



What To Expect When They're Expecting: MR Imaging of the Acute Abdomen in Pregnancy

Hemang M. Kotecha, DO; Lacey J. McIntosh, DO, MPH; Hao S. Lo, MD; Byron Y. Chen, MD; Carolyn S. Dupuis, MD
Department of Radiology, UMass Memorial Medical Center, University of Massachusetts Medical School



Objectives

1. Discuss the clinical challenges and the role of imaging in the evaluation of pregnant patients with abdominal pain.
2. Review differential diagnoses, and illustrate MR imaging findings of acute abdominal pain during pregnancy.

Normal Causes of Pain in Pregnancy

- Enlarging uterus
- Fetal position or fetal movement
- Braxton-Hicks uterine contractions
- Pain related to round ligaments

Anatomic Alterations in Pregnancy

- Abdominal and pelvic structures are displaced from their normal anatomic locations by the enlarged gravid uterus
- Enlarged uterus may compress the urinary tract

Physiologic Alterations in Pregnancy

- Nausea and vomiting common in early pregnancy
- High **progesterone** levels lead to decreased:
 - Tone of the lower esophageal sphincter
 - Bowel and colonic motility
 - Gallbladder emptying
 - Ureteral tone
- **White blood cell count** increases to normal range of 10,000 to 14,000 cells/mm³
- Increase in plasma volume results in physiologic anemia

Role of Imaging

- Conventional diagnostic procedures that utilize ionizing radiation should be avoided in pregnancy to limit carcinogenic and deterministic risks to the fetus
- **Radiography and CT** should not be withheld if a delay in diagnosis may result in adverse maternal or fetal outcomes
- **Ultrasound is frequently the first-line imaging** modality due to its wide availability and lack of ionizing radiation
- **MRI preferred when US inconclusive**
 - Wide field of view, high soft tissue contrast, and lack of ionizing radiation

