

# AMSER Case of the Month:

18 year-old male with severe abdominal pain

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# Patient Presentation

- HPI: 18 year old male presents with abdominal pain for the past 24 hours. Pain started in the periumbilical region but later localized to the right lower abdominal quadrant. Patient denies fevers or chills.
- Past medical history: None.
- Past surgical history: None
- Vital signs: Normal
- Physical exam:
  - Awake, alert, no acute distress
  - Clear lungs
  - Regular heart rate and rhythm
  - Abdomen soft, tender in the RLQ, normal bowel sounds

# Pertinent Labs

- Elevated white blood cell count of 16.7 (3.50 - 10.00 K/uL)
    - Normal range
  - Normal basic metabolic panel
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What Imaging Should We Order?

# Select the applicable ACR Appropriateness Criteria

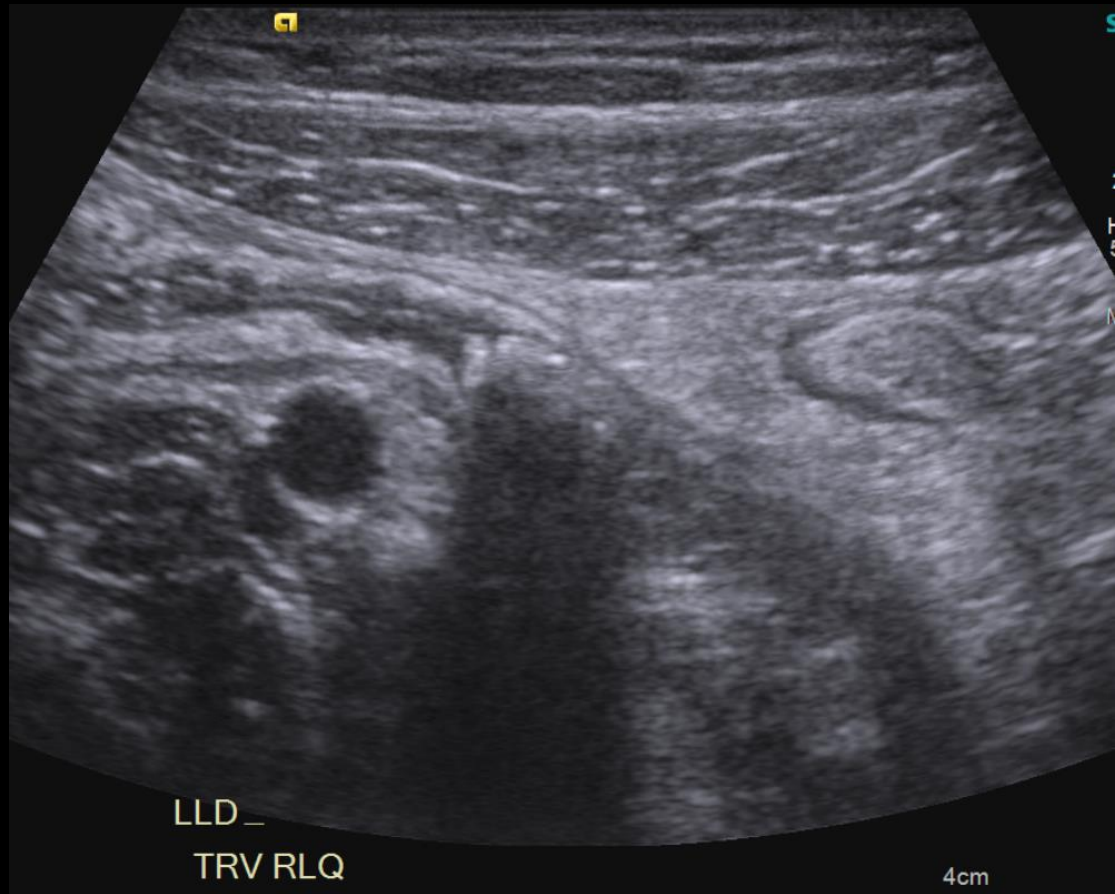
**Variant 1:** Right lower quadrant pain, fever, leukocytosis. Suspected appendicitis. Initial imaging.

