

## ACUTE APPENDICITIS PATHWAY GUIDELINES

**LEGAL DISCLAIMER:** The information provided by Dell Children's Medical Center (DCMC), including but not limited to Clinical Pathways and Guidelines, protocols and outcome data, (collectively the "Information") is presented for the purpose of educating patients and providers on various medical treatment and management. The Information should not be relied upon as complete or accurate; nor should it be relied on to suggest a course of treatment for a particular patient. The Clinical Pathways and Guidelines are intended to assist physicians and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. These guidelines should not be considered inclusive of all proper methods of care or exclusive of other methods of care reasonably directed at obtaining the same results. The ultimate judgment regarding care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient. DCMC shall not be liable for direct, indirect, special, incidental or consequential damages related to the user's decision to use this information contained herein.

### **Definition:**

Acute appendicitis is the inflammation of the vermiform appendix; a blind ended tube connected to the cecum of the bowel. 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 intraluminal pressure with the appendix. The increased pressure can lead to mucosal ischemia with stasis, providing an environment for bacterial overgrowth.

### **Incidence:**

Acute appendicitis is the most common abdominal condition requiring surgery in children, accounting for more than 320,000 operations in the United States annually. Appendicitis accounts for 1/3 of all childhood admissions for abdominal pain. The incidence of perforated appendix is highest in infants. 70% - 95% of children < 1 year old, 70% - 90% of children 1-4 years old, and 10% - 20% of adolescents with acute appendicitis have a perforated appendix. The reported median perforation rate in children is 38.7%. Dell Children's Medical Center performs approximately 700 appendectomies a year.

### **Diagnosis:**

The diagnosis of acute appendicitis must be considered in children who present with abdominal pain. It is most common in 4 -15 year olds.

### **Guideline Eligibility Criteria:**

Children  $\geq$  4 years of age presenting with abdominal pain and signs/symptoms highly suspicious of acute appendicitis.

### **Guideline Exclusion Criteria:**

- Children < 4 years of age
- Previous appendectomy
- History of bloody stools
- Crohn's disease
- History of cystic fibrosis, transplant or malignancy

### **Diagnostic Evaluation:**

#### **History: Assess for**

- Pain in the abdomen that is continuous even when lying down, first around the umbilicus, then moving to the lower right abdomen (McBurney's Point)
- Pain may also be in the right upper quadrant (RUQ) under the gallbladder, in the pelvis, across the top of the bladder, and behind the large intestine, depending on the position of the appendix
- Pain intensifies with activity, deep breathing, coughing, and sneezing

- Nausea, loss of appetite, lack of interest in favorite food, vomiting
- Frequent, small volume stool or mucous (tenesmus)
- Fever, essentially always following onset of other symptoms
- Abdominal swelling
- Menstrual and sexual history

#### **Physical Examination: Assess for**

- A quiet child reluctant to move sometimes with hips flexed
- Child reluctant to stand erect, walk or make sudden movements
- Tenderness in right lower quadrant (RLQ) of the abdomen (examine last)
- Peritoneal signs

#### **Classic Signs and Symptoms for High Index of Suspicion Cases:**

- Nausea, anorexia (less reliable in young children)
- Point of maximal tenderness in RLQ
- Vomiting after onset of pain
- Progressive increase in pain
- Migration of pain to RLQ after onset in mid abdomen (usually periumbilical)

#### **Classic Signs and Symptoms for Low Index of Suspicion Cases:**

- Absence of nausea, emesis or anorexia
- Minimal or absent abdominal tenderness without localization in RLQ
- Pain that is intermittent or cramping in nature

#### **Pediatric Appendicitis Score (PAS) [point value], max score=10<sup>(3-6)</sup>**

- Migration of pain [1]
- Anorexia [1]
- Nausea/Vomiting [1]
- RLQ tenderness [2]
- Cough/Hopping/Percussion tenderness in RLQ [2]
- Elevation of temperature [1]
- Leukocytosis ( $\geq$  10,000) [1]
- Differential WBC with left shift [1]

