

# Acute Abdominal Pain

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Diagnostic Radiology, RAD 4001

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# Clinical History

- Patient is a 29 yo male who presents with abdominal pain x2 days w/ associated nausea, but no vomiting
  - Pain (8/10) in RLQ abdomen and has worsened acutely in the past day; febrile OSH; on arrival was afebrile most likely 2/2 to Toradol given at OSH
  - PMH: non-significant
  - Surgical Hx: hernia repair as an infant
  - Social Hx: occasional marijuana use

# ROS

- Constitutional: **+fever, +chills, +anorexia**
- CV: +chest pain
- GI: **+nausea**, -vomiting
- GU: +tenesmus, -hematuria

# Physical Exam

- VS: T: 98.1 HR: 70 RR: 16 BP: 104/66 SpO2: 100%
- General: alert, **acute distress**
- CV: RRR, normal S1/S2 w/out murmur
- Lungs: CTAB, no wheezes or rales
- Abdomen: soft, non distended, normal bowel sounds, **+TTP to RLQ w/guarding and involuntary abd rigidity. No rebound +Psoas, -Rovsing, -Obturator**
- Ext: Normal ROM, no swelling
- Neuro: AOx4, no FND
- Psych: normal affect

# Work-Up (notable labs)


- CBC: **WBC: 14.6 w/ 80% PMNs**
- Lactic acid: Normal
- CT abdomen pelvis w/ contrast was done at outside hospital

# CT Abdomen & Pelvis w/ contrast (10/12/2020)

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IMAGE 113



Distended/dilated appendix with wall enhancement. Note the periappendiceal fat stranding= 

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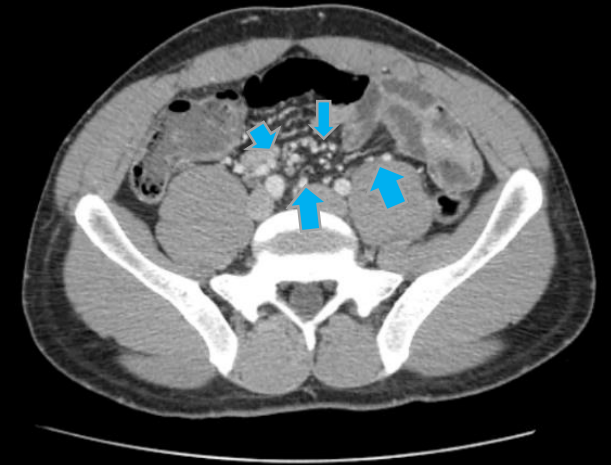
IMAGE 115




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IMAGE 93

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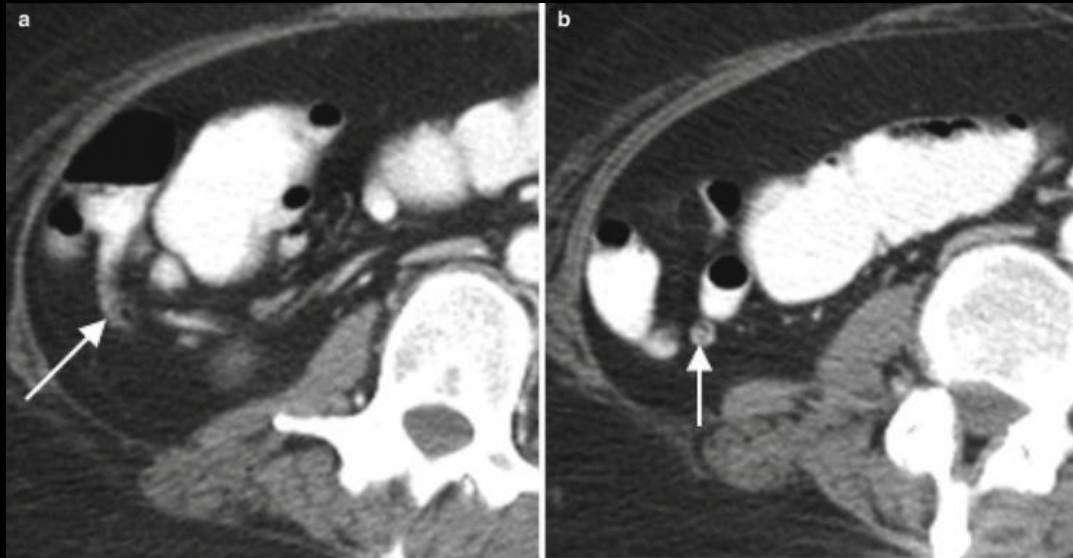


