Uterine Rupture: Imaging with MRI and Ultrasound

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Agenda

- Introduce Patient J P
- Discuss the work up of the pregnant patient with abdominal pain
  - Review of how pregnancy affects our differential diagnosis
  - Menu of tests
- Radiologic findings on US and MRI in case of Patient J P
Our patient J P: History

History of Present Illness: J P is a 40 year-old-woman (G5P1) at 29w5d presenting with increasing pelvic pain over past two weeks. Pain is constant, sharp, and shooting with intermittent bursts. Acutely worse in last day, more localized to RUQ

- ROS: +fetal movement; negative for shortness of breath, contractions, vaginal bleeding or leakage of fluid
Our patient RS: Additional History

Past Medical History

- Gestational Diabetes (GDMA1)
- GERD/IBS
- Preeclampsia in prior pregnancy (c-section at 33w in 2006)
- AML, s/p BMT 1997, chemo and radiation

- Social Hx: 20 pack years (quit 10 years ago)
- No medications and NKDA
Our patient J P: Exam and Labs

- Vitals: T 98.7 HR 76 BP 141/82 RR 20
- Abdomen: soft, gravid, tender to palpation diffusely
- Vaginal Exam: long, closed, posterior cervix
- Labs: CBC, ALT, AST, Cr and UA all WNL
Differential Diagnosis: Abdominal Pain in Pregnant Patient

- When evaluating the pregnant patient, it is important to consider the categories of etiologies for abdominal pain:
  - Obstetrical
  - Non-obstetrical
  - Gynecologic
Obstetrical Etiologies

- Placental abruption
- Uterine rupture
- Extrauterine pregnancy
- Severe preeclampsia or HELLP
- Intraamniotic infection
- Acute fatty liver
Non-obstetric Etiologies

- Appendicitis
- Gall bladder disease
- Bowel obstruction
- Inflammatory bowel disease
- Pancreatitis
- Perforated ulcer
- Trauma
Gynecologic Etiologies

- Ovarian torsion or cyst rupture
- Fibroid degeneration
- Pelvic inflammatory disease
- Endometritis
- Pelvic girdle pain
Imaging Considerations in Pregnancy

- Safety of radiation exposure during pregnancy is a common concern
- Missed or delayed diagnosis can pose a greater risk to the woman and her pregnancy
- Potential deleterious consequences of ionizing radiation can be divided into four categories (2)
  - Pregnancy loss (miscarriage, stillbirth)
  - Malformation
  - Disturbances of growth or development
  - Mutagenic and carcinogenic effects
Radiologic Tests to Evaluate Abdominal Pain in Pregnancy

- US
  - Primary modality for screening abdominal pathology
  - No ionizing radiation exposure

- MRI
  - Expensive and time consuming
  - No ionizing radiation

- (CT)
  - Standard after US in non-pregnant patients
  - Reserved for special circumstances
Radiologic Tests to Evaluate Abdominal Pain in Pregnancy

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Initial US: Abnormal, heaped placenta

Normally, would expect placenta to lie flat against contour of uterus
Initial US: placental abruption

1. Chorion
2. Blood/abruption
3. Uterine wall
4. Fetus
Initial US: rule out appendicitis?

- Even though the appendix not clearly visualized with sonography in our patient, the findings on US consistent with abruption satisfied our radiologic search for an etiology for our patient JP’s pain.
- Patient remained afebrile without leukocytosis and peritoneal signs, also making appendicitis less likely
Placental Abruption: Definition and Management

- Separation of placenta from uterus, usually resulting in hemorrhage and placental insufficiency
- Treatment depends on age of fetus and amount of blood loss
- If EGA < 36 weeks with no maternal or fetal distress, observation and symptomatic management
Biophysical Profile (BPP)

- Two points each given for AFI, fetal tone, activity and breathing movements
- Our patient’s results: 8/8
  - Vertex position; AFI 13; reassuring fetal heart rate
  - Maternal sharp pain with fetal movement
- OB/GYN Impression: Not consistent with fetal distress due to abruption, in spite of initial US findings
Our Patient J P: Clinical Change

- Patient observed initially
- Worsening abdominal pain:
  - Patient was initially able to ambulate to bathroom on her own, then change to fetal position, crying and writhing in pain.
  - Physical Exam: +peritoneal signs.
- Transferred to labor and delivery for r/o chorioamnionitis, appendicitis, worsening placental abruption.
Diagnostic Dilemma