\*The PAS is the cumulative point total from all clinical findings

PAS  $\leq$  4: low suspicion for appendicitis

NOTE: sensitivity of 97.6%, with a negative predictive value of 97.7%

PAS 5-7: equivocal for appendicitis

PAS  $\geq$  8: high suspicion for appendicitis

NOTE: specificity of 95.1%, with a positive predictive value of 85.2%

## **Critical Points of Evidence**

### **Evidence Supports**

Use of clinical H&P examination alone as sufficient for diagnostic accuracy of appendicitis in children when the index of suspicion is high or low. <sup>(7)</sup>

Use of the PAS for the diagnosis and management of suspected appendicitis. <sup>(3-6)</sup>

Use of WBC and CRP to assist in the diagnosis of appendicitis in *equivocal cases only*. <sup>(8)</sup>

Use of WBC and CRP in postoperative evaluation of an infectious process.

Ultrasound (US) has a sensitivity that is inferior to Computed Tomography (CT), but a US-CT staged pathway is efficacious in diagnosing appendicitis among children with suspected appendicitis. <sup>(21-25)</sup>

Pediatric Emergency Medicine physicians and surgeons do not differ significantly in their ability to clinically predict appendicitis. <sup>(15)</sup>

The need for evaluation and appropriate treatment of patients with acute appendicitis and suspected SIRS or sepsis.

Scheduled dosing of postoperative pain medication. <sup>(32)</sup>

Surgical intervention is the preferred practice for pediatric appendicitis. Surgical options include a laparoscopic approach or open appendectomy. <sup>(33-42)</sup>

### **Evidence Against**

WBC and CRP alone to diagnose appendicitis in children. <sup>(8)</sup>

The *routine* use of laboratory studies for diagnostic purposes in cases of appendicitis where the index of suspicion is either high or low. <sup>(8)</sup>

The *routine* use of radiologic studies when the index of suspicion is either high or low. <sup>(27)</sup>

Withholding analgesia to improve the diagnostic accuracy of the physical exam in children with appendicitis. <sup>(46-51)</sup>

## **Practice Recommendations**

### **Pediatric Appendicitis Score (PAS)**

The PAS should be used for predicting the presence of appendicitis in children  $\geq 4$  years. <sup>(3-6)</sup>

*(Strong recommendation; Moderate quality evidence.)*

### **Laboratory Testing**

WBC or WBC and CRP should be used to assist in the diagnosis of appendicitis *in equivocal cases only*. <sup>(8)</sup>

In cases of lower clinical suspicion of appendicitis, a negative CRP ( $< 0.8$  mg/dL) in conjunction with a normal white blood cell count can safely exclude most cases of acute appendicitis. CRP used alone is not a useful screening tool to rule in or out acute appendicitis. <sup>(8)</sup>

*(Strong recommendation, Moderate quality evidence.)*

### **Imaging**

No imaging is necessary if there is a high or low suspicion for appendicitis.

- High Suspicion  $> 8$
- Low Suspicion  $< 3$

US should be the initial imaging test in intermediate suspicion cases. CT or MRI should be performed only when US equivocal in diagnosing appendicitis in children. <sup>(21-27)</sup>

Based on MRI availability and clinical appropriateness consider admit to obs under surgical services.

MRI ordering should be in accordance with the following:

- MRI available
- Age  $\geq 5$
- Can tolerate 10-15 minute scan without sedation

*(Strong recommendation; Moderate quality evidence.)*

**Note:** CT is more accurate than US in diagnosing appendicitis in children. However, the risk of ionizing radiation exposure needs to be considered. Studies have shown that non-contrast MRI can be equal to CT in diagnosis of acute appendicitis<sup>90</sup>.