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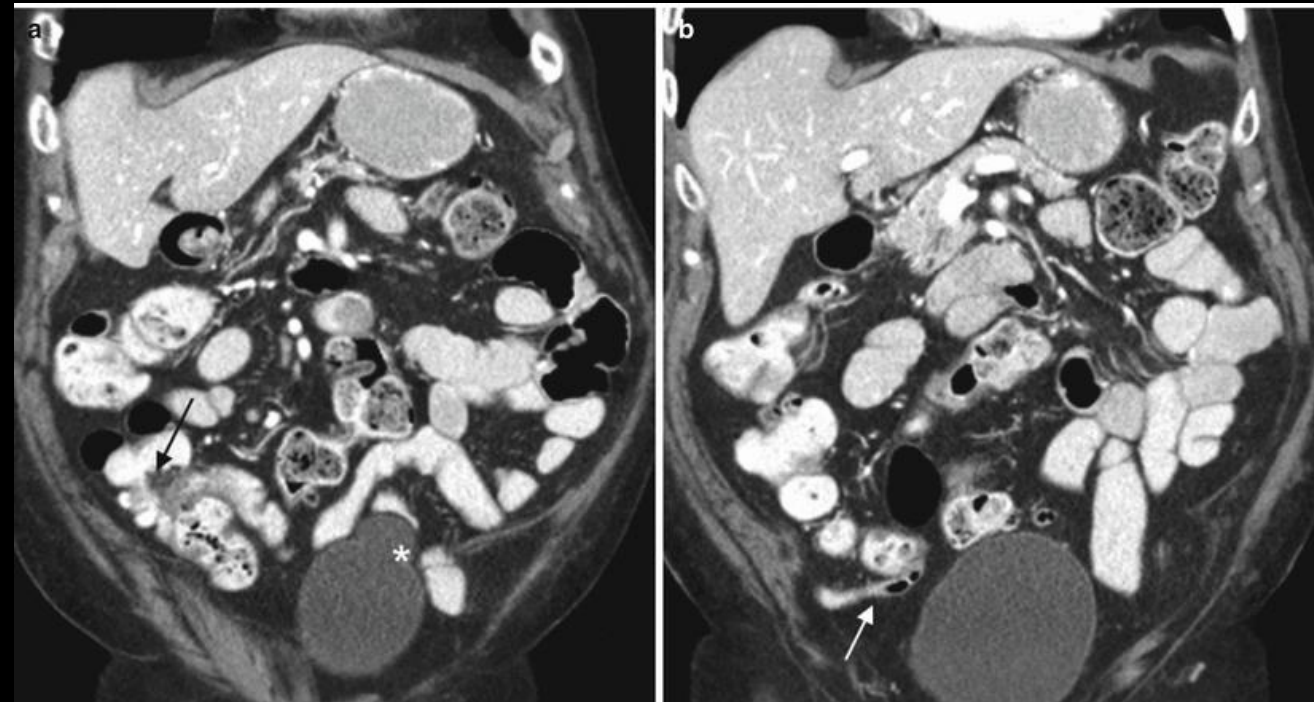
Reactive lymph nodes = 

# Normal Imaging<sup>1</sup>

Axial view



Coronal View



# Summary of Key Imaging Findings

- Chief Complaint: RLQ abdominal pain x 2 days w/ fever, nausea, and leukocytosis
- Imaging Findings
  - Fluid-filled appendix w/dilation measuring up to 1.1 cm
  - Wall thickening and enhancement of appendix
  - Fat stranding
  - Small amount of fluid in the right paracolic gutter
  - Prominent RLQ reactive lymph nodes



# Differential Diagnosis of Abdominal Pain<sup>2</sup>

- Appendicitis
- Bowel obstruction
- Bowel perforation
- Nephrolithiasis
- Cholecystitis
- Urinary tract Infection
- Pancreatitis