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	0
MRI abdomen and pelvis without and with IV contrast	May Be Appropriate	0
US pelvis	May Be Appropriate	0
MRI abdomen and pelvis without IV contrast	May Be Appropriate	0
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☼ ☼ ☼ ☼
Radiography abdomen	Usually Not Appropriate	☼ ☼
Fluoroscopy contrast enema	Usually Not Appropriate	☼ ☼ ☼
Tc-99m WBC scan abdomen and pelvis	Usually Not Appropriate	☼ ☼ ☼ ☼



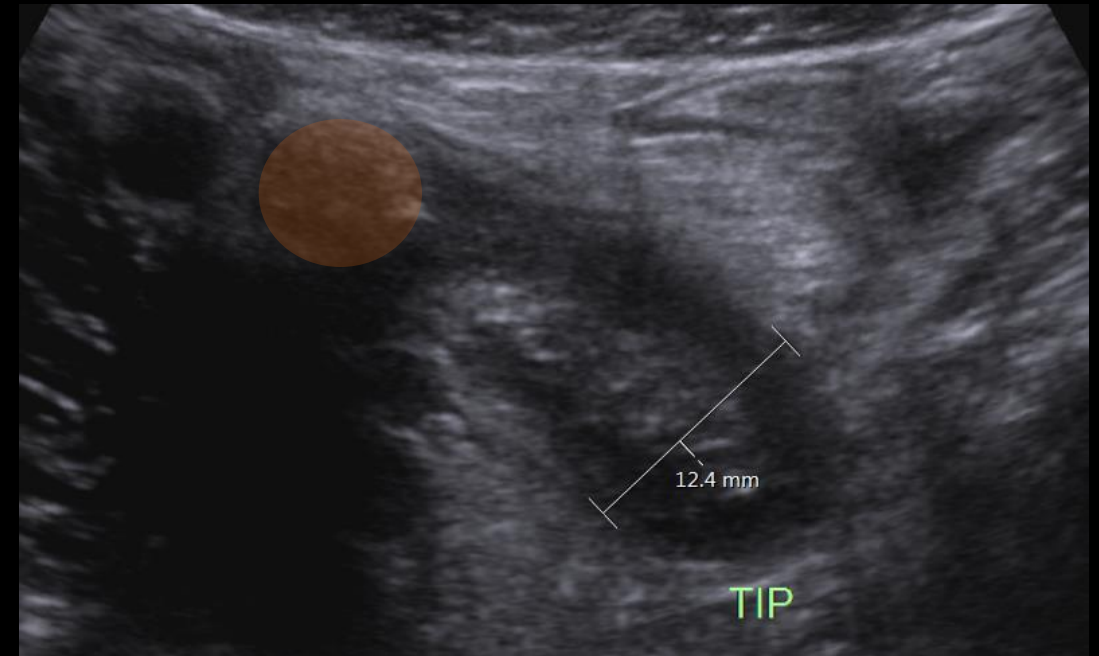
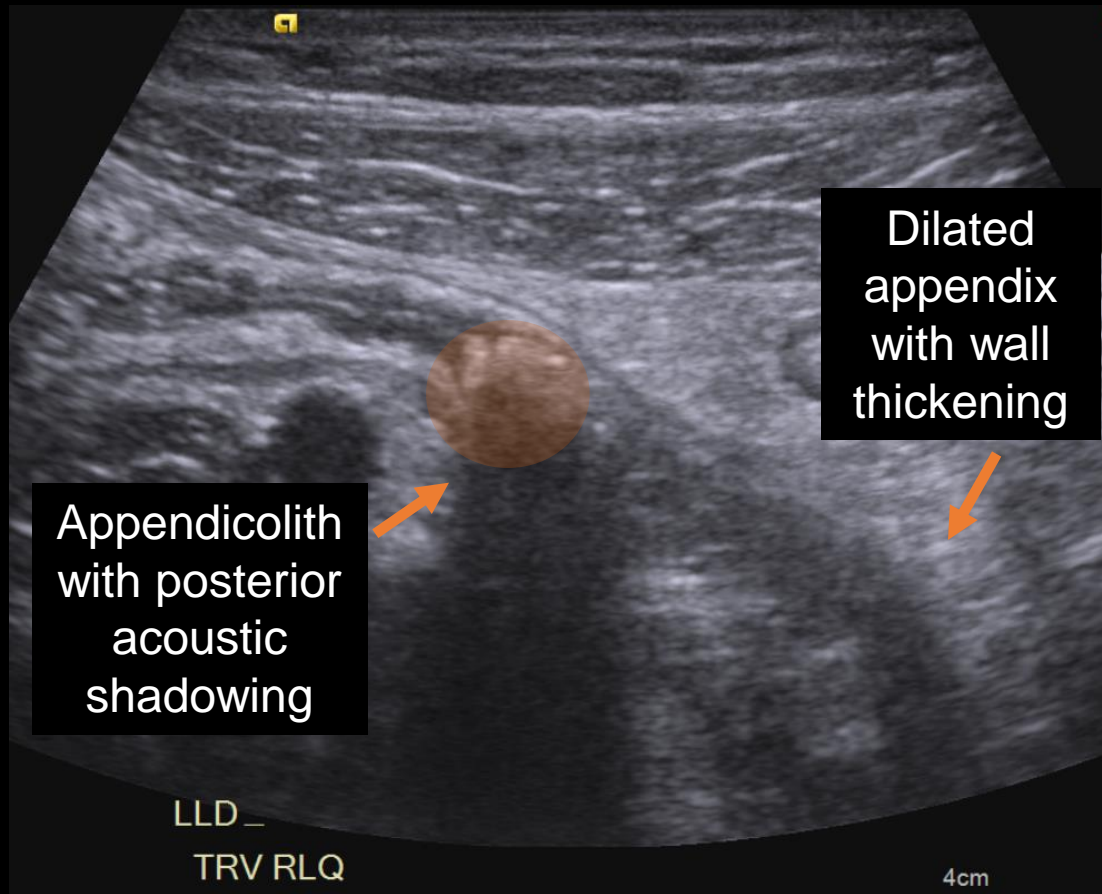
ED physician ordered this study

