

AMSER Case of the Month

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26-year-old female with right-sided abdominal pain

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Patient Presentation

- **HPI:** 26-year-old female with a history of previous hernia repair presented to the ED with a one day of right sided abdominal pain
 - Associated symptoms include nausea and vomiting
 - Pertinent negatives include no diarrhea/constipation/blood in the stool, no urinary symptoms, no fevers/chills, no chest pain or palpitations, no SOB/cough, no vaginal discharge/pain
- **PMH:** N/A
- **PSH:** inguinal hernia repair
- **Medications:** N/A
- **Physical Exam:** stable vital signs, afebrile, in distress due to pain, abdominal tenderness in RLQ with guarding but no peritoneal signs

Pertinent Labs

- WBC count of 15
- UA showed many bacteria but negative nitrite and leukocyte esterase
- Pregnancy test was negative
- CMP was normal
- Lipase was normal

Differential Diagnosis

- Acute appendicitis
- Mesenteric lymphadenitis
- Rupture of ovarian cyst
- Ectopic pregnancy
- Nephrolithiasis
- Urinary tract infection
- Pyelonephritis
- Adnexal torsion
- Pelvic inflammatory disease
- Inflammatory bowel disease
- Acute pancreatitis
- Gastroenteritis

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

Variant 1: Right lower quadrant pain, fever, leukocytosis. Suspected appendicitis. Initial imaging.

| Procedure | Appropriateness Category | Relative Radiation Level |
|---|--------------------------|--------------------------|
| CT abdomen and pelvis with IV contrast | Usually Appropriate | ☼☼☼ |
| CT abdomen and pelvis without IV contrast | May Be Appropriate | ☼☼☼ |
| US abdomen | May Be Appropriate | ○ |
| MRI abdomen and pelvis without and with IV contrast | May Be Appropriate | ○ |
| US pelvis | May Be Appropriate | ○ |
| MRI abdomen and pelvis without IV contrast | May Be Appropriate | ○ |
| CT abdomen and pelvis without and with IV contrast | Usually Not Appropriate | ☼☼☼☼ |
| Radiography abdomen | Usually Not Appropriate | ☼☼ |
| Fluoroscopy contrast enema | Usually Not Appropriate | ☼☼☼ |
| WBC scan abdomen and pelvis | Usually Not Appropriate | ☼☼☼☼ |

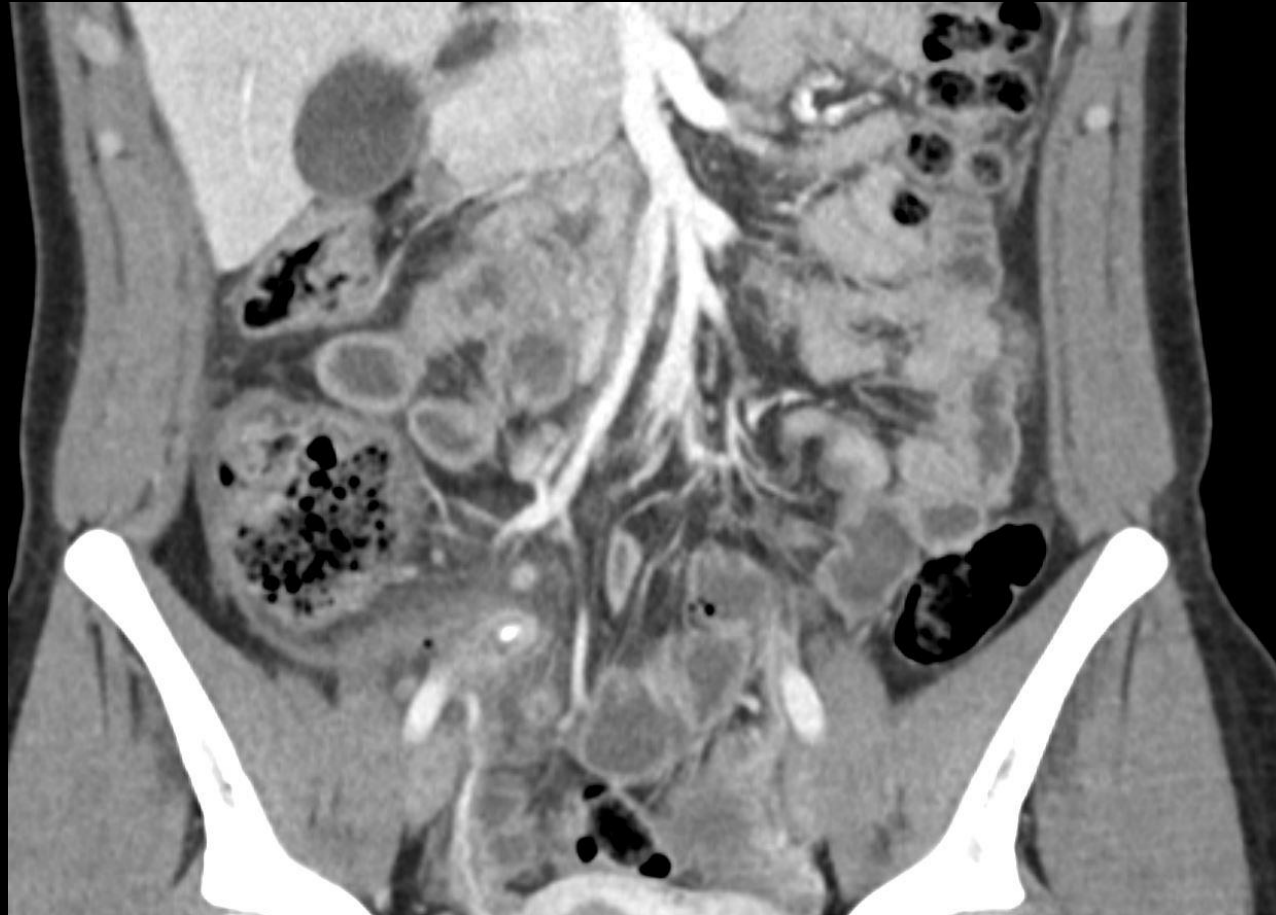
This imaging modality was ordered by the ER physician