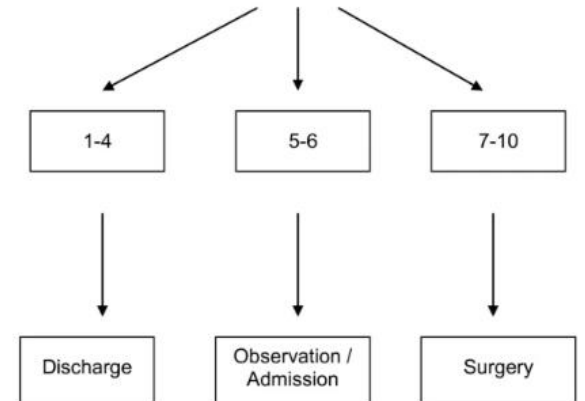
# Final Diagnosis: Uncomplicated acute appendicitis<sup>3</sup>

- Pathophysiology: acute inflammation of the appendix, typically due to an obstruction of the appendiceal lumen
  - Uncomplicated: no evidence of an appendiceal fecalith, perforation or gangrene
  - Complicated: associated w/ perforation, gangrene, abscess
- Clinical Presentation:
  - Migrating abdominal pain (most common and specific symptom)
  - RLQ guarding and/or rigidity
  - Rovsing sign, Psoas, Obturator
  - Nonspecific symptoms: nausea, anorexia (up to 80% of cases), fever
  - Alvarado score for our patient: 9/10

# Alvarado Score for Acute Appendicitis<sup>4</sup>

- Clinical scoring system used to diagnose appendicitis
- Stratifies adult patients to low risk (1-4), moderate risk (5-6), and high risk (7-10)

Alvarado score	
Feature	Score
Migration of pain	1
Anorexia	1
Nausea	1
Tenderness in right lower quadrant	2
Rebound pain	1
Elevated temperature	1
Leucocytosis	2
Shift of white blood cell count to the left	1
<b>Total</b>	<b>10</b>



Predicted number of patients with appendicitis:

- Alvarado score 1-4 - 30%
- Alvarado score 5-6 - 66%
- Alvarado score 7-10 - 93%

