

## Appendicitis Clinical Guideline

**Scope:** To provide evidence-based and consensus guidelines for the care of patients with appendicitis

**Patient Population:** Pediatric patients  $\geq 2$  years old with signs and symptoms as well as a medical history suggestive of appendicitis

**Exclusion criteria:**

- Children  $< 2$  years of age
- Previous appendectomy
- History of bloody stools
- History of Crohn's disease
- History of cystic fibrosis, transplant or malignancy

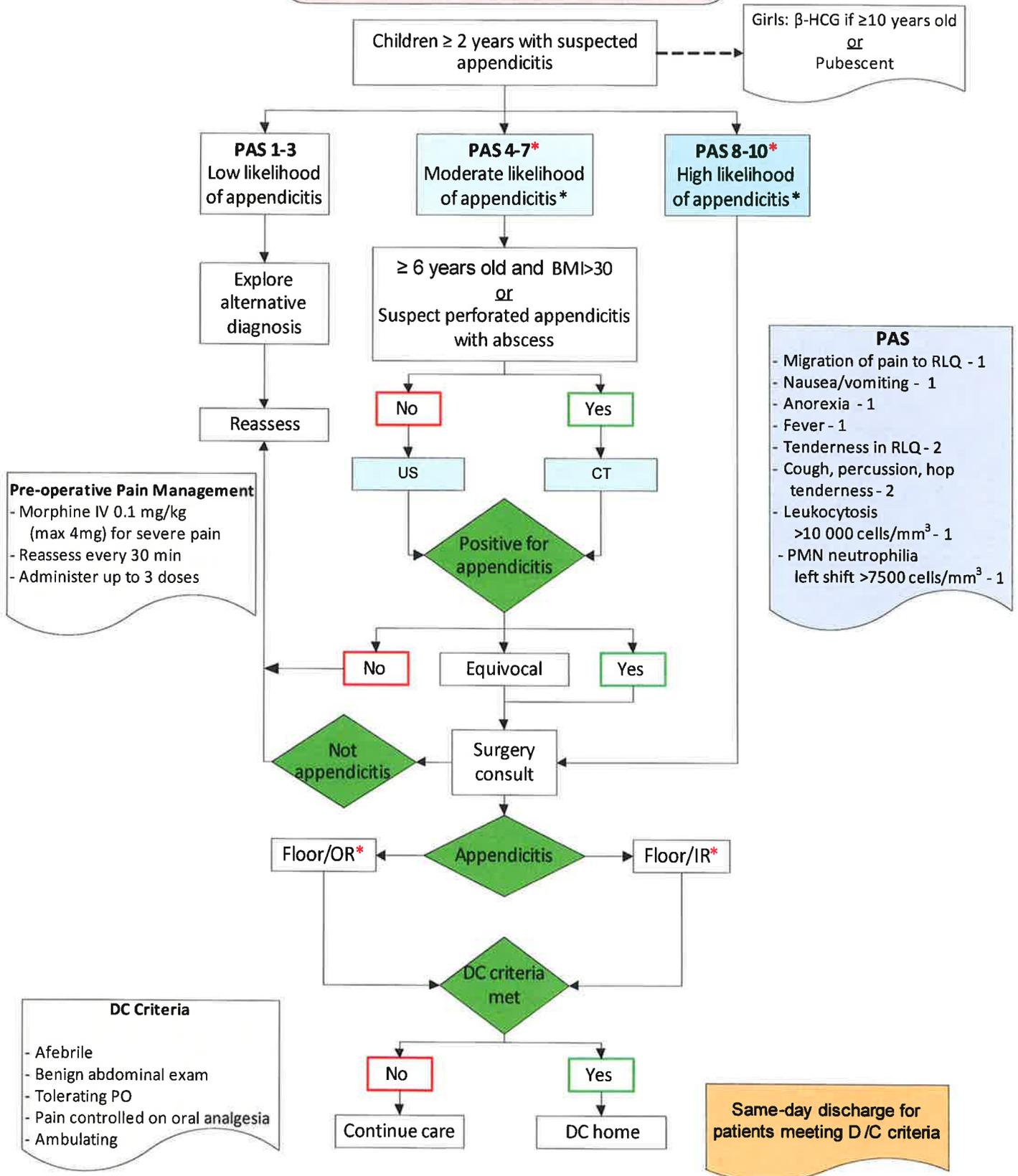
**Assessment Tools (if used):** Pediatric Appendicitis Score (PAS) [point value]