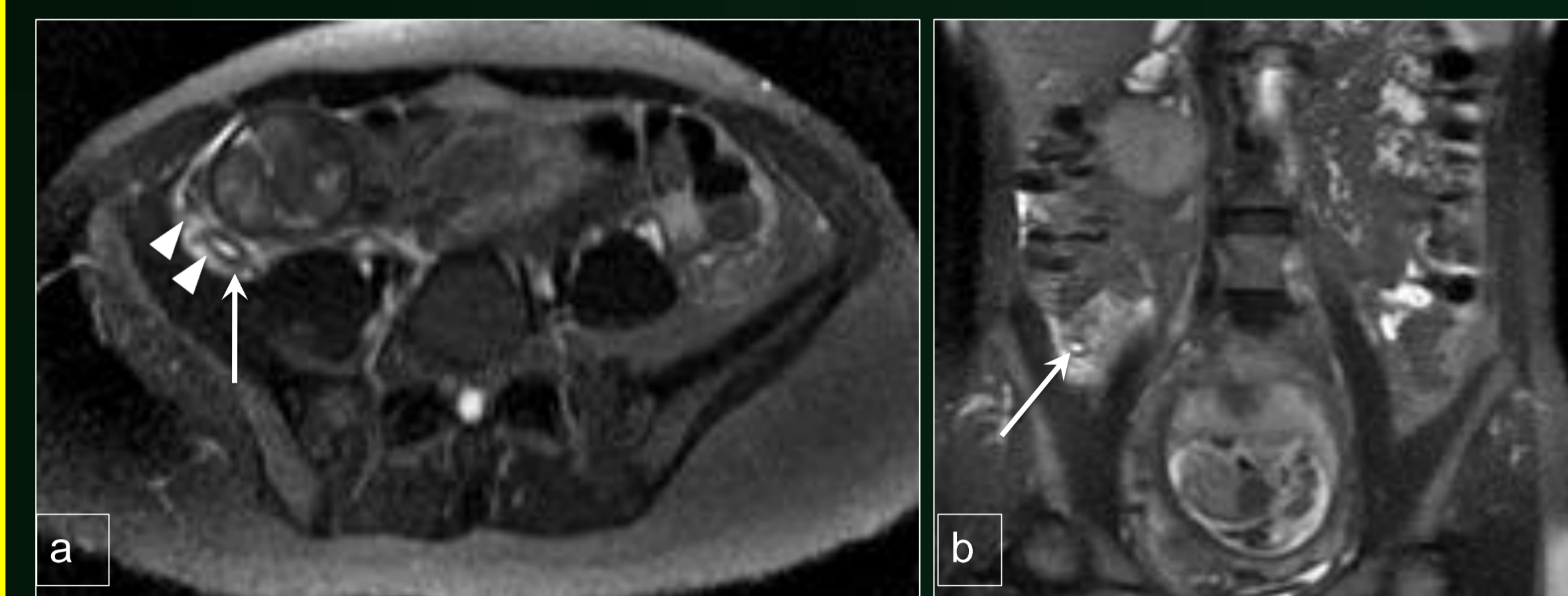


Fig 1. Acute appendicitis. Axial (a) and coronal (b) T2-weighted SSFSE fat suppressed (FS) images show a fluid-filled 9-mm-diameter appendix (arrow) with wall thickening and periappendiceal edema (arrowheads).

Acute Appendicitis in Pregnancy

- Most common non-obstetric indication for **emergency surgery**
- Imaging indicated to reduce delays in surgical intervention
 - Delay of >24 hrs after onset of symptoms increases **risk of perforation**; **Risk of fetal loss** ~36% when appendix perforates
- **ACR Appropriateness Criteria: ultrasound is first line**
- **MRI preferred when ultrasound inconclusive**

MRI Findings in Acute Appendicitis

- **Diameter > 7 mm; Wall thickness > 2 mm**
- **High T2 signal of luminal contents**
- **Periappendiceal edema**