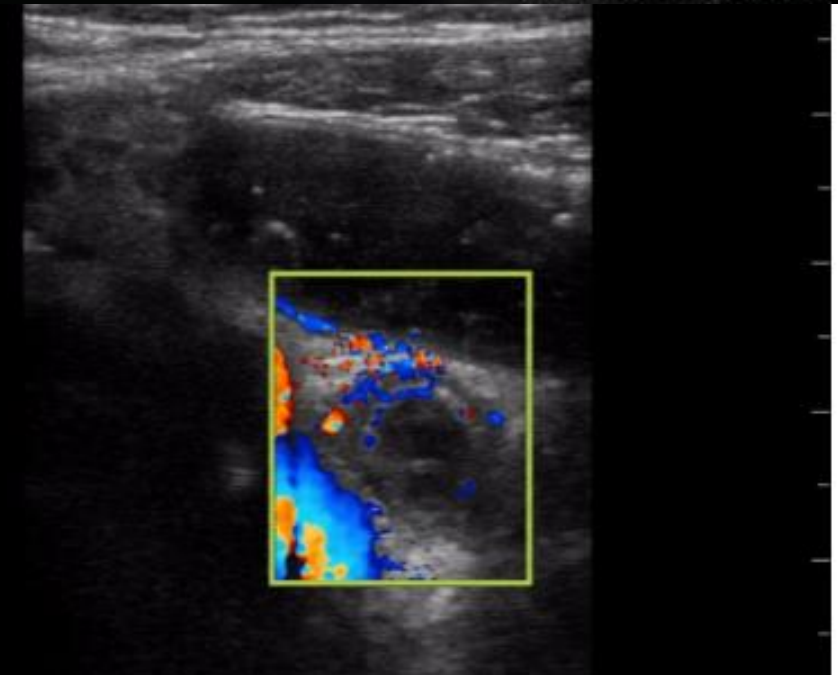
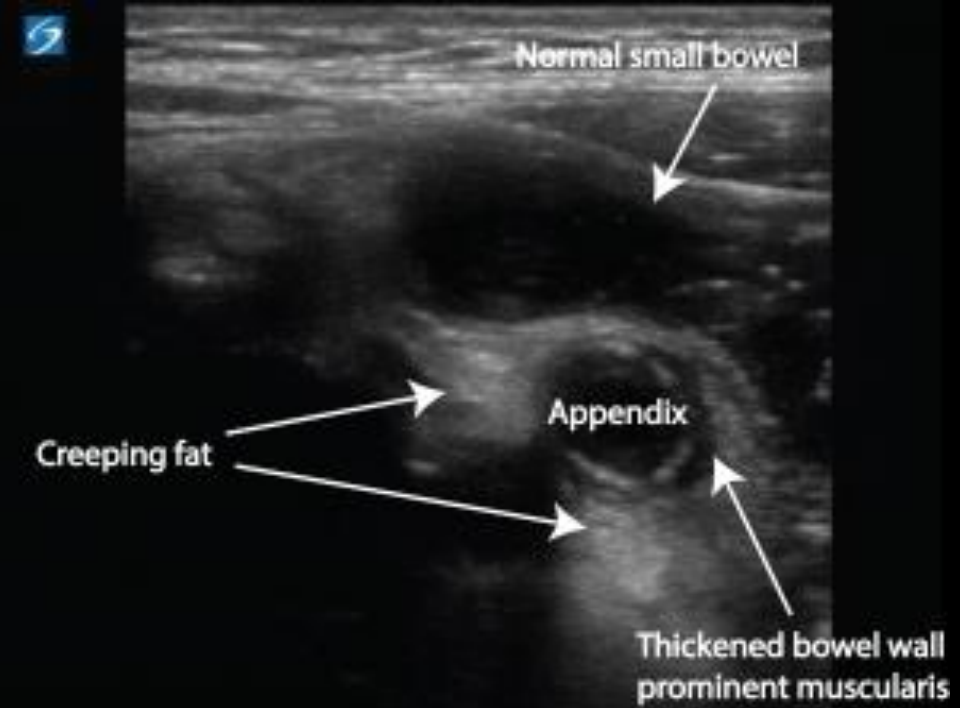
Probability of appendicitis by the Alvarado score [5]: risk strata and subsequent clinical management strategy.

# Imaging Choice for Special Populations

- Children
  - Ultrasound: 1<sup>st</sup> line
    - Easier to detect due to less abdominal fat
  - If unequivocal ultrasound, then CT or MRI
- Pregnant patients
  - MRI