### **Diagnosis**

A timely diagnosis of appendicitis should be made by physicians. <sup>(15)</sup>

*(Strong recommendation; Low quality evidence.)*

### **Surgical Management**

Laparoscopic appendectomy is the preferred surgical approach for children with appendicitis. <sup>(28-31)</sup>

*(Strong recommendation; Moderate quality evidence.)*

### **Pain Management**

Analgesia should **NOT** be withheld. Withholding analgesia does **NOT** aid in the diagnosis of appendicitis. <sup>(46-51)</sup> *(Strong recommendation, High quality evidence.)*

### **Principles of Clinical Management**

*(for full recommendations see attached pathway and addendums)*

**Laboratory Assessment:**

**Diagnostic:**

Utilize only in cases where H&P is not definitive for acute appendicitis (*Exception: Urine pregnancy test in all post pubescent females*)

**Postoperative:**

Use WBC +/- CRP trending for determination of length of antibiotic treatment, and presence of postoperative infection/ abscess

**Antibiotics:**

- Administer ceftriaxone and metronidazole as soon as possible once the diagnosis is confirmed. (53,54, 58-66)  
*(Strong recommendation, Low quality evidence.)*
- Administer a second dose of antibiotics if more than 2 hours since first dose and prior to operation. (59,61)
- Administer ceftriaxone/metronidazole (Flagyl®) for patients with perforated appendix (54,55,58,60,63,66,69-73)  
*(Consensus, Strong recommendation, Low quality evidence.)*
- Administer 24-48 hours of IV ceftriaxone/metronidazole (Flagyl®) for patients with gangrenous appendix (83)  
*(Consensus, Weak recommendation, Low quality evidence.)*
- Postoperative antibiotics are unnecessary in children with simple nonperforated appendicitis (60,62,67,68)  
*(Strong recommendation, Moderate quality evidence.)*

**Antibiotic Allergy Recommendations:**

- Confirm that allergy is **TRUE and SEVERE**. Document reaction, age of onset, time to onset, and if patient has been rechallenged in the allergy tab of the Electronic Health Record.
- If true and severe penicillin allergy **ONLY**, then **IV ceftriaxone + IV metronidazole** is still recommended first-line because penicillins and ceftriaxone have negligible risk of cross-reaction due to dissimilar side chains (See attached image).
- If true and severe cephalosporin allergy **ONLY** (like ceftriaxone), then piperacillin-tazobactam recommended. (Exception is cefadroxil, cefaclor, and cephalexin have small chance of cross-reaction in which case, can go to step 4).
- If true and severe penicillin allergy **AND** cephalosporin allergy, then gentamicin, metronidazole, and clindamycin should be used.

**Post-operative antibiotic transition for patients with perforated appendix:**

- A combination of intravenous and oral antibiotics for a total of 4 ± 1 days is recommended for post-operative treatment of perforated appendicitis. (55, 57, 58, 63, 65, 69, 70, 74-82, 100)  
*(Consensus, Moderate recommendation, Moderate quality evidence.)*
- Intravenous antibiotics may be transitioned to oral on postoperative days 1-3 if the following clinical criteria are met: afebrile for 24 hours, pain controlled with oral medications, eating a regular diet, and stooling or passing flatus. (60, 62, 74, 81, 82)

*(Strong recommendation, Moderate quality evidence.)*

- Oral antibiotics options include monotherapy or dual therapy with amoxicillin/clavulanate, metronidazole, and/or trimethoprim/sulfamethoxazole. (58, 78, 79)

**Consults/Referrals:**

- Consult surgery:
  - o For a PAS ≥ 8
  - o Proven Appendicitis
- Call Surgery (non-consult) for equivocal cases
  - o Prior to ordering CT

**Radiologic Evaluation:**

Use US imaging in cases where H&P is equivocal for acute appendicitis (PAS of 5-7) or differential diagnosis is gynecologic. Use of standard ultrasound reporting for grading findings on ultrasound.

