Abdominal Pain in a Pregnant Patient

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Ms. O is a 21yo pregnant female
(23+6 weeks gestation)

HPI
- Woke with 5/10 crampy abdominal pain followed by nausea, vomiting,
- Pain intensified over 12 hours
- Presented to the ED at St. Luke’s Hospital
- Diagnostic tests and an imaging study were inconclusive.
- Monitored over next 12 hours
- Transferred to BIDMC 24 hours after the onset of pain

ROS
- Occasional flatus
- No hx of pain after eating, flank pain, dys/hematuria, hematochezia, melana, vaginal discharge, new sexual partners, PID, no ingestion of exotic foods/undercooked meats
Ms. O’s story continues

Physical Exam (pertinent points)

- **Vitals**  
  T 99.4  BP 123/79  P 91  O2sat 98%

- **HEENT**  
  Dry mucous membranes

- **Abdomen**  
  Gravid, Distended, marked RUQ and moderate diffuse abdominal tenderness, no rebound or guarding, negative Rovsing’s sign

Pertinent Labs

- **WBC 13.9**
- **UA negative**
- **LFTs normal**
- **Amylase and Lipase normal**
DDX: abdominal pain in the pregnant patient

Acute Appendicitis
Acute Cholecystitis
Intestinal Obstruction
Nephrolithiasis
Gastroenteritis

*Special concerns during pregnancy*
Ligamentous Laxity, Preterm Labor, Abruption, Miscarriage, and Ovarian Torsion
Female pelvic anatomy

The female abdomen and pelvis is full of structures that may develop pathology and result in abdominal pain. The history, physical, labs, and studies, help narrow the list of possible offenders.
Anatomy of the appendix

The vermiform appendix projects off of the cecum distal to the ileocecal valve.
Acute Appendicitis

**Definition**  Inflammation of the appendix due to obstruction by fecalith (appendicolith), lymphoid hyperplasia, or rarely, parasite, foreign bodies, or tumor

**Classic Presentation**  Peri-umbilical (visceral) pain followed by nausea and vomiting that ultimately migrates to become right lower quadrant (somatic) pain within 24 hours

**Associated Findings**  Rovsing’s sign, leukocytosis (>10,000), tachycardia, hypotension

**Incidence during Pregnancy**  0.05-0.07% (similar to general population)
Diagnostic Challenges in Pregnancy

Anatomic Changes
- Enlarging uterus displaces appendix cephalad
- Separation of visceral & parietal peritoneum (impaired pain localization)

Physiologic Changes
- Masking of leukocytosis (normal pregnancy WBC range 6-16,000)
- Increased blood volume blunts tachycardia and hypotension
Appendicitis in pregnancy: a risky situation

A pregnant woman with appendicitis

- Increased risk of perforation (43%) compared to general population 4-19%)

- If perforation occurs, risk of fetal mortality increases from 1.5% to up to 35%

Appendectomy during pregnancy

- Usual risks of surgery
- Spontaneous abortion
- Preterm labor
- Premature delivery

Levine, 2006 and Augustin, 2006
Imaging studies in appendicitis

- **CT Scan**
  - Sensitivity 94%
  - Specificity 95%

- **Ultrasound**
  - Sensitivity 86%
  - Specificity 81%

- **MRI**
  - Sensitivity 100%
  - Specificity 94%

**Key Findings**
- Diameter $> 7$mm
- Fluid filled structure
- Wall thickening $> 3$mm
- periappendiceal fluid
- Appendicolith

Humes and Simpson, 2006 and Pedrosa et al, 2006
Companion Patient #1: Appendicolith

Frontal Plain Film

Appendicolith (Lateral to S.I. Joint)

http://www.learningradiology.com
Companion Patients #2 and 3: Appendicitis on CT Scan

Findings:

11 mm appendix
fat stranding

Blind tip

Appendicolith

Drawback:
Exposure to ionizing radiation.