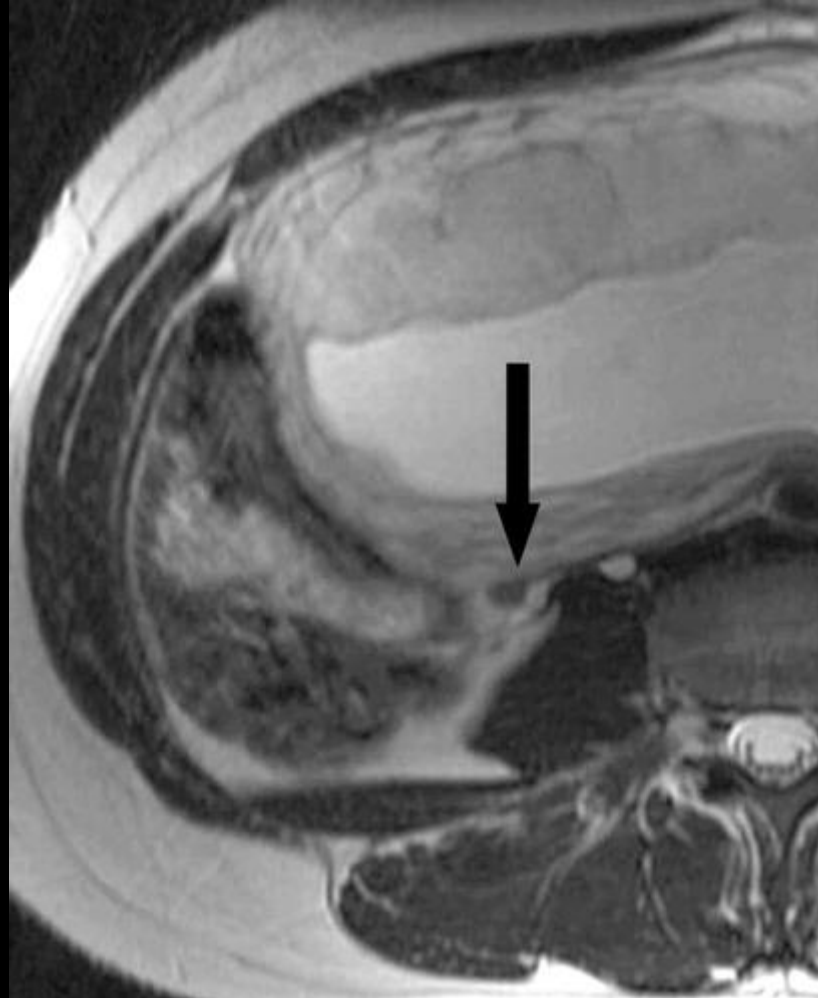
# Ultrasound Findings<sup>5</sup>

- Dilated appendix (>6mm), noncompressible, aperistaltic
- Target appearance (axial section)
- Wall thickening (>3mm)
- Echogenic periappendiceal fat
- Hyperemia w/ color flow Doppler (increased vascularity)

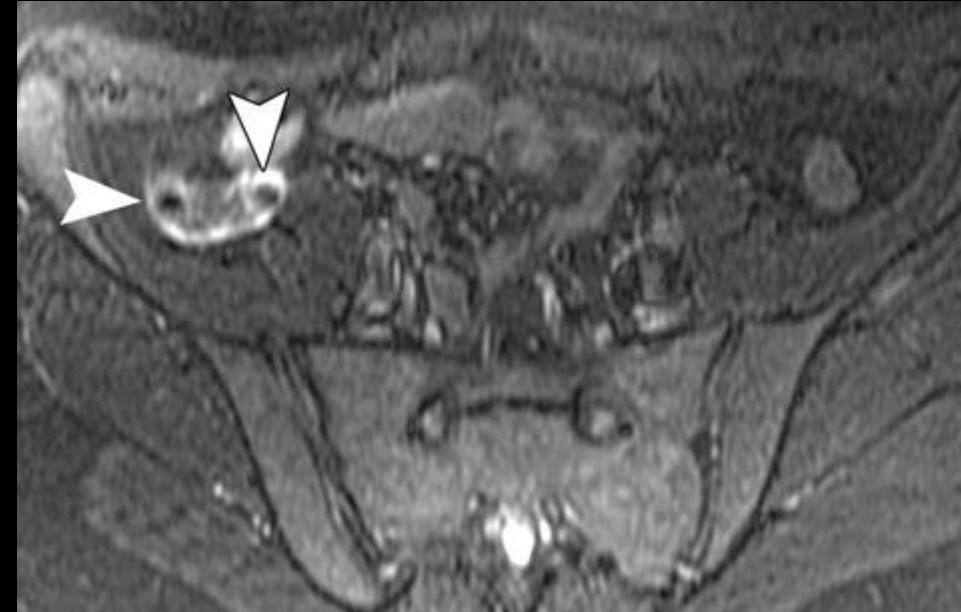


# MRI Findings<sup>6</sup>

- Similar findings to other modalities
  - Luminal distension
  - Wall thickening
  - Periappendiceal free fluid