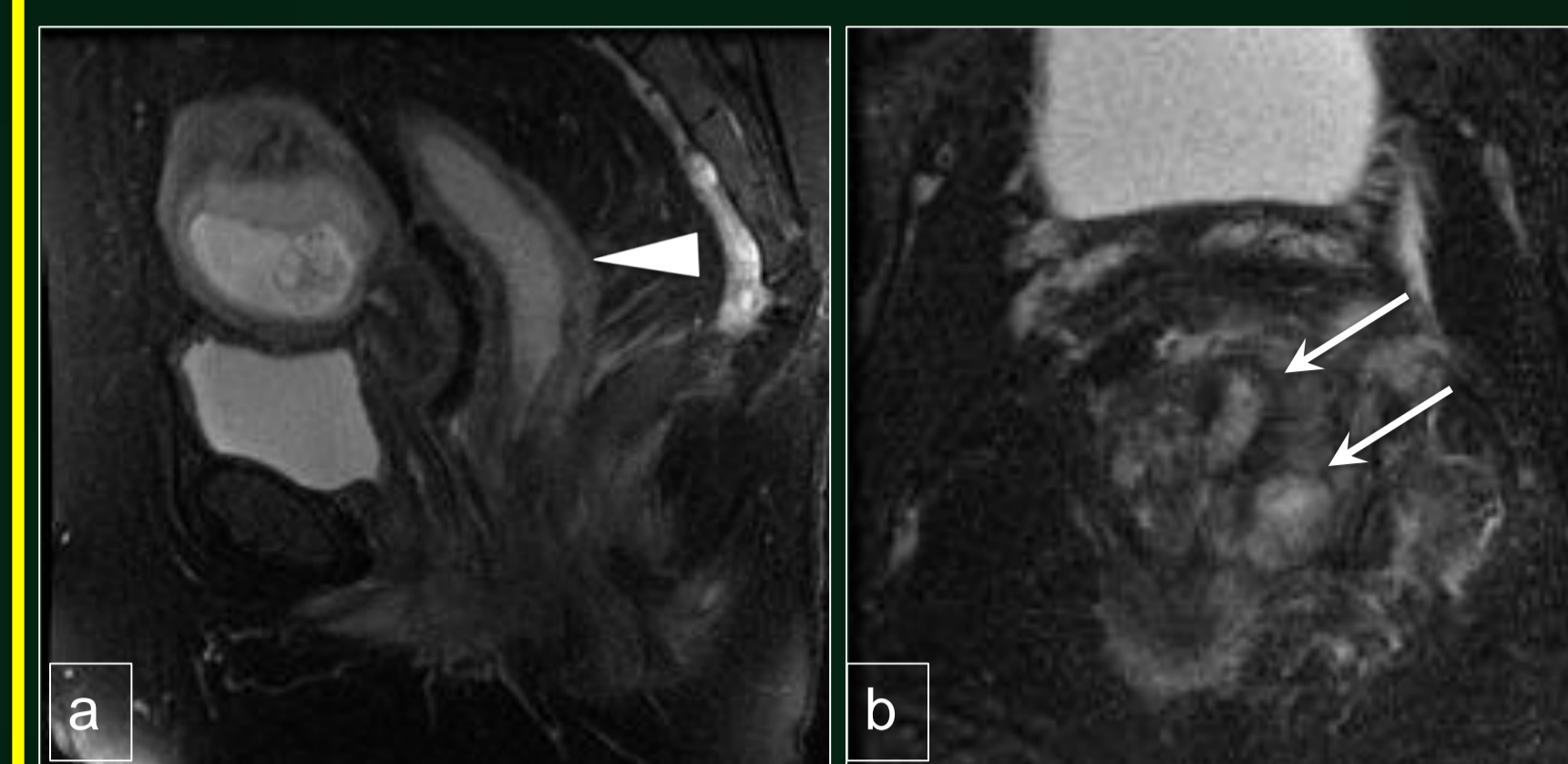


Fig 2. Crohn disease. Sagittal proton density FS image (a) depicts rectal wall thickening (arrowhead) and mural edema. Axial T2-weighted FS image (b) reveals perianal abscesses (arrows) and extensive soft tissue edema.

Inflammatory Bowel Disease in Pregnancy

- Peak incidence overlaps with the age of the reproductive population
- **Terminal ileum** involvement is most common, and may **mimic appendicitis** clinically
- **MR is imaging modality of choice**
 - **Findings include bowel wall thickening, mural edema, mucosal enhancement, luminal narrowing, and fluid or edema in the adjacent soft tissues**
- Complications include abscess, fistulae, and strictures

