Appendicitis/Abdominal Pain: Emergency Department Clinical Practice Guideline (CPG)

Clinical Practice Guideline Protocol Approved by: Divisions of Pediatric Emergency Medicine and Pediatric Surgery Date of Approval: 8/14
Appendicitis/Abdominal Pain:
Emergency Department
Clinical Practice Guideline (CPG)

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Protocol Approved by: Divisions of Pediatric Emergency Medicine,
Pediatric Radiology, and Pediatric Surgery
Date of Approval: 2/09, 8/14
Suspected Appendicitis Clinical Practice Guideline
Work-up/ Diagnostic Algorithm

Pediatric Patient Presenting to the ED with Signs and Symptoms Suggestive of Acute Appendicitis

Exclusion Criteria:
- Previous appendectomy
- Bloody stool
- Acute medical history (PID, Pregnancy)
- Chronic PMH (CF, Crohn’s, transplant, malignancy)

History and Physical Exam by ED Attending

The WBC is Elevated in 87 to 92% of patients with acute appendicitis (8-13% have a normal WBC).
- WBC differential:
  - Left shift more c/w appendicitis
  - Right shift more c/w viral illness

Ovarian Pathology Suspected?

- Diagnostic Studies:
  - WBC with differential count
  - HCG (females)
  - Urinalysis (Not routinely recommended)
- IF Severe Pain, Obtain Immediate Surgical Consultation (i.e. do not wait for lab results)

Yes

Trans-abdominal Pelvic Ultrasound (US): “Suspected Ovarian Torsion or Ruptured Cyst”

Negative Pelvic US

Pediatric Surgical Evaluation Within 30 minutes of Consult

Pain medication can be given AFTER surgical resident evaluation

Positive Pelvic US: -Management as Clinically Indicated

H&P of “Classic Appendicitis” as judged by both ED Attending and Surgical Resident

Yes

Admit to Surgery:
- NPO, IVF
- IV Antibiotics (as selected by the Surgical Attending)
Recommended:
  - Ampicillin 50 mg/kg plus
  - Gentamicin 2.5mg/kg plus
  - Clindamycin 10 mg/kg

No

H & P is not classic but “Consistent with Acute Appendicitis”

In case of “Low Probability of Acute Appendicitis”, consider:
  - IV Hydration
  - Repeat WBC in 4-6 hours
  - Repeat exam in 4-6 hours

Yes

Diagnostic Imaging for Acute Appendicitis
- Only After Discussion with Surgical Attending

Yes
Diagnostic Imaging – Acute Appendicitis
(Only After Discussion with Surgical Attending)

Computed Tomography with IV contrast:
- Obese, or
- Guarding, or
- Gaseous bowel distention on abdominal x-ray

Appendicitis Ultrasound (US): ONLY if
- Thin, and
- Focal tenderness

- If Focal Tenderness Only - order: “CT abdomen and pelvis with IV contrast:
  Suspected Acute Appendicitis”
- If Diffuse Peritonitis, Symptoms > 36 hrs, WBC > 16,000, Age < 2 yrs, or Palpable Mass,
  - order: “CT abdomen and pelvis with IV and Po contrast: Suspected Perforated Appendicitis”

Negative for Appendicitis:
- Clinical re-evaluation.
- Consider alternate imaging

CT Results

Positive Alternate Diagnosis:
- Management as Clinically Indicated
- Admit to Medicine

Positive Acute Appendicitis:
- Admit to Surgery
  - NPO
  - IVF
  - Antibiotics

Equivocal:
- Clinical re-evaluation
- Admit to Medicine (as needed)
  - Serial exams
  - Consider repeating studies

Ultrasound Results

Positive Alternate Diagnosis, Or Non-Diagnostic US:
- Clinical re-evaluation as needed
- Consider CT scan
- Management as Clinically Indicated
- Admit to Medicine (as needed)

Negative for Appendicitis (= fully compressible appendix):
- Clinical re-evaluation
  - Admit to Medicine (as needed)
Emergency Department Evaluation and Management of Appendicitis in Children