- If diagnosis remains equivocal, consult with radiologist and surgeon (ED Physician Discretion) regarding further imaging prior to ordering CT or MRI.
  - o If formal consultation is not performed before discharge, the patient may be referred to follow up in the surgery clinic the following day.

**Follow-Up Care**

- See Addendum regarding ED and post-operative discharge instructions

**Outcome Measures**

See addendum 7.

**Addendums**

1. Pediatric Appendicitis Score
2. DCMC ED Pain Management Guidelines
3. Radiology Ultrasound Scoring Report
4. Antibiotic Dosing and Recommendations
5. DCMC ED Pre-Operative Checklist for Appendicitis
6. Austin Pediatric Surgery Discharge Instructions
7. DCMC ED Discharge Instructions for "Abdominal Pain, Unknown Cause"
8. DCMC Appendicitis Scorecard
9. DCMC Pediatric Appendicitis Score Sheet

**Perioperative Cultures:**

- Obtain cultures only for patients undergoing interventional drainage of abscess (16-19)

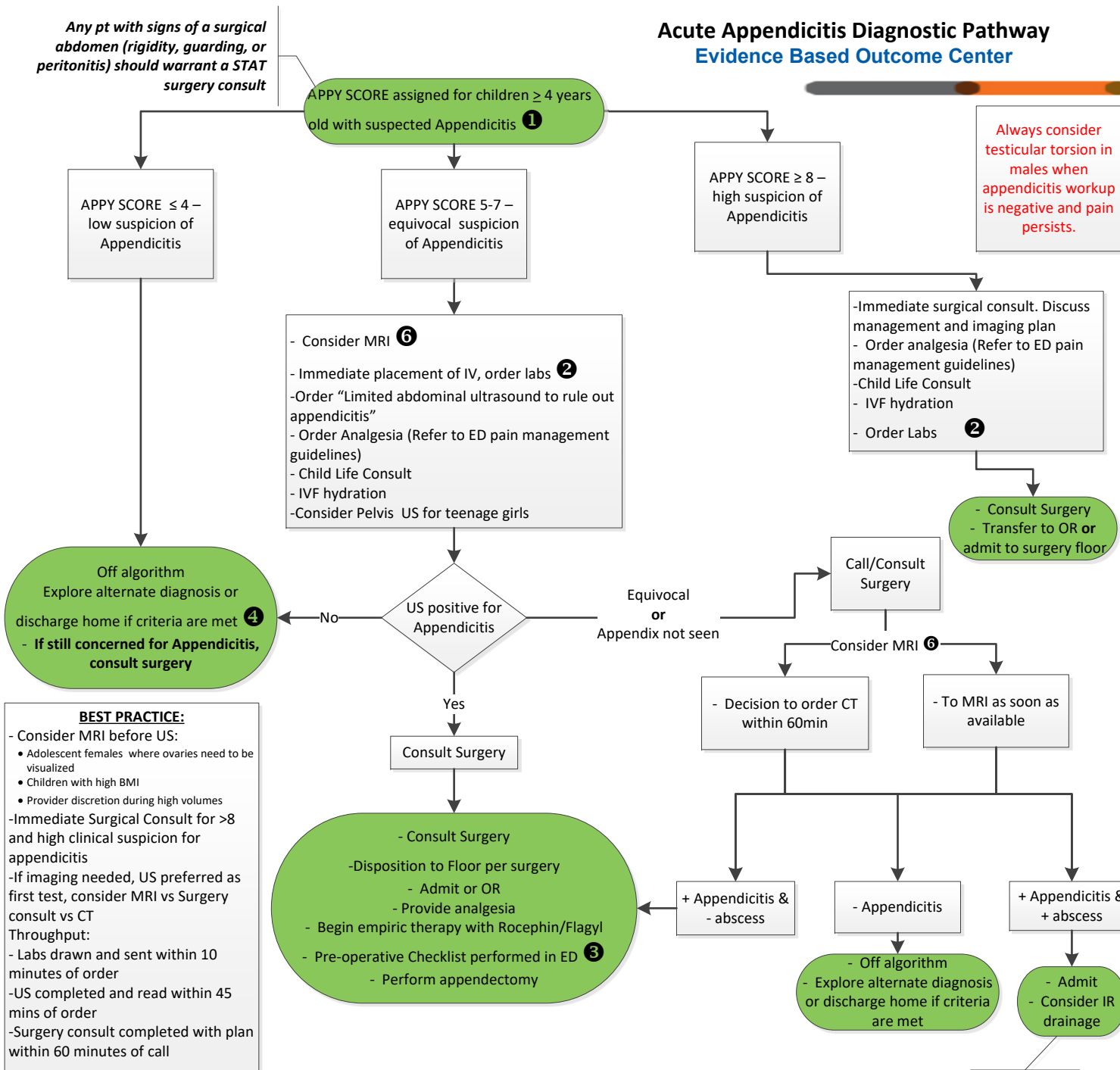
**Pain Management:**

- Administer analgesia to promote comfort
- Withholding analgesia does not improve diagnostic accuracy
- Schedule postoperative pain medication **Sepsis Evaluation**
- Patients with a diagnosis of acute appendicitis should have an evaluation for sepsis and SIRS. Appropriate IVF resuscitation and antibiotics should be given.

# Acute Appendicitis Diagnostic Pathway

## Evidence Based Outcome Center

Any pt with signs of a surgical abdomen (rigidity, guarding, or peritonitis) should warrant a STAT surgery consult



