

# Suspected Appendicitis Clinical Pathway

Jan 2022

<b>Inclusion criteria</b>	Patients aged 3-18 years who present with right lower quadrant abdominal pain and/or suspected appendicitis
<b>Exclusion criteria</b>	Patient with known inflammatory GI disease (e.g. IBD); children < 3 years of age present atypically
<b>Outcomes/Goals</b>	<ol style="list-style-type: none"> <li>1. Create an efficient, timely, team oriented, standardized approach for the evaluation, work up, and accurate diagnosis of children with suspected appendicitis</li> <li>2. Decrease radiation exposure where possible during diagnostic workup</li> </ol>
<b>NURSE</b> documentation	Chief complaint. Onset and duration of pain/nausea/vomiting/diarrhea. Abdominal exam including ambulatory status, last po intake, last bowel movement, fever history
<b>INTERVENTIONS</b> Initiate on arrival	ESI Triage level III Full set of vitals Ondansetron ODT 0.1-0.2mg (maximum dose 8mg/dose) for nausea Place topical Lidocaine (LMX) in anticipation of peripheral IV start Place on monitor if toxic appearance or suspected peritonitis UA UHCG (if indicated) CMP Lipase CBC with differential Initiate NS bolus 20 ml/kg if clinically indicated
<b>DIAGNOSTICS</b>	Labs (CBC with diff, CMP, lipase, UA, UHCG) Ultrasound for intermediate or high risk patients Consider MR/CT for non-diagnostic US results or first-line for obese patients
<b>PHYSICIAN (LIP)</b> Scoring Criteria	Score patient using Alvarado Score. If score is $\leq 3$ , patient is low risk and may be discharged home with close follow-up vs observed. If intermediate or high risk, obtain imaging and follow pathway according to results.
IV Fluids (if indicated)	NS bolus 20 ml/kg Maintenance fluid
Medication Pain Medication  Anti-emetics	Use opioids as needed to treat pain Tylenol 15 mg/kg po/pr Q4 hours for fever/mild pain Fentanyl 1mcg/kg IV maximum 50mcg q 10 minutes prn or Morphine 0.1mg/kg IV maximum 8 mg q 10 minutes prn Ondansetron Oral dose 2-4 years of age: 2-4 mgs (0.15mg/kg) 4-11 years of age: 4 mgs >11 years of age: 4-8 mgs IV dose 6 months–18 years of age: 0.15mg/kg/dose (maximum dose 4mg)
<b>DISPOSITION</b>	If confirmed appendicitis, consult pediatric surgery Prepare family/infant for admission/transfer
<b>Special Considerations</b>	Clinical presentation differs depending on age. <b>Infants:</b> vomiting (85-90%), pain (35-77%), diarrhea (18-46%), fever (40-60%), irritability (35-40%), grunting respirations, cough/rhinitis, R hip complaint (3-23%)  <b>PreSchool:</b> abdominal pain (89-100%), vomiting (66-100%), fever (80-87%), anorexia (53-60%)  <b>School Age:</b> pain with movement (41-75%), pain with cough (95%), pain with jumping (93%), vomiting (68-95%, nausea (36-90%, anorexia (47-75%)

# Clinical Pathway Decision Making Process

## Suspected Acute Appendicitis (3-18 years)

Jan 2022

Patient with Suspected Appendicitis

Place peripheral IV  
CBC with differential, CMP, Lipase  
Urinalysis (HCG if indicated)

Apply Clinical Appendicitis Score  
(PAS vs pARC vs Alvarado)—  
see next page

**Low Risk PAS or Alv Score ( $\leq 3$ ) or  
Very Low Risk pARC**

Discharge home with PCP f/u <24 hours

**Low Risk pARC**

Consider ED Observation for 6 hours, serial exams vs US abd

**High Risk PAS or Alv Score ( $\geq 7$ ) or  
High Risk pARC**

1. NPO
2. IV access (if not already obtained)
3. IV pain medications, fluid bolus
4. Obtain **US abdomen to evaluate appendicitis (also rule out ovarian torsion for females)**

**Intermediate Risk PAS or Alv Score (4-6)  
or  
Intermediate Risk pARC**

1. NPO
2. IV access (if not already obtained)
3. Consider IV pain medications, fluid bolus
4. Obtain **US abdomen to evaluate appendicitis (also rule out ovarian torsion for females)**

US Positive

Appendix not seen  
OR appendix normal

**Diagnosis of Appendicitis**

1. Consult to Pediatric Surgery
2. Start broad spectrum antibiotics\*\* if surgery requests or perforation detected

US Positive

CT positive (wall thickening,  
appendix > 6mm, +  
appendicolith, fat stranding)

**Inconclusive**

1. Repeat PE. Consider alternative dx
2. If appendicitis still considered likely, consider **abdominal CT vs transfer for further evaluation depending on local resources**