# Findings: (unlabeled)



Ultrasound images of the right lower abdominal quadrant

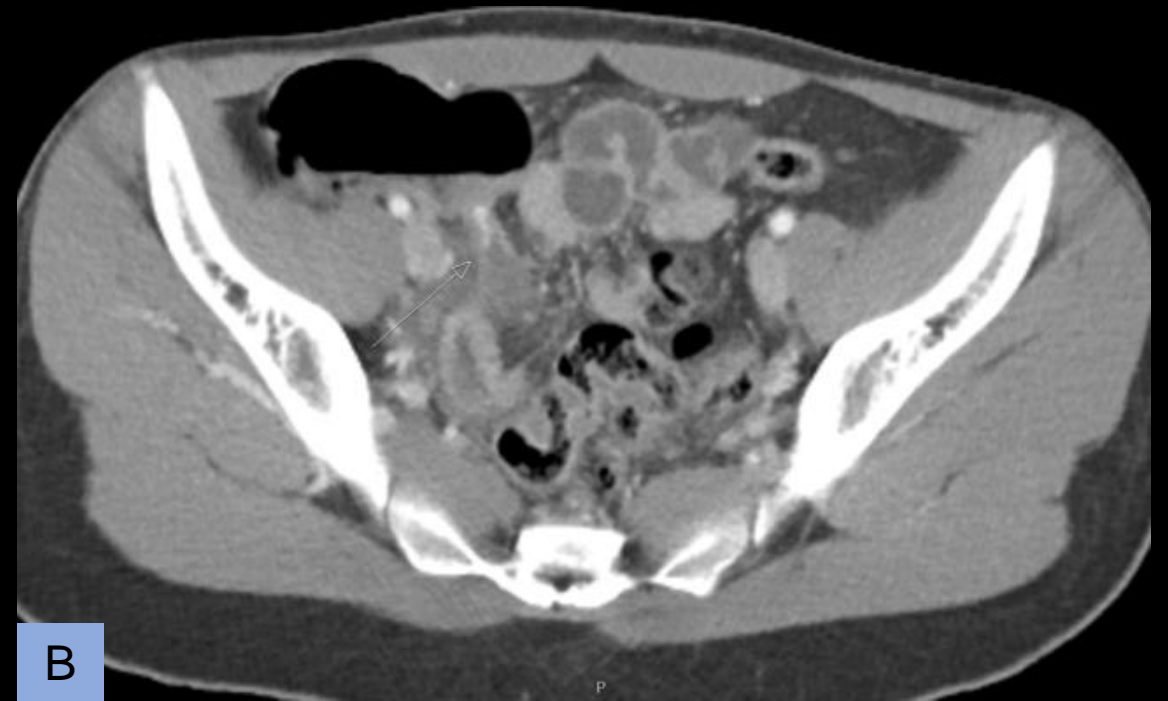
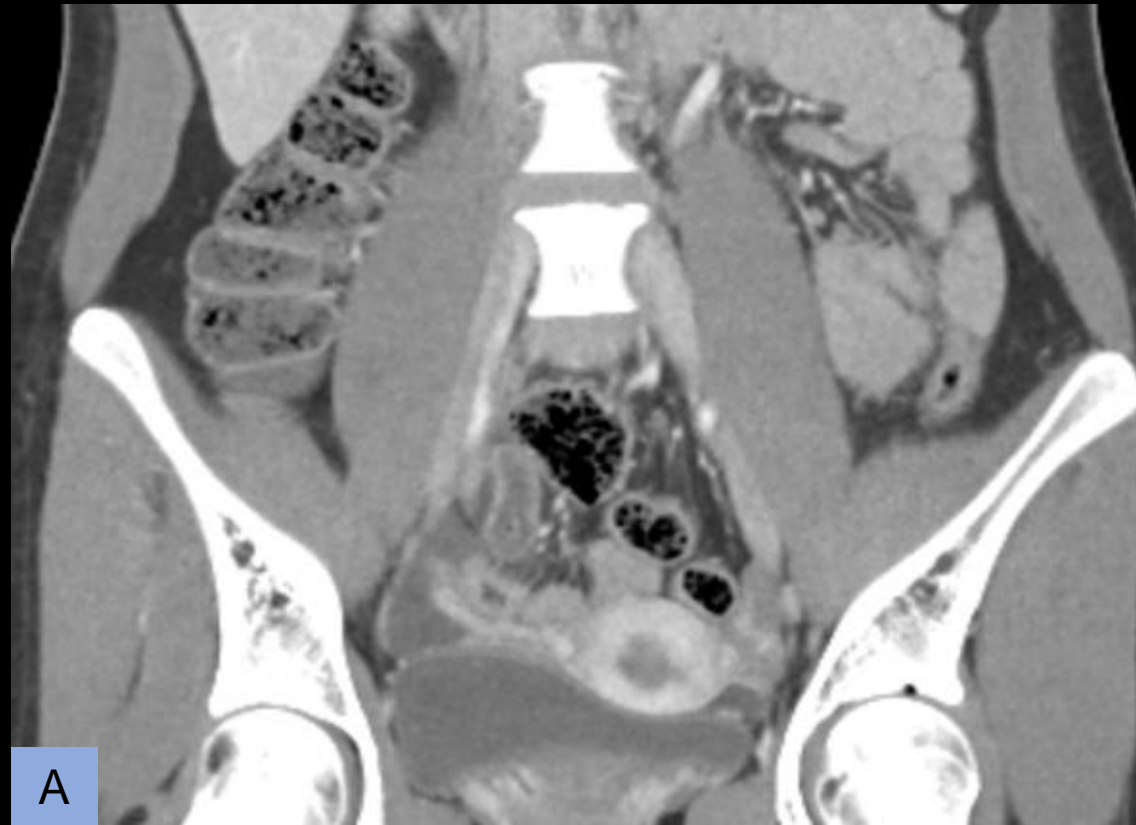
# Findings: (labeled)



More distal images of the tubular structure confirms it to be blind-ending and dilated.

ED physician subsequently ordered a CT of the abdomen and pelvis to confirm the diagnosis.