Signs, symptoms, laboratory findings	Point value
Nausea/vomiting	1
Anorexia	1
Migration of pain (periumbilical to RLQ)	1
Fever	1
Tenderness in RLQ	2
Cough, percussion, hop tenderness	2
Leucocytosis $> 10\,000$ cells/mm <sup>3</sup>	1
PMN neutrophilia, left shift $> 7\,500$ cells/mm <sup>3</sup>	1
<b>Total</b>	<b>10</b>

**Definition:** Acute appendicitis is the inflammation of the vermiform appendix- a blind ending tube connected to the cecum

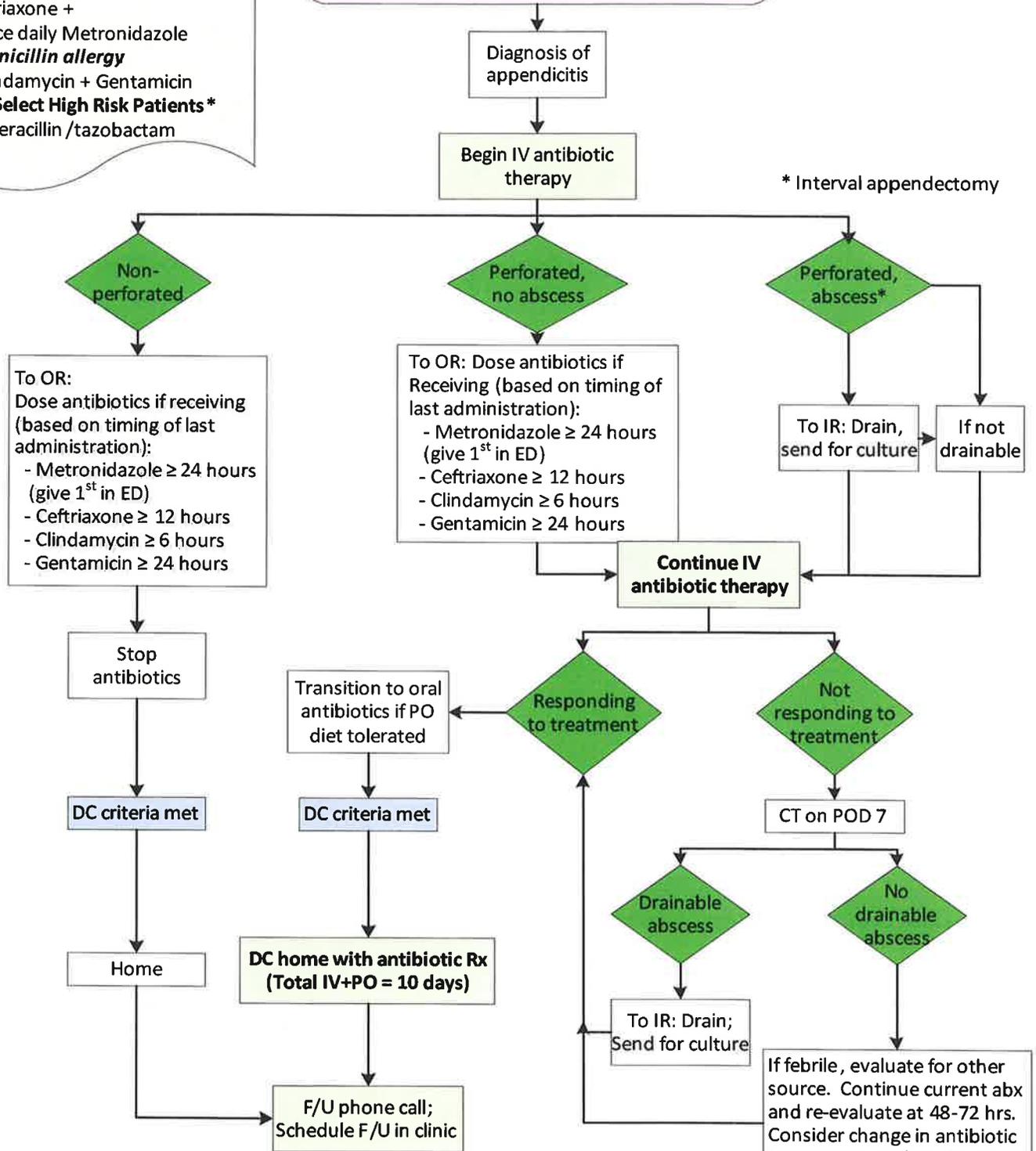
**Pathophysiology:** Although the cause is unknown, most theories relate to an obstruction of the appendiceal lumen which prevents the escape of secretions and eventually leads to a rise in intra-luminal pressure with the appendix. The increased pressure can lead to mucosal ischemia with stasis, providing an environment for bacterial overgrowth. The obstruction may be caused by: fecalith, parasites, calculi, foreign body, neoplasm, stricture, worms, lymphoid hyperplasia secondary to Crohn's disease, carcinoid syndrome or viral illnesses including upper respiratory infection, mononucleosis, and gastroenteritis.