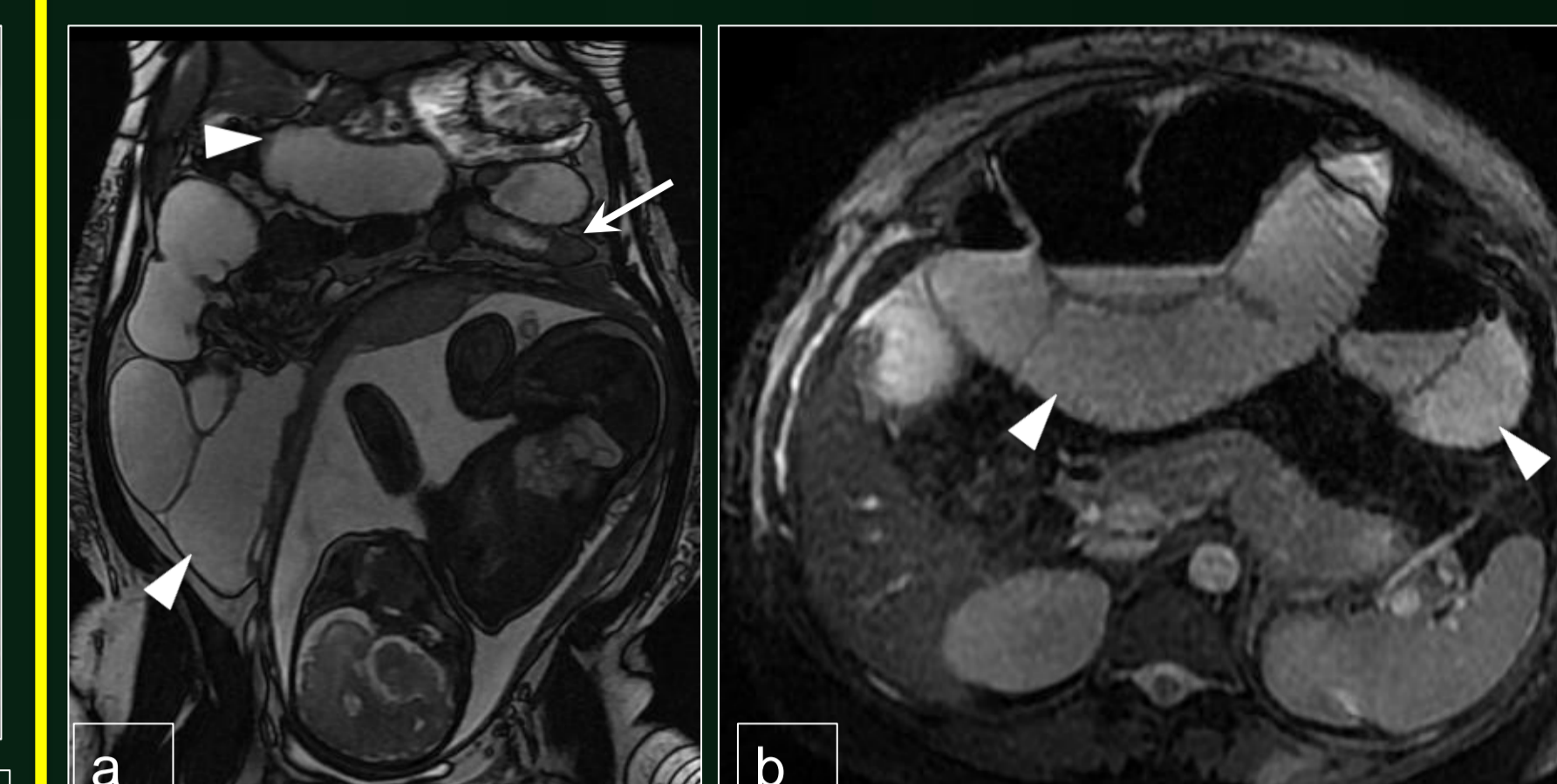


Fig 3. Small bowel obstruction. Coronal 2D FIESTA (a) and axial 2D FIESTA FS (b) images demonstrate multiple dilated fluid- and air-filled loops of small bowel (arrowheads) with a transition point (arrow) in the left upper quadrant.

Small Bowel Obstruction in Pregnancy

- Maternal mortality ≈ 6%
- **Fetal mortality 20-26 %**
- 1/3 of patients with prenatal bowel obstruction complete term pregnancies after surgery
- Fluid-filled dilated bowel loops may be evident on radiographs
- **MR imaging preferred over CT to localize transition point and direct surgical intervention**