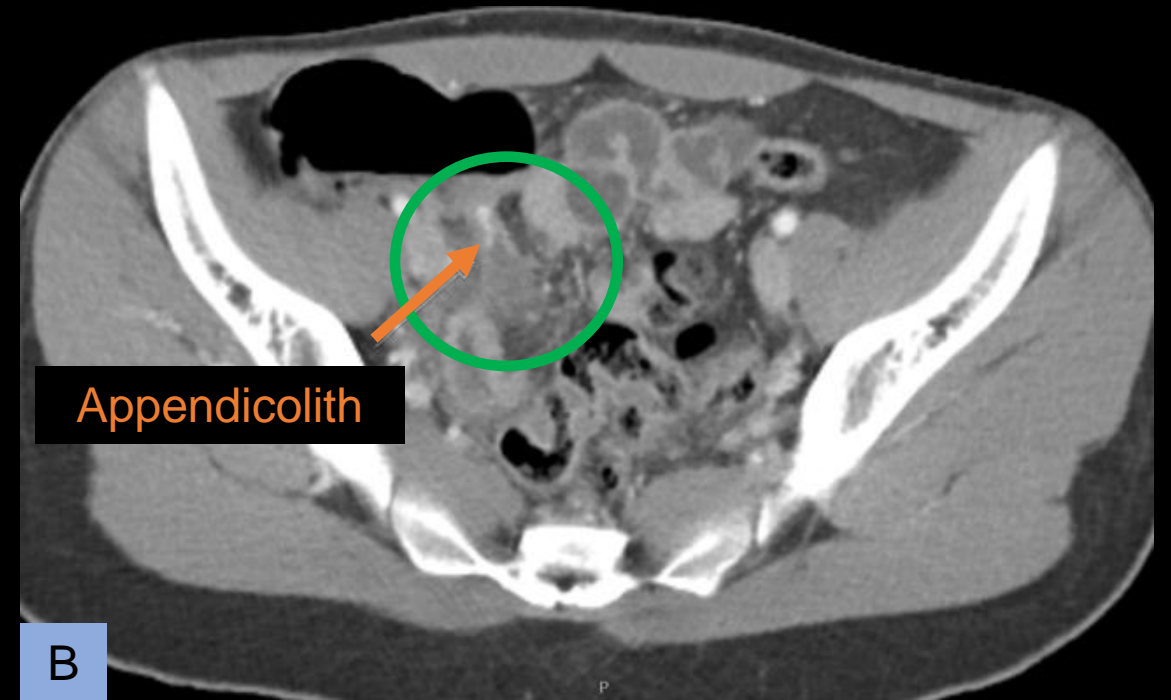
# Findings: (unlabeled)



CT images of the abdomen and pelvis in the coronal (A) and axial (B) planes.



# Findings: (labeled)

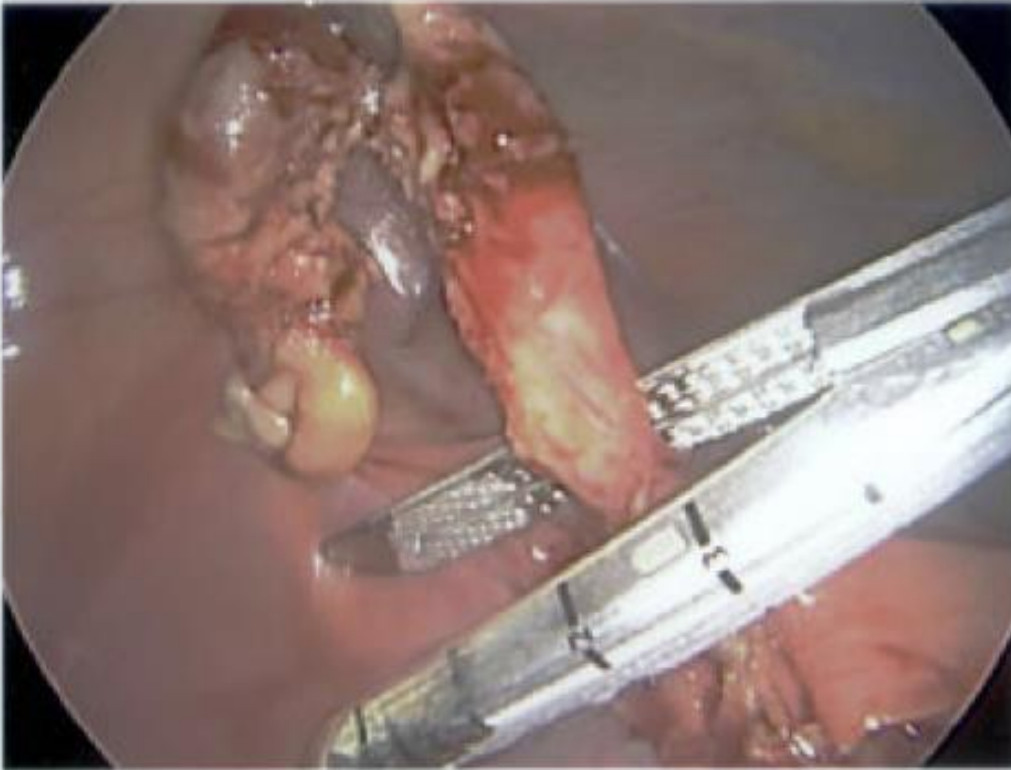


CT images of the abdomen and pelvis in the coronal (A) and axial (B) planes.