**The Pediatric Appendicitis Score (Appy Score)**  
– use for children ≥ 4 years

- Migration of pain (1)
- Pain with cough/hopping/percussion (2)
- Anorexia (1)
- Fever >38°C (100.5°F) (1)
- Nausea/vomiting (1)
- Leukocytosis (≥ 10,000) (1)
- RLQ tenderness (2)
- Neutrophils plus band forms >7500 cells/microL (1)

\*The APPY SCORE is the cumulative point total from all clinical findings.

**Labs:**

- UA with micro and culture
- CBC with Diff
- BMP
- Consider:
- CMP
- CRP (for hold in lab for low likelihood cases)
- Always: Urine pregnancy test for all post-pubescent females

**Pre-Operative Checklist:**

- Evaluate for Sepsis /SIRS
- IVF Resuscitation
- Pain Control
- IV Antibiotics
- NPO
- Consent in Chart

**ED Discharge Criteria:**

- Tolerating liquids
- Pain able to be controlled at home
- Ambulating
- Benign abdominal exam

**Imaging:**

- MRI Availability
- Ordering Timing
- Patient Presentation

**MRI Protocol:**

- Age ≥ 5 Years
- Stable Condition
- Can hold still for 10 minutes without sedation
- No MRI Contraindications
- MRI Suite Available (Call to Verify)

**BEST PRACTICE:**

- Consider MRI before US:
  - Adolescent females where ovaries need to be visualized
  - Children with high BMI
  - Provider discretion during high volumes
- Immediate Surgical Consult for >8 and high clinical suspicion for appendicitis
- If imaging needed, US preferred as first test, consider MRI vs Surgery consult vs CT
- Throughput:
  - Labs drawn and sent within 10 minutes of order
  - US completed and read within 45 mins of order
  - Surgery consult completed with plan within 60 minutes of call