I. **Cardinal features**

- Diffuse periumbilical or central abdominal pain usually lasting several hours, with brief cessation, followed by pain in the right lower quadrant in a constant, localized form; pain may be atypical in patients with retrocecal appendix, and may be shifted up onto the right upper quadrant in pregnant women
- Tenderness to palpation of right lower quadrant
- Rebound tenderness
- Nausea, vomiting, and constipation may occur after right lower quadrant pain is established
- Body temperature around 37.8°C is common
- Leukocytosis and neutrophilia are common

II. **Causes**

- Increased incidence 1-2 weeks after a viral syndrome
- Luminal obstruction (secondary to lymphoid hyperplasia, fecolith, or less commonly by calculus, tumor, foreign body or parasites)
- Secondary infectious process
- Mucoid secretions result in organ distention, increased intraluminal pressure, decreased venous drainage with venous engorgement, and arterial compromise leading to ischemia
- With diagnostic delay, increase in intraluminal pressure can ultimately result in gangrene leading to perforation, contamination of abdominal cavity with fecal contents, and development of peritonitis

III. **Epidemiology**

**Incidence and Prevalence**

- 1.1/1000 per year overall
- 2.3/1000 between ages 10 and 20

IV. **Demographics**

**Age**

- Peak incidence among teenagers
Gender
- Male: female 3:2 between ages 10 and 30
- Male = females >30 years

Race
- Caucasian: non Caucasian 1.5:1

Genetics
- Some research suggests familial predisposition

Geography
- Suspected, not well studied

Socioeconomic Status
- Increased risk of morbidity and mortality associated with underinsured population

V. Differential Diagnosis
- Ectopic pregnancy
- Crohn’s terminal ileitis
- Mesenteric Lymphadenitis
- Pelvic Inflammatory Diseases
- Ruptured graafian follicle or corpus luteum cyst
- Acute gastroenteritis
- Acute cholecystitis
- Diverticular disease
- Pyelonephritis
- Psoas abscess
- Cecal tumor with localized perforation
- Renal colic
- Perforated Meckle’s diverticulum

VI. Symptoms and Signs
- Possible diffuse periumbilical abdominal pain then right lower quadrant pain and tenderness approximately at McBurney’s point
- ± Anorexia
- ± Nausea
- ± Vomiting
- Possible diarrhea or constipation
- Atypical presentation common in the elderly, young age, poorly localized pain
- Fever
- Tachycardia
- Abdominal tenderness
VII. Summary of Investigative Laboratory Tests

- Complete blood count with differential: Leukocytosis with left shift is present in 90% of patients with appendicitis
- Serum pregnancy test: consider ectopic pregnancy in women of child-bearing age
- Urinalysis: Hematuria and pyuria occur in 20% of patients and their presence may suggest another diagnosis (does not rule out appendicitis)
- Occasionally there are circumstances in which additional bloods tests prior to transfer to surgical care are appropriate. However, they are not normally required

VIII. Diagnostic Imaging for Acute Appendicitis:

A. Graded Compression Ultrasonography (US):

Performed by applying continuous pressure with the transducer in the right lower quadrant during transabdominal ultrasound, it is particularly useful in women of child-bearing age when diagnosis is unclear

Abnormal
- Appendiceal diameter > 6 mm
- No compressibility of appendix
- Absent peristalsis
- Collection of fluid surrounding the appendix
- Keep in mind the possibility of a falsely abnormal result
- Abnormal results have 85-90% sensitivity and 92-96% specificity for the diagnosis of appendicitis

Advantages: safe, relatively inexpensive, can rule out pelvic diseases in females, better for children

Disadvantages: Operator dependent, technically inadequate studies due to gas, pain, obesity
Other Considerations: Whenever considering the diagnosis of acute appendicitis at Cardinal Glennon, then order the following US Study in EPIC:

1) “US ER RLQ PAIN”:
   a. This study is now available 24 hours/day, 365 days/year.
   b. This study should be ordered whenever the diagnosis of appendicitis is being considered.
   c. This study will evaluate the right lower quadrant for appendicitis, both kidneys, gall bladder, liver and pancreas (boys/girls), and the ovaries and uterus (girls).
   d. For girls who are NOT Sexually Active, the bladder must be Full before ordering this study (see below under item 2 “Pelvic US”), DO NOT order this study until the bladder is FULL (see below).
   e. For girls who are Sexually Active, the bladder does NOT need to be full for the Transvaginal portion of this study (see below) so it is OK to order this study before the bladder is full.
   f. When ordering this study, there is NO need to order a Pelvic US as in item 2 (the US technologists will transform this order in EPIC to match the limited studies performed).

2) “Pelvic Ultrasound”
   - This study should be ordered separately ONLY as clinical suspicion dictates; i.e. when there is NO clinical suspicion for appendicitis.
   - It DOES NOT need be ordered as part of “US ER RLQ Pain” (item 1).
   - When ordering this as a separate study, order as follows:
     a. “Pelvic (US Pelvis w/Transvag and Doppler)”
        i. For Sexually Active Females ONLY
        ii. Bladder can be empty for this study
     b. “Pelvic (US Pelvis w Doppler Uterus Ovaries)”
        i. For Non-Sexually Active Females ONLY
        ii. Must have a full bladder to perform Transabdominal Pelvic US
iii. **Physician/RN to perform bladder scan prior to ordering Transabdominal Pelvic US:**

--Obtain bladder volume measurement by obtaining measurements of bladder in 3 planes.

- **Formula:** \( \text{Minimal Bladder volume (mL)} = \frac{\text{length} \times \text{width} \times \text{height of bladder}}{2} \)

-Minimal Bladder volume (mL) = \([\text{Age (in years)} + 2] \times 30\); (minimal for an Adult/Teenager = 400-600 ml)

**iv. If the Bladder is not full, then follow the following protocol:**

1. **Begin filling the patient’s bladder** by starting a normal saline or 5% dextrose in normal saline bolus of 20 to 40 cc/kg to run over ½ hour. Inform the family of the importance of a sufficiently full bladder to obtaining an accurate study.

2. **Only after the bladder is confirmed full by bladder scan**, order the Pelvic US as above and then contact the radiology department and inform them of the order for Transabdominal Pelvic US and of the need to call in the on-call ultrasound technologist (if after normal business hours).

3. **When the ultrasound technologist calls for the patient, transfer her to the radiology department with an appropriate size Foley catheter** and inform the family and patient that if the bladder is not sufficiently full for the study that the Foley catheter will need to be inserted to complete the filling of the bladder. **If the ultrasound technologist assesses that the bladder is not full the emergency department nurse will be responsible for placing the Foley catheter in the US Suite.**

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**B. CT Scan with Intravenous Contrast Only:**

**Main Indication: Suspected Appendicitis without Perforation**

- Normal
  - Normal abdomen visualized

- Abnormal
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- Any number of abdominal processes may be visualized during CT, particularly with contrast or using a helical technique
- Keep in mind the possibility of a falsely abnormal result
- Abdominal CT scan has an accuracy of > 90% (sensitivity of 90 to 100%, and specificity of 95 to 97%). Is very sensitive and specific for appendicitis and is the confirmatory test of choice in equivocal situations

**Advantages**: More accurate, better identification of phlegmon, abscess, better identification of normal appendix

**Disadvantages**: cost, ionizing radiation, contrast use

C. CT Scan with Intravenous and Oral Contrast:

**Main Indication**: Suspected Appendicitis with Perforation or when considering alternative diagnoses, including Crohn’s Disease or Infectious Colitis

IX. Summary

Points to remember:
- Consider analgesia if patient is distressed
- Treat/ avoid dehydration in a patient unable to eat or vomiting
- Obtain prompt surgical consult if appendicitis appears likely, or evaluate other causes of acute abdomen

References:
- Journal of American Family Physician
- Journal of Radiology
- Journal of Pediatric Surgery
- Pediatrics
- Hospital Practice, Capsule & Comment