Findings (unlabeled)

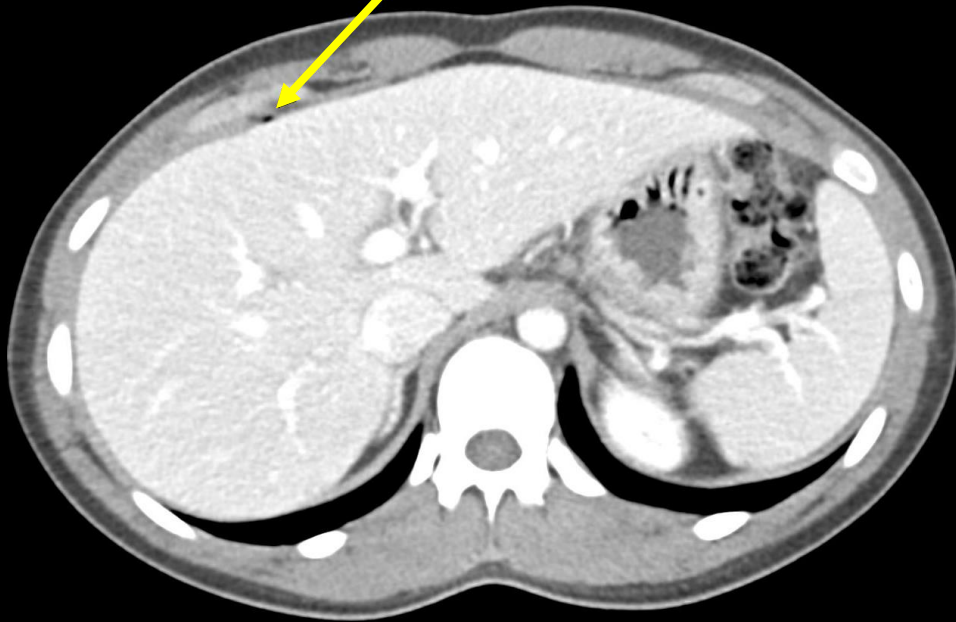


Findings (unlabeled)