Culture all abscesses drained in IR



# Acute Appendicitis Treatment Pathway

## Evidence Based Outcome Center

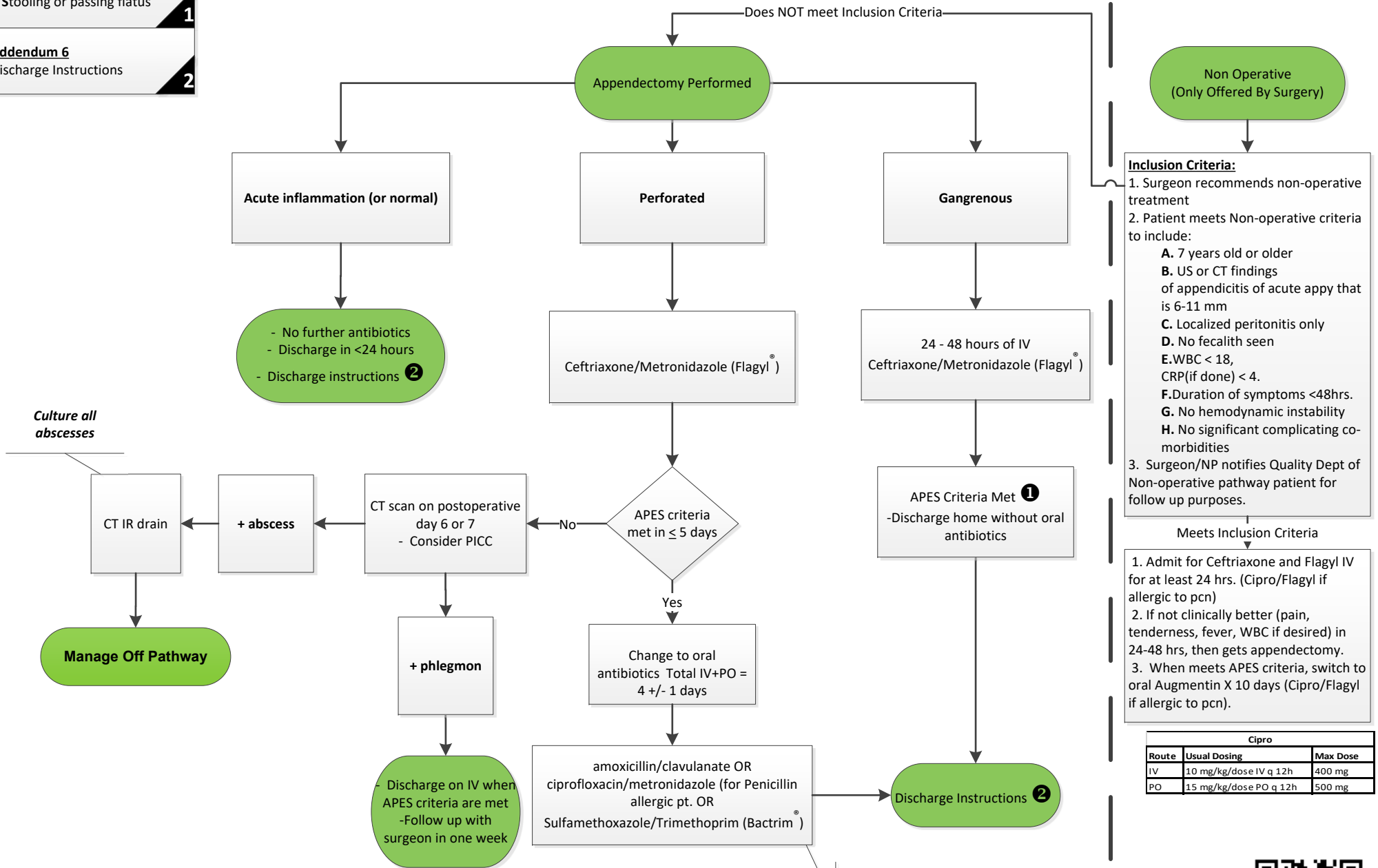
**APES Criteria**

- Afebrile X 24 hours
- Pain controlled with oral meds
- Eating regular diet
- Stooling or passing flatus

1

**Addendum 6**  
Discharge Instructions

2



**Inclusion Criteria:**

- Surgeon recommends non-operative treatment
- Patient meets Non-operative criteria to include:
  - 7 years old or older
  - US or CT findings of acute appy that is 6-11 mm
  - Localized peritonitis only
  - No fecalith seen
  - WBC < 18, CRP (if done) < 4.
  - Duration of symptoms < 48hrs.
  - No hemodynamic instability
  - No significant complicating comorbidities
- Surgeon/NP notifies Quality Dept of Non-operative pathway patient for follow up purposes.