**Appendicitis Clinical Care Flow Chart(algorithm)**



**Recommended Antibiotic:**  
 - Ceftriaxone + once daily Metronidazole  
 - **If penicillin allergy**  
 Clindamycin + Gentamicin  
 - **For Select High Risk Patients\***  
 Piperacillin /tazobactam

**Antibiotic Therapy Algorithm Appendicitis**



**\*Criteria for Identifying High Risk Patients**  
 1) Recent (< 30days) exposure to broad spectrum antibiotics  
 2) Severe illness requiring or anticipated to require ICU management  
 3) Significant chronic diseases or co-morbidities ( i.e. malignancy, inflammatory bowel disease)

**Home Antibiotic Rx:**  
 Augmentin  
**If penicillin allergy**  
 Cipro and Metronidazole

### Transfer from Other Healthcare Facility

- Direct admission to inpatient floors for pediatric patients transferred from other healthcare facilities with a CT scan positive for appendicitis from the transferring facility and a PAS  $\geq 8$ 
  - Patients with PAS  $< 8$  and/or equivocal CT should be seen in the Emergency Department (ED) for further evaluation.
- ED admission is recommended for pediatric patients suspected of appendicitis transferred from other healthcare facilities with US imaging even if US is positive

### Pediatric Appendicitis Score (PAS)

- Use of Pediatric Appendicitis Score (PAS) is recommended for assessment of pediatric patients  $\geq 2$  years old in whom appendicitis is suspected<sup>2-8</sup>
- Patients with a PAS  $< 4$  should be evaluated for other diagnoses
- Patients with suspected appendicitis and a PAS  $\geq 8$  should have a surgical consult and evaluation<sup>2,4-8</sup>
  - Use of radiological imaging for pediatric patients with suspected appendicitis with a PAS  $\geq 8$  is not supported by evidence and therefore not recommended<sup>2,4-8</sup>
- Patients with suspected appendicitis with a PAS  $\geq 4$  and  $< 8$  should undergo radiological imaging<sup>2,4-8</sup>

### Ultrasound (US)

- US is recommended as the first line of radiological imaging for patients with suspected appendicitis:<sup>10,11,13</sup>
  - Age  $\leq 5$  years old and PAS 4 to 7 regardless of BMI
  - Age  $\geq 6$  years old and PAS 4 to 7 and BMI  $\leq 30$
  - A standardized assessment of secondary signs is recommended during the US<sup>12,13</sup>
  - Consider the use of pelvic US immediately after appendix US if appendix US is not positive for acute appendicitis and if patient is female  $\geq 10$  years of age or pubescent female
- Patients with suspected intra-abdominal abscess should not have an US as the first line of radiological imaging<sup>10,11,13</sup>

### Computed Tomography (CT)

- CT is recommended as the first line imaging for patients age  $\geq 6$  years old with a BMI  $> 30$ <sup>9,14-22</sup>
- The use of a CT is recommended as the first line of radiological imaging if intra-abdominal abscess is suspected<sup>15-21</sup>
- CT is recommended for patients with suspected appendicitis with an inconclusive US and a continued suspicion of appendicitis<sup>15-20</sup>
  - CT may be considered if the US is inconclusive and if a positive diagnosis of appendicitis cannot be made based on clinical assessment and medical history<sup>20,21</sup>
- A post-operative CT is recommended for patients with perforated appendicitis and suspicion of intra-abdominal abscess on post-operative day seven<sup>23</sup>