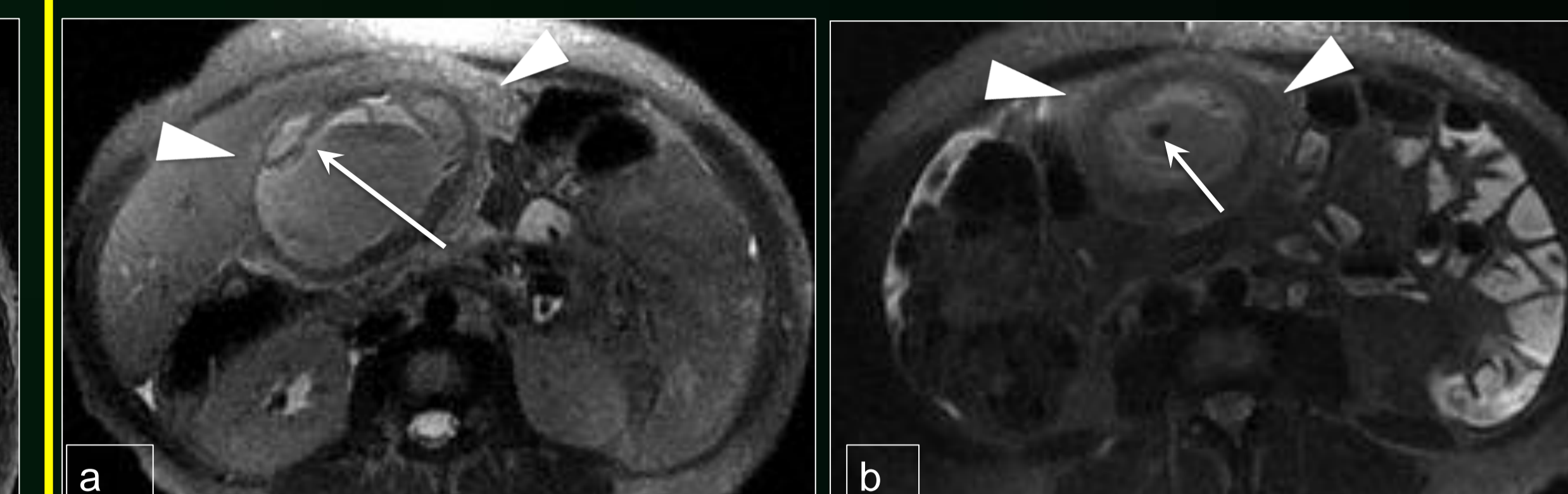


Fig 4. Gangrenous gallbladder. Axial T2-weighted SSFSE images exhibit gallbladder wall thickening, intramural fluid-fluid levels, mural perforation (black arrow), and pericholecystic edema (white arrowheads). At gallstone (white arrow) was identified in the fundus.

Acute Cholecystitis in Pregnancy

- Gallstones common during pregnancy due to increased cholesterol content of bile and decreased gallbladder motility
- Ultrasound used for gallstones and acute cholecystitis
- **2nd most common indication for emergency surgery**
- High risk of recurrence with medical management

MRI Findings in Acute Cholecystitis

- **Gallbladder wall thickness > 3 mm**
- **Gallbladder wall edema (high signal on T2WI)**
- **Pericholecystic fluid**
- **Signal void in from obstructing stone**