Meets Inclusion Criteria

- Admit for Ceftriaxone and Flagyl IV for at least 24 hrs. (Cipro/Flagyl if allergic to pcn)
- If not clinically better (pain, tenderness, fever, WBC if desired) in 24-48 hrs, then gets appendectomy.
- When meets APES criteria, switch to oral Augmentin X 10 days (Cipro/Flagyl if allergic to pcn).

Cipro		
Route	Usual Dosing	Max Dose
IV	10 mg/kg/dose IV q 12h	400 mg
PO	15 mg/kg/dose PO q 12h	500 mg

Confirm susceptibility prior to prescribing sulfamethoxazole-trimethoprim  
See **Antibiotic Recommendations**



## MRI Utilization for Pediatric Appendicitis Diagnosis

- **ED:** ED provider will determine if patient qualifies before placing order
- **Admission:** Surgery provider will determine if admitted obs patient qualifies before placing order
- **Order:** MR Abdomen Ltd w/o Contrast - appendicitis

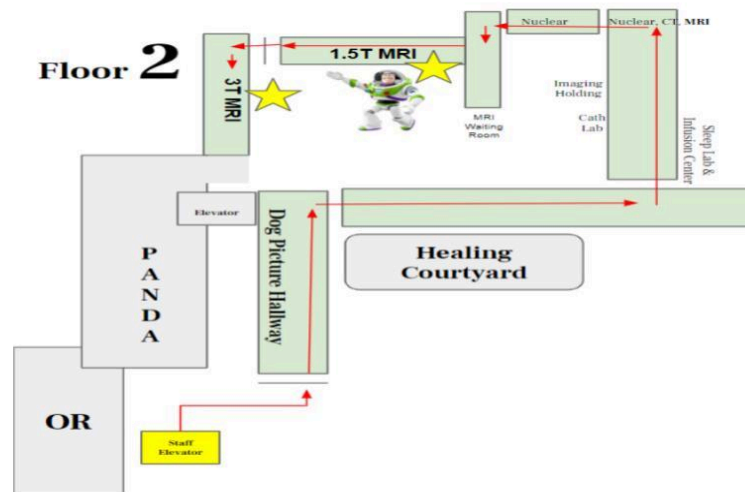
**Patient Qualifications (predetermined at the time of ordering):**

- Age ≥ 5
- Stable condition
- Can hold still for 10 min without sedation (total cooperation - patient cannot move at all)
- No MRI contraindications (Examples: No concern for ferromagnetic FB, No implanted devices - pacemakers, vagal nerve stimulation devices, VP shunts, etc)

**Process:**

- Provider calls MRI Tech for available time (**Ext 86490 or 86483**) → If MRI is available within appropriate time frame:
  - Provider places MRI Order
  - Unit preps patient and family:
    - Complete screening form (1 per person)
    - Safety precautions (pt in gown, remove jewelry, etc.)
    - Complete UPT on female patients age ≥ 10
  - Unit transports patient (with RN if sedative medications are given)
    - *Patient must be in MRI 5 min before time given by MRI tech*
  - If not within appropriate time frame, Provider refers to guideline for alternate path

**Directions to MRI Magnets:**



### Addendum 1 Pediatric Appendicitis Score

Finding	Point Value
Migration of pain	1
Anorexia	1
Nausea/Vomiting	1
RLQ tenderness	2
Cough/Hopping/Percussion tenderness in RLQ	2
Elevation of temperature	1
Leukocytosis	1
Neutrophils plus band forms >7500 cells/microL	1

#### **Interpretation**

The Pediatric Appendicitis Score is the cumulative point total from all clinical findings.