- Radiology: US shows likely abruption; but appendix not visualized
- OB/GYN: BPP was not consistent with abruption
- General Surgery Consult- Exam not consistent with appendicitis
- Plan: Proceed with additional imaging
Radiologic Tests to Evaluate Abdominal Pain in Pregnancy

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Additional Imaging Concerns

- Given J P’s pregnancy was high risk, OB/GYN had concern over ability to continuously monitor fetus during further imaging studies.
- However, the risk of ionizing radiation to fetus were considered of greater significance.
- Availability of MRI at our institution with experienced fetal imagers made this the next step, in spite of the acknowledged rapidity of a CT scan.
Radiologic Tests to Evaluate Abdominal Pain in Pregnancy

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MRI: retroperitoneal abnormalities

Bilateral hydronephrosis
right > left

Fluid in Morrison’s pouch

Fetus

Coronal T2 MRI
MRI: Liver with ascites

Ascites around liver
MRI: Myometrial defect and ascites

Disrupted outline of myometrium
Free fluid in abdomen
MRI: Oligohydramnios

Outline of uterus-oligohydramnios
MRI: Oligohydramnios

Outline of uterus- oligohydramnios
MRI: Myometrial silhouette

Outline of myometrium

PACS, BIDMC coronal T2 MRI
MRI: Myometrial defect

Defect in myometrium
Fetal parts in LLQ

PACS, BIDMC  coronal T2 MRI
MRI: Additional Defect in Myometrium

Defect in myometrium
Fetal parts in LLQ
MRI: Shortened Cervix

Funnel shaped, short cervix

PACS, BIDMC

Sagittal T2 MRI
Umbilical cord protruding out of uterine defect (flow voids)

Free fluid in maternal pelvis

MRI: Free Fluid in Pelvis

PACS, BIDMC  sagittal T2 MRI
MRI: Umbilical cord in myometrial defect

Funnel shaped, short cervix

Umbilical cord protruding out of uterine defect

Defect in myometrium

Image courtesy of Deb Levine

Sagittal T2 MRI
MRI: Fetal parts abutting maternal body wall

Fetal parts
Myometrium
Maternal abdominal wall

Axial T2 MRI
Image Courtesy of Deb Levine
Uterine Rupture

- Complete breach in myometrial wall with fetal parts in maternal peritoneal cavity
- Symptoms: abdominal pain, vaginal bleeding, changes in fetal heart rate, maternal hypovolemic shock
- Risk factors: prior uterine surgery (ie c-sections)
Management of our patient

- Urgent C-section
- Per operative report: uterine rupture was immediately apparent; defect in wall of lower uterine segment along area of prior hysterotomy. Defect extended inferiorly within 1 cm of bladder; infant and placenta delivered in normal fashion without further complication. No evidence of abruption was noted.
- Hysterotomy repaired in usual fashion.
Revisiting original US in hindsight

- Bladder wall
- Abnormal uterine contour
- Fetus

PACS, BIDMC
US Interpreted initially as placental abruption

1. Chorion
2. Blood/abruption
3. Uterine wall
4. Fetus

In lieu of MRI findings, this interpretation was revisited.
1. Uterine wall
2. Fetus
3. Fluid in abdomen

Findings consistent with uterine rupture
Defect in myometrium/uterine wall

This image was from the original US sequence, but was not initially considered because of the earlier image which was believed to clearly show abruption.
Putting it all together: hindsight

- Our patient J P had gestational diabetes and polyhyramnios
- Leakage of fluid from myometrial defect → normal appearing AFI on initial BPP
- Prior C-section a risk for uterine rupture
- Cervical changes on MRI indicate J P was also in preterm labor, which may have contributed to her changing pain.
Lessons Learned

- Ultrasound is a good screening test for imaging pregnant women with abdominal pain.
- Beware of satisfaction of search: consider clinical picture
- MRI provides detailed cross-sectional imaging without the hazards of ionizing radiation on the fetus
- MRI is a reliable modality for providing valuable diagnostic imaging in pregnant patients with abdominal pain (1)
Update on Patient JP

- Post-operative course uneventful, patient discharged on POD #4
- Infant daughter had surgery at Children’s Hospital for tracheo-esophageal fistula, then spent 2 weeks in NICU
- Mother and baby both doing well at subsequent follow up
Acknowledgements

- Patient J P and her daughter
- Neely Hines, MD
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- Maria Levantakis
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References


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