Final Diagnosis:

Acute Appendicitis

# Intraoperative Pictures



Intraoperative pictures during laparoscopic appendectomy confirmed a dilated and inflamed appendix.

# Case Discussion

- Depending on age, an ultrasound (US) or CT would be ordered first
  - US is usually the first line for children and often the first line for pregnant females
    - Pros
      - Less economic and radiation burden
      - Widely available
      - May obviate the need for cross-sectional imaging to make the diagnosis
  - CT is usually the first line for adults
    - Higher sensitivity than US
    - Patient body habitus dependent (higher BMI leads to lower sensitivity)
    - Very technologist skill dependent
- In this case, the physician chose ultrasound as the first imaging modality

# ACR recommendations

**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	☼☼☼
Tc-99m WBC scan abdomen and pelvis	Usually Not Appropriate	☼☼☼☼

For adults, enhanced CT abdomen and pelvis is usually the first line modality for evaluation.

**Variant 2:** Child. Suspected acute appendicitis, intermediate clinical risk. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
US abdomen RLQ	Usually Appropriate	○
US abdomen	Usually Appropriate	○
CT abdomen and pelvis with IV contrast	May Be Appropriate (Disagreement)	☼☼☼☼
CT abdomen and pelvis without IV contrast	May Be Appropriate (Disagreement)	☼☼☼☼
MRI abdomen and pelvis without and with IV contrast	May Be Appropriate (Disagreement)	○
MRI abdomen and pelvis without IV contrast	May Be Appropriate (Disagreement)	○
Radiography abdomen	May Be Appropriate (Disagreement)	☼☼
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☼☼☼☼☼
US pelvis	Usually Not Appropriate	○

For children, ultrasound is usually the first line modality for evaluation.

# Case Discussion

## Epidemiology

- Most common age range for appendicitis is 10-19 years old
- Appendicitis rates: 1.5x higher for Caucasian than Non-Caucasians
- Lifetime risk:
  - Males: 8.6%
  - Females: 6.7%

## Symptoms

- Discomfort notably in RLQ
- Patients have extreme tenderness and discomfort
- Rebound tenderness and pain migration are two symptoms which show increased specificity for appendicitis

# Case Discussion

## Complications of Acute Appendicitis

- Appendiceal perforation
  - Portions of appendiceal wall can turn ischemic or necrotic
  - CT may demonstrate an appendiceal wall defect or extraluminal air
- Periappendiceal Abscess
  - Frequent complication
  - Remains localized if fibrinous adhesions develop pre-rupture
  - More common in young children because progression tends to be faster
- Small bowel obstruction
  - Not common
  - May be secondary to inflammatory changes or a post-operative complication caused by post-op fibrous adhesions

# Case Discussion

## Treatment

- First line of treatment – antibiotics along
- Second line of treatment – surgery, especially if uncomplicated
  - If surgery is the first approach, there is risk for spreading and infection
- Appendectomy - surgical term referring to the removal of the appendix
  - Laparoscopic surgery
    - Small incisions allow the removal of the appendix
    - CO<sub>2</sub> gas is used to inflate abdomen for easy visualization
    - This procedure leads to fewer complications and less likely to be infectious (including post-op infections)
  - Laparotomy
    - A single incision (5-10 cm) in the lower right quadrant of the abdomen used for removal
    - Abdominal muscles will be separated from abdominal area
    - May be necessary when associated with complications



# References:

- Koberlein, George C. “Suspected Appendicitis–Child.” *ACR Appropriateness Criteria*, 2018, <https://acsearch.acr.org/docs/3105874/Narrative/>.
- Leite, Nuno Pinto, et al. “CT Evaluation of Appendicitis and Its Complications: Imaging Techniques and Key Diagnostic Findings.” *American Journal of Roentgenology*, vol. 185, no. 2, Aug. 2005, pp. 406–417., doi:10.2214/ajr.185.2.01850406.
- Mostbeck, Gerhard, et al. “How to Diagnose Acute Appendicitis: Ultrasound First.” *Insights into Imaging*, vol. 7, no. 2, 16 Apr. 2016, pp. 255–263., doi:10.1007/s13244-016-0469-6.
- Sivit, Carlos J., et al. “When Appendicitis Is Suspected in Children.” *RadioGraphics*, vol. 21, no. 1, 1 Jan. 2001, pp. 247–262., doi:10.1148/radiographics.21.1.g01ja17247.