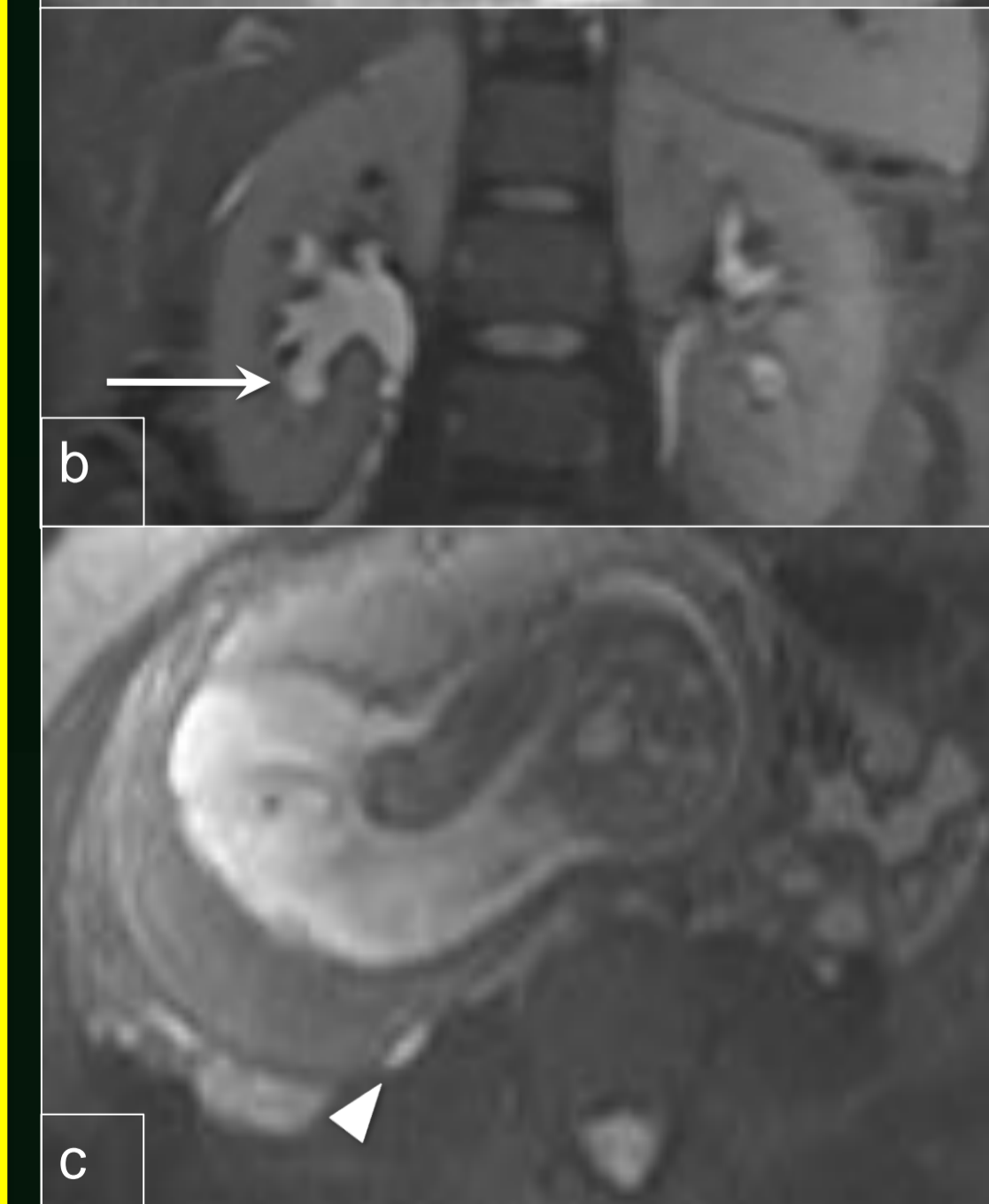


Fig 5. Physiologic hydronephrosis. Axial (a) and coronal (b) T2-weighted FS images demonstrate right hydronephrosis (arrows). Axial image (c) reveals compression of the right ureter (arrowhead) between the uterus and right psoas muscle.

Physiologic Hydronephrosis

- In up to 90% of gravid females
- Progesterone decreases urothelial tone
- Uterus may compress the ureters
- Right more prominent
- Usually asymptomatic

MRI:

- **Normal size kidneys**
- **Absent perinephric fluid**
- Gradual smooth tapering of the ureter, usually between the uterus and psoas muscle

Obstructive Hydronephrosis

- Renal stone most common cause
- Right = Left
- Complications: pyelonephritis; preterm labor

MRI:

- **Renal enlargement**
- **Perinephric fluid**
- **Abrupt change in ureteral caliber**
- **Stones can be identified as low signal filling defects**



Fig 6. Ovarian torsion. Coronal FIESTA image (a) demonstrates an enlarged right ovary containing multiple cysts (arrowheads). Axial T2-weighted SSFSE FS image (b) exhibits free fluid (arrow) adjacent to the thickened, twisted vascular pedicle.

Ovarian Torsion in Pregnancy

- Complicates approximately 7% of ovarian masses in pregnancy; 1/1800 pregnancies overall
- Symptoms include pelvic pain, nausea, and vomiting, and **may mimic appendicitis**
- Delay in diagnosis leads to **ovarian necrosis** and necessitates oophorectomy

MRI Findings in Ovarian Torsion

- **Enlarged ovary**
- **Thickened, twisted vascular pedicle**
- Signal varies on T1WI depending on age of internal blood products
- High signal on T2WI in late torsion due to necrosis