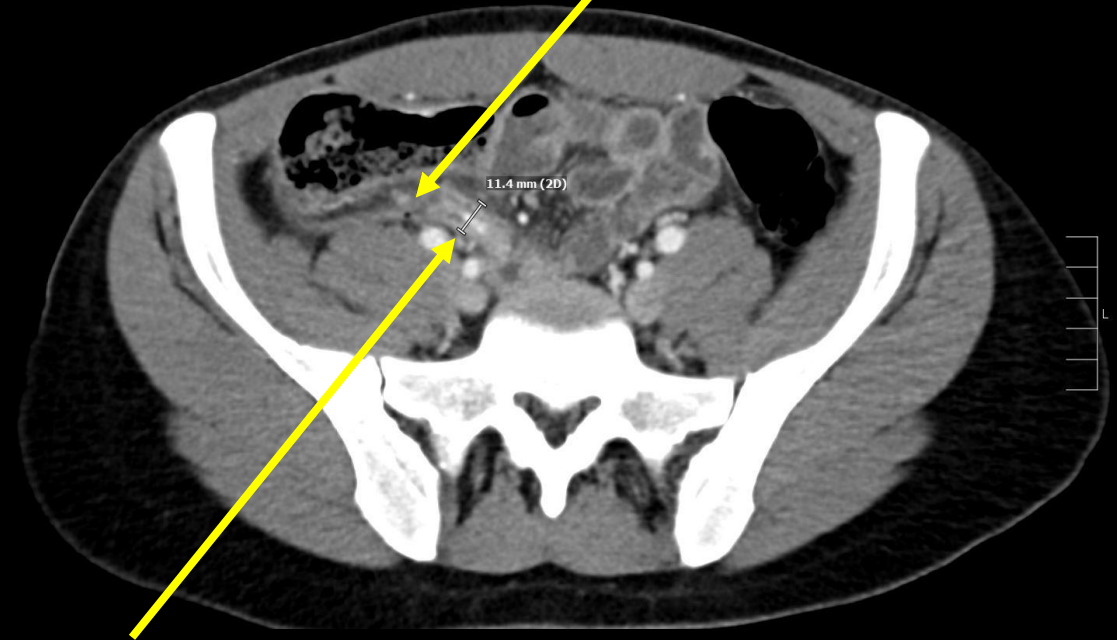


Findings: (labeled)

Locule of free air by
right hemidiaphragm



Tiny locule of
extraluminal gas



Dilated appendix
measuring up to 1.1
cm, thickened wall

Findings: (labeled)

Appendicolith
measuring up to 6 mm

Tiny locule of
extraluminal gas



Final Dx:

Perforated Appendicitis

Outcome

- Given the imaging findings, our patient was taken to the OR for a laparoscopic appendectomy
- A perforated appendix was identified with localized peritonitis and abscess formation
- Appendix was removed and RLQ was irrigated
- Patient was initially placed on ceftriaxone and metronidazole in the ED, but was subsequently switched to piperacillin/tazobactam following culture results
- Patient tolerated surgery well and recovered appropriately

Case Discussion

- Appendicitis is more difficult to diagnose in females of childbearing age due to possibility of gynecologic disorders
 - Women are misdiagnosed in 33% of cases, which leads to an increased incidence of perforation/complications
- Complications of acute appendicitis include perforation and peri-appendiceal abscess formation
 - Necrosis of the appendiceal wall can cause a focal rupture/perforation, leading to peritonitis
 - Approximately 20% of patients with perforated appendicitis present within 24 hours of onset of symptoms
 - Perforation should be considered in patients with temperatures exceeding 103°F, WBC count greater than 15,000, and imaging studies showing fluid collection in RLQ
 - Peri-appendiceal abscess formation is a result of concealed perforation and classically present after 5 days with high fever and abdominal pain

Imaging Considerations

- **Contrast-enhanced CT** can detect perforation with a sensitivity and specificity of 95% when certain findings are present:
 - Focal defect in enhancing appendiceal wall
 - Peri-appendiceal abscess or phlegmon
 - Extraluminal gas or appendicolith
 - Extraluminal leak of contrast
- **Ultrasound** can diagnose perforation by demonstrating right iliac fossa abscess or phlegmon with associated signs of appendiceal inflammation
 - Less accurate than contrast-enhanced CT
 - Detects perforation with a sensitivity of 44% and specificity of 93%

Management of Perforated Appendicitis

- Depends on clinical stability of the patient and the presence of an abscess
- If the patient is unstable/septic or with free perforation/generalized peritonitis, immediate appendectomy is indicated
- If the patient is stable with an abscess that is ≤ 3 cm or cannot be drained percutaneously, then immediate surgery is indicated
- If the patient is stable and appendectomy is not accessible or is high-risk, then non-operative treatment with IV antibiotics is indicated
- If the patient has an abscess ≥ 3 cm, then percutaneous drainage is indicated with interval appendectomy 6-8 weeks later to exclude appendiceal neoplasm and prevent recurrent appendicitis

References:

1. ACR Appropriateness Criteria <https://acsearch.acr.org/list>
2. Kim HY, Park JH, Lee YJ, Lee SS, Jeon JJ, Lee KH. "Systematic Review and Meta-Analysis of CT Features for Differentiating Complicated and Uncomplicated Appendicitis." *Radiology*, 2018, pubmed.ncbi.nlm.nih.gov/29173071
3. Butler, Kenneth, et al. "Right Lower Quadrant Abdominal Pain in Women of Reproductive Age: An Algorithmic Approach." *Relias Media - Continuing Medical Education Publishing*, 2001, www.reliasmedia.com/articles/118031
4. Jones, Jeremy. "Perforated Appendix: Radiology Reference Article." *Radiopaedia Blog RSS*, radiopaedia.org/articles/perforated-appendix
5. Hernanz-Schulman, Marta, et al. "CT and US in the Diagnosis of Appendicitis: An Argument for CT." *Radiology*, 10 Mar. 2010, pubs.rsna.org/doi/full/10.1148/radiol.09091211.
6. Carpenter, Jennifer L., et al. "Diagnostic Performance of US for Differentiating Perforated from Nonperforated Pediatric Appendicitis: A Prospective Cohort Study." *Radiology*, 31 Oct. 2016, pubs.rsna.org/doi/10.1148/radiol.2016160175.