CT with oral contrast

CT with colon contrast

Image from PACS

Mullins, Rhea and Novelline, 2003
Appendiceal Imaging modalities during Pregnancy

Graded-Compression Sonography

**Benefits:** readily available and no associated ionizing radiation

**Drawbacks:** operator dependent, pain and/or gravid uterus may hinder exam, a normal or perforated appendix may not be visualized

MRI

**Benefits:** no ionizing radiation and excellent sensitivity and specificity

**Drawbacks:** limited availability, contraindications, cost, claustrophobia
Companion Patients #4 and 5: Appendicitis on Graded-Compression Sonography

How is it performed?
- Compress abdomen with high resolution transducer
- Identify terminal ileum
- Scan for cecal tip and adjacent appendix

What are the findings?
- Enlarged, fluid-filled appendix
- Appendicolith
- Periappendiceal Inflammation

Sivit and Applegate, 2003

Transverse US
Sagittal US
Sagittal US
Companion patient #6: Appendicitis on MRI

How is it performed?
- Oral contrast is given 1 hour prior to the study
- Patients are placed feet first into the magnet.
- Numerous images* are obtained during breath holds (20-24 seconds)
- Exam time takes approximately 30 minutes

What are the findings?
- Dilated tubular appendix
- Periappendiceal edema

C=cecum, U=uterus

Pedrosa et al, 2006
MRI in Pregnancy

Advantages of MRI Protocols

- HASTE or SSFSE images have less motion artifact and can visualize periappendiceal fat stranding
- Fat-saturated T-2 images reveal high-intensity-signal inflammatory fluid
- Fat-saturated T-1 images reveal hemorrhage

Safety of MRI in Pregnancy

- Radiofrequency pulses may cause tissue heating
- No adverse fetal affects have been linked to MRI
- Gadolinium is used cautiously in 2nd and 3rd trimesters, avoided in the 1st

Current Practice at BIDMC

- Perform MRI only when ultrasound is inconclusive
- Use extra caution with MRI during the first trimester
Back to our patient...

- Ms.0 is tearful and complaining of continuous 8/10 pain in her abdomen—worst in her RUQ

- She undergoes Graded-Compression Sonography
Our Patient Ms. O’s Ultrasound Study

No appendix is visualized.

Sagittal gallbladder
normal gallbladder

Sagittal rt. ovary
normal rt. ovary
(good flow on doppler)

Sagittal rt. kidney
Proximal ureter 1.6 cm
Rt. Hydronephrosis (common in pregnancy)
Ms. O’s MRI Imaging Study
Axial SSFSE Images with oral contrast

Proximal Appendix
Normal caliber, non-fluid filled

Mid Appendix (site of obstruction)
Appendicolith (intraluminal low-signal-intensity foci)

Distal Appendix
9mm diameter, high-signal-intensity fluid-filled lumen

Right hydronephrosis

Images from PACS
Appendiceal Tip

- 8.75mm diameter
  (normal <7mm)
- High intensity fluid within lumen
- Minimal periappendiceal inflammation
Ms. O's hospital course

**Diagnosis**  Acute appendicitis involving the distal 3.5 cm

**Intervention**  Emergent appendectomy with removal of mottled appendix and perforated tip

**Pathologic Diagnosis**  Acute gangrenous appendicitis, average diameter 1.3 cm and obstructing fecalith in the lumen.

**Outcome**  Ms. O recovers gradually and is sent home on post-op day 9 in stable condition.
Take Home Points  Appendicitis in Pregnancy

- Clinical signs and symptoms of appendicitis may be masked
- Delayed diagnosis may lead to perforation
- Surgery may lead to premature delivery and fetal loss
- Ultrasound is the initial imaging modality of choice
- MRI is performed if the ultrasound is inconclusive
- Key findings include an enlarged fluid-filled appendix and periappendiceal inflammation
References

- http://z.about.com/d/p/440/e/f/7028.jpg
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Baby O. courtesy of BIDMC PACS