**Likely NOT Appendicitis**

1. Repeat PE
2. Consider alternative diagnoses
3. PO challenge
4. Consider discharge vs Observation

US Negative

Appendix not seen

CT Negative (appendix  
NML **OR** appendix not  
seen but no RLQ fat  
stranding, no free fluid in  
boys or expected  
physiologic volume in girls)

CT Equivocal (appendix not  
visualized **AND** + RLQ fat stranding  
**OR** ANY free fluid in boys **OR** more  
than physiologic volume in girls)

**Diagnosis Uncertain**

1. Repeat PE. Consider alternative dx
2. Consult Pediatric Surgery.
3. Avoid empiric antibiotics unless suspected

### \*\*Antibiotics:

Ceftriaxone 50mg/kg IV q24 (max 2g)

Flagyl 30mg/kg/day IV q24 (max 1.5g)

### Cephalosporin allergy:

Ciprofloxacin 25mg/kg/day IV q12 (max 400mg) + Flagyl

## Pediatric Clinical Appendicitis Scoring Tools

Alvarado/Mantrels Score		Pediatric Appendicitis Score		Pediatric Appendicitis Risk Calculator (pARC)	
	Points		Points		Calculate using scoring tool available in EMR or at MDCALC <a href="https://www.mdcalc.com/pediatric-appendicitis-risk-calculator-parc">https://www.mdcalc.com/pediatric-appendicitis-risk-calculator-parc</a>
Anorexia	1	Anorexia	1	Male sex	
Nausea or vomiting	1	Nausea or vomiting	1	Age and sex	
Migration of pain to RLQ	1	Migration of pain to RLQ	1	Duration of pain	
Fever > 37.3° C (>99.2°F)	1	Fever	1	Presence of pain with walking	
RLQ Rebound tenderness	1	Cough/percussion/hopping tenderness	2	Migration of pain to RLQ	
RLQ tenderness	2	RLQ tenderness	2	Maximal TTP in RLQ	
WBC > 10,000	2	WBC > 10,000	2	Abdominal guarding	
ANC > 7,500	1	ANC > 7,500	1	ANC	
Total Points					

Experienced clinician judgment has been found to be comparable to the Alvarado score and the Pediatric Appendicitis Score. Of the tools listed above, the pARC appears to have the best test characteristics for ruling in and ruling out appendicitis.

# Pediatric Suspected Acute Appendicitis

## Goals of Clinical Pathway

1. Create an efficient, timely, team-oriented, standardized and accurate approach for the evaluation and work up of children with suspected appendicitis
2. Decrease radiation exposure where possible during diagnostic workup

Data Considerations	Interventions	Rationale
<b>Diagnosis</b>	Appendicitis is the most common surgical emergency in children. Symptoms overlap many childhood illnesses making this a challenge to diagnosis. Delayed diagnosis and rupture are associated with increased morbidity, mortality and prolonged hospital stays. Initial misdiagnosis rates range from 28-57% for children age 12 years or younger, and can be much higher in children aged less than 2.	
	<b>Clinical Assessment</b>	Several clinical scoring systems have been prospectively studied in children to aid in the diagnosis of appendicitis, including the Pediatric Appendicitis Score, the Alvarado Score, and the Low-Risk Appendicitis Score. The newest of these, the Pediatric Appendicitis Risk Calculator (pARC) appears to have the best test characteristics though requires more sophisticated calculations.
	<b>Ultrasound</b>	Though ultrasound is inferior to CT scan for the diagnosis of appendicitis, both ACEP and ACR recommend US as the initial study to minimize radiation exposure in pediatric patients. A multicenter study at major pediatric centers by Mittal showed ultrasound to have sensitivity of 73% and specificity of 97%. However, utility of US for diagnosis of appendicitis depends on pretest probability. A study combining US and PAS found that in kids with high risk PAS, 19% of US were falsely negative and 45% with equivocal results had appendicitis. For intermediate risk, 13% of equivocal had appendicitis, while 6% with negative US did.
	<b>CT Scan</b>	CT is superior to US and in most studies to MRI. CT with contrast is the preferred study in the diagnosis of appendicitis with rupture. There is not good evidence suggesting oral contrast improves diagnostic accuracy, though IV contrast is useful.

## References:

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3. Moore MM, Gustas CN, Choudhary AK, et al. MRI for clinically suspected pediatric appendicitis: an implemented program. Pediatr Radiol 42 (2012): 1056-63
4. Mushtaq R, Desoky SM, Morello F. First Line Diagnostic Evaluation with MRI for Children Suspected of Having Acute Appendicitis. Radiology 29 (2019): 170-7
5. Ebell MH, Shinholser J. What are the most clinically useful cutoffs for the Alvarado and Pediatric Appendicitis Scores? A systematic review. Ann Emerg Med 64 (2014): 365-372