### Pain Management

- Use of narcotic analgesia (morphine 0.1mg/kg; max dose 4mg) is recommended in patients whom appendicitis is suspected if in pain as reflected by an age appropriate pain assessment and score (per CMC policy)<sup>24-28</sup>
- Use of scheduled non-narcotic intravenous analgesia is recommended after appendectomy<sup>29-36,38-42,46</sup>

- Use of intravenous narcotics as rescue analgesia in addition to scheduled non-narcotic analgesia is recommended if moderate and/or severe pain is experienced (per policy)<sup>37,40,41,45</sup>
- The use of scheduled oral analgesia may be considered when patient is able to tolerate fluids orally<sup>29-36,38-42,46</sup>
- Use of Patient Controlled Analgesia (PCA) may be considered for age appropriate patients after appendectomy for perforated appendicitis<sup>43,44</sup>

### Antibiotic Therapy<sup>69-71</sup>

- Ceftriaxone and once daily metronidazole are recommended as the antibiotics of choice for patients with appendicitis
  - Ceftriaxone 50 mg/kg /dose IV every 24 hours (Max 2000 mg/dose)
  - Metronidazole 30 mg/kg/dose IV every 24 hours (Max 1000mg/dose)
    - Upon transition to oral regimen patients should be transitioned to 7.5 mg/kg/dose orally every 8 hours as per the standard dosing schedule
  - Consider using clindamycin and gentamicin for patients who are allergic to penicillin
- Initiation of intravenous antibiotic therapy is recommended at the time of appendicitis diagnosis
- A dose of antibiotics should be administered at the time of surgery if patient is currently receiving antibiotics and last dose administered is greater than the following for each respective agent: Ceftriaxone ≥ 12 hours, Metronidazole ≥ 24 hours, Clindamycin ≥ 6 hours, or Gentamicin ≥ 24 hours
- Prior to surgery, if time only allots for one antibiotic to be administered in ED, consider metronidazole.
- **Antibiotic therapy post-operatively is NOT recommended for patients with non-perforated appendicitis**
- Transition to oral antibiotic therapy should be initiated for hospitalized patients when oral diet tolerated
- Use culture results to guide antibiotic therapy for patients with perforated appendicitis with abscess and undergo abscess drainage
  - Consider switching antibiotic regimen to meropenem if poor response to therapy and no abscess identified after the seven post-surgical day (*may require additional approval*)
- Piperacillin/Tazobactan is recommended for selected high-risk patients including those with any of the following:
  - Recent (< 30 days) exposure to broad-spectrum antibiotics
  - Severe illness requiring or anticipated to require ICU management
  - Significant chronic diseases or co-morbidities (i.e. malignancy, inflammatory bowel disease)
- Clindamycin and gentamicin should be considered for patients who are allergic to penicillin

### Discharge Antibiotic Therapy

- It is recommended to prescribe oral antibiotic, amoxicillin/clavulanate (Augmentin) for patients with perforated appendicitis with or without abscess when discharged home to complete a 10 day total antibiotic course (including the intravenous antibiotics administered while in the hospital)
  - Consider using oral ciprofloxacin and metronidazole (Cipro+Flagyl) for patients allergic to penicillin

**Admission/Discharge**

- Otherwise healthy patients undergoing laparoscopic appendectomy for non-complicated appendicitis may not require hospital admission and be treated as same-day surgery<sup>62-68</sup>
- **Discharge Criteria**
  - Able to ambulate
  - Tolerating oral diet
  - Afebrile
  - Pain controlled on oral analgesia
  - Benign abdominal exam

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**Disclaimer:** *The guideline is not intended to impose standards of care preventing selective variation in practice that is necessary to meet the unique needs of individual patients. The physician must consider each patient and family's circumstance to make the ultimate judgment regarding best care.*

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**Approvals:**

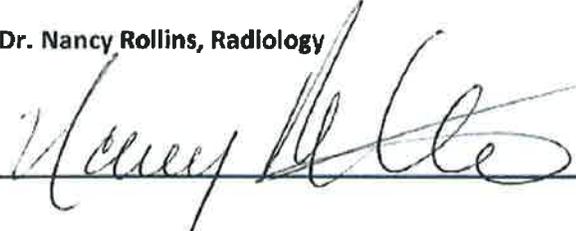
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**Review:**

*Clinical Guidelines need to be reviewed every ----2---- years*

Review date 2018

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