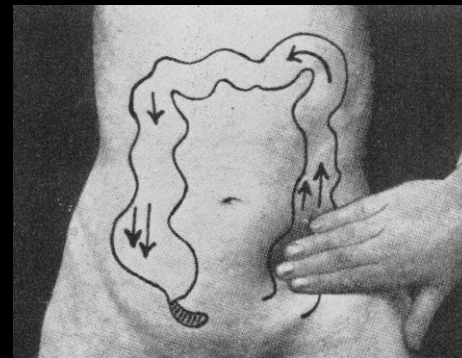
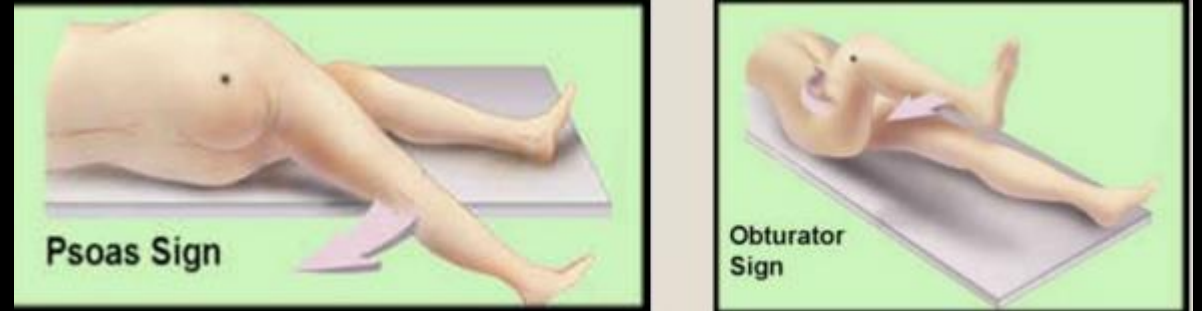
Normal appendix seen in a pregnant woman



Appendicitis seen in pregnant woman  
-dilated appendix (12mm), wall edema, appendicoliths

# Physical Exam Findings for Appendicitis<sup>7</sup>

- Psoas Sign
  - Pain elicited on passive extension of right hip
- Obturator Sign
  - RLQ pain on passive internal rotation of hip when right knee is flexed
- Rovsing Sign
  - RLQ pain elicited on palpation of LLQ



# Treatment

- Appendectomy (open surgery vs laparoscopic)
  - Definitive treatment
  - Risks: bleeding, infections, bowel perforation, hernia
- Conservative treatment
  - IV antibiotics and supportive care
  - Success rate 95-98%
  - Recurrent appendicitis was 34% at 2 years and 43% of patients with antibiotic therapy required appendectomy within 1 year<sup>8</sup>



# ACR appropriateness Criteria<sup>9</sup>

- RLQ abdominal pain, fever, leukocytosis. Suspected appendicitis
- CT abdomen pelvis w/ contrast is **appropriate**

American College of Radiology  
ACR Appropriateness Criteria®  
Right Lower Quadrant Pain-Suspected Appendicitis

**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	☼☼☼☼

# Cost of Imaging at Memorial Hermann<sup>10</sup>

- CT Abdomen Pelvis w/ contrast
  - **Insured:** typically charged \$7,998, but patient only pays approximately \$480
  - **Uninsured:** patient pays **\$2,879**

# Take Home Points / Teaching points

- Diagnosis of appendicitis is both clinical and radiographic
- Utilizing different prediction scores such as the Alvarado to stratify risk and workup
- Different imaging modalities in special populations

# References

- 1) The Appendix. Website URL: <https://radiologykey.com/the-appendix/>
- 2) Causes of abdominal pain in adults. Website URL: <https://www.uptodate.com/contents/causes-of-abdominal-pain-in-adults>
- 3) Appendicitis. Website URL: [https://www.amboss.com/us/knowledge/Acute\\_appendicitis](https://www.amboss.com/us/knowledge/Acute_appendicitis)
- 4) The Alvarado score for predicting acute appendicitis: a systematic review. Website URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3299622/>
- 5) Appendicitis .Website URL: <https://www.criticalcare-sonography.com/2017/06/08/appendicitis-4/>
- 6) MR Imaging of the Acute Abdomen and Pelvis: Acute Appendicitis and Beyond. Website URL: <https://pubs.rsna.org/doi/full/10.1148/rg.275065021>
- 7) Abdominal Physical Signs and Medical Eponyms: Movements and Compression. Website URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6306146/>
- 8) Five-Year Follow-up of Antibiotic Therapy for Uncomplicated Acute Appendicitis in the APPAC Randomized Clinical Trial. Website URL: <https://pubmed.ncbi.nlm.nih.gov/30264120/>
- 9) ACR Appropriateness Criteria® Right Lower Quadrant Pain-Suspected Appendicitis. Website URL: <https://acsearch.acr.org/docs/69357/Narrative/>
- 10) Cost of imaging at Memorial Hermann, Website URL: <https://www.memorialhermann.org/patients-caregivers/pricing-estimates-and-information/>



Questions?