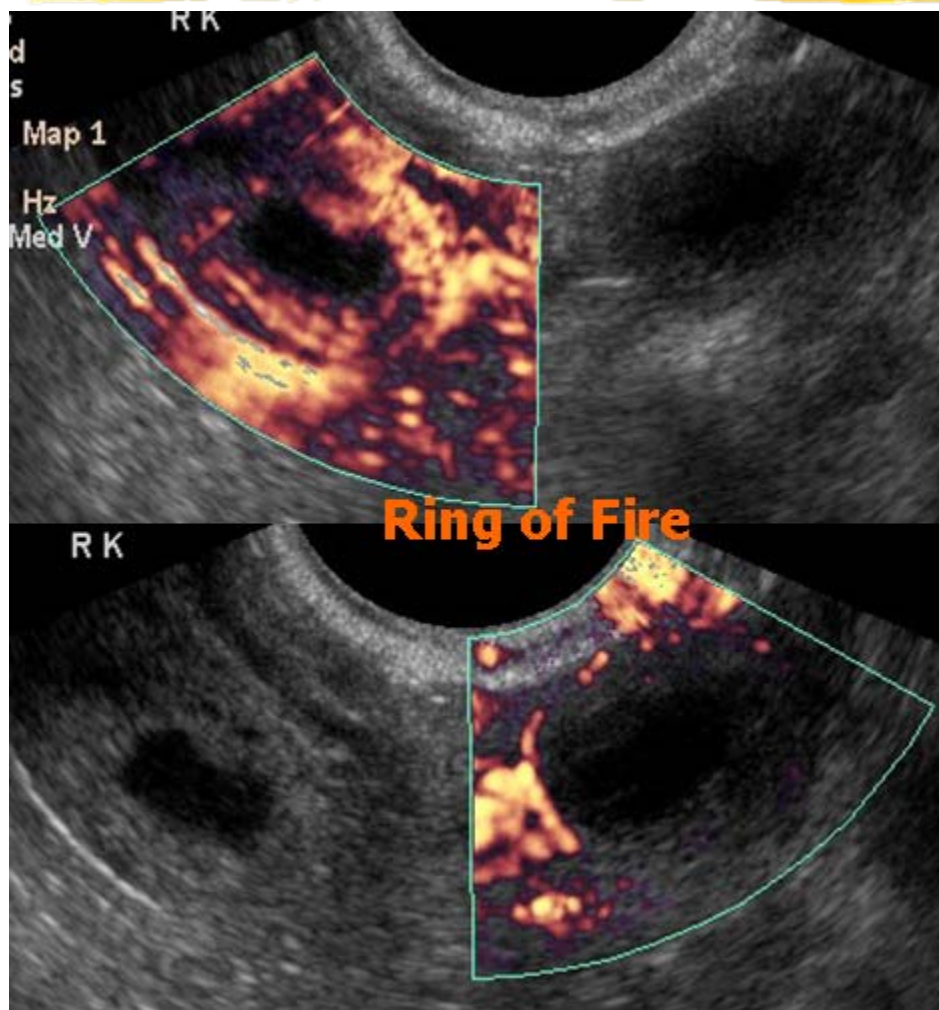
## ⌘ Diagnosis: SAB

## ⌘ Plan: send home



# 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







# Ectopic pregnancy at 9 weeks

## ⌘ History 36yo G6P3

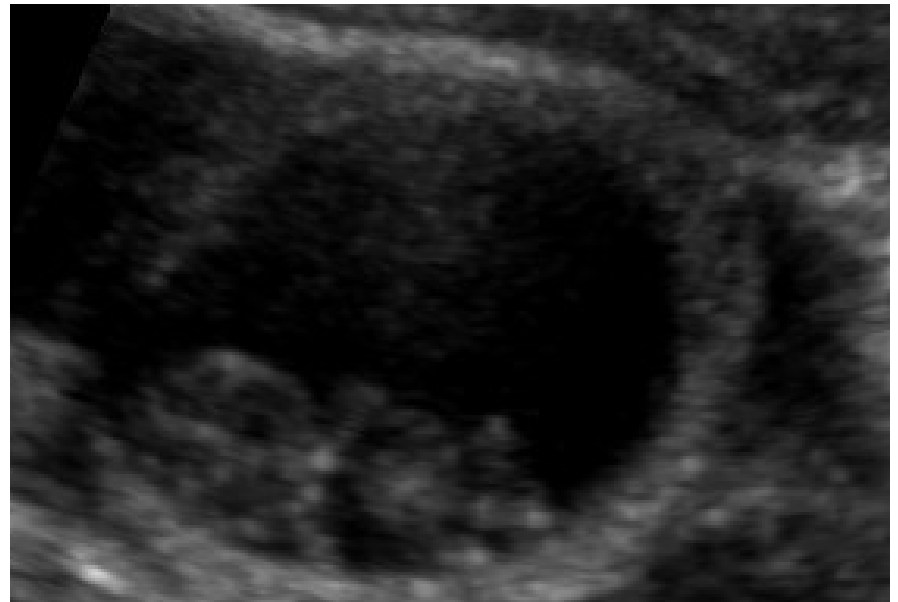
- ☒ LMP: 9wks
- ☒ Abdominal pain
- ☒ Previous study: no fetal pole in uterus
- ☒ HCG: 7350 mIU/ml

## ⌘ 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







# 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 sonography as the ultimate diagnostic tool for the management of ectopic pregnancy: experience 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](http://www.emedicine.com), 2002.
- ⌘ Valley, Verena T, Pregnancy, Ectopic, *emedicine*, [www.emedicine.com](http://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