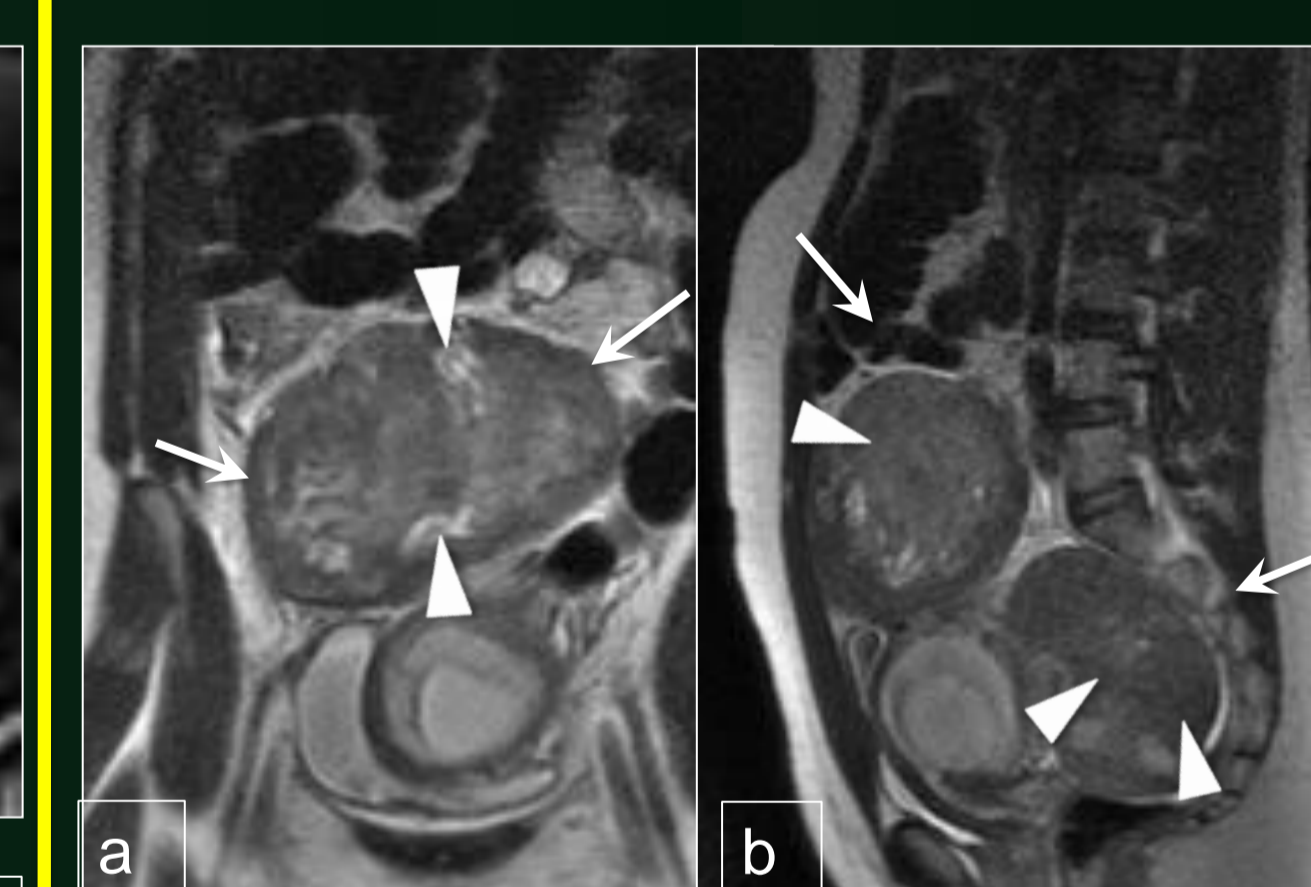


Fig 7. Degenerating leiomyomas. Coronal (a) and sagittal (b) T2-weighted SSFSE images demonstrate two pedunculated uterine leiomyomas (arrows) with internal foci of high T2 signal (arrowheads) indicative of degeneration.

MRI of Fibroid Degeneration

- T1WI: hyperintense peripheral rim or diffusely high signal due to hemorrhage
- T2WI: variable, heterogeneous
- Peripheral areas of increased T2 signal may correspond to vessel thrombosis or cystic necrosis



Fig 8. Ovarian vein thrombosis. Coronal T2-weighted SSFSE (a) and T2-weighted SSFSE FS (b) images depict an enlarged right ovarian vein (arrows). The left ovarian vein is normal (arrowhead). Axial T2-weighted SSFSE FS image (c) shows the thrombosed right ovarian vein (white arrow) just below confluence with the inferior vena cava.

Venous Thromboembolism in Pregnancy

- **Leading cause of maternal death in US**
- Pregnancy is a risk factor for DVT
- Gonadal vein thrombosis more common postpartum, on the **right side (80-90%)**, and due to septic thrombophlebitis
- Treatment is anticoagulation and antibiotics

Imaging Venous Thromboembolism

- **Ultrasound 1st line in extremities but limited in abdomen by gravid uterus and bowel gas**
- T1WI: intermediate to high signal thrombus
- T2WI high signal thrombus
- May see adjacent inflammation