Score	Assessment
≤ 4	Low suspicion for appendicitis*
Between 5 & 7	Equivocal for appendicitis
≥ 8	High suspicion for appendicitis**

*\*NOTE: sensitivity of 97.6%, with a negative predictive value of 97.7%*

*\*\*NOTE: specificity of 95.1%, with a positive predictive value of 85.2%*

## Addendum 2

### ED Pain/Anxiety Guidelines for Children

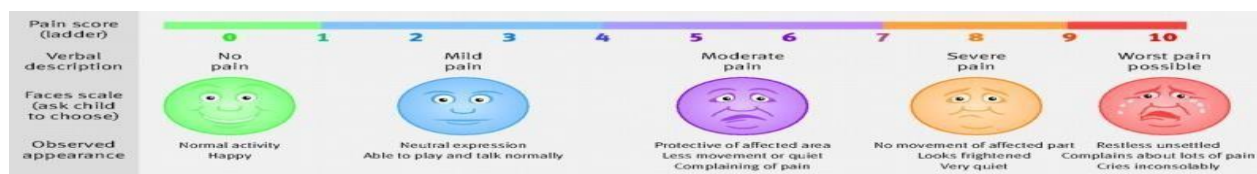
#### Best Practices

- Use of LMX cream in triage on potential IV sites for any child with a possible need for IV later
  - Cold Spray appropriate in older children who understand expected discomfort of spray
- Child Life Consult early and often
- Age appropriate pain scale
- Intranasal medications may be of use to decrease anxiety and pain prior to IV placement in some cases
  - Intranasal medications do not provide enough pain relief for diseases causing ongoing pain

#### Medication Guide

- Lidocaine topical (LMX 4%), for IV insertion pain
  - 1 application topical once. Apply cream prior to IV insertion
  - Use occlusive dressing for young children who may disturb site
  - Leave on for 30-60 minutes (may add more cream)
- Fentanyl Intranasal – short term analgesia only
  - 2 micrograms/kg Intranasal, Max Dose 100 micrograms, Max of 1 ml per nostril
  - Only dispense using Mucosal Atomization Device
- Versed Intranasal – short term anxiety relief only
  - 0.2 milligrams/kg, Max Dose 8mg, Max of 1 ml per nostril
  - Only dispense using Mucosal Atomization Device
- Morphine – acute analgesia relief. Titrate to effect and careful titration of low dosing to start in opioid naïve patients (most children)
  - Initial dosing .05 – 01.mg/kg for initial dose
  - Subsequent doses 0.1 to 0.2 mg/kg/dose every 2 hours. Titrate to effect- careful of side effects in opioid naïve
  - Usual Maximum dose:
    - Infants: 2mg/dose
    - Children 1-12 years: 4mg/dose, recommend titrating to effect with repeat assessment of pain

#### Pain Scale





## Addendum 3

### Ultrasound Radiology Report

#### Ultrasound Scoring

##### Negative ultrasound:

- 1 = Normal completely visualized appendix
- 2 = Partially-visualized appendix - no findings to suggest appendicitis

##### Equivocal Ultrasound

- 3 = Non-visualized appendix - no findings to suggest appendicitis
- 4 = Equivocal study - e.g. peri-appendiceal inflammation or borderline appendiceal enlargement but otherwise normal appendix

##### Positive Ultrasound

- 5 = Appendicitis (with or without abscess)

#### Standard reporting components:

EXAM: Limited abdominal ultrasound

CLINICAL HISTORY: [Abdominal pain - concern for appendicitis]

#### FINDINGS:

##### Appendix:

- Visualized: [Completely]
- Fluid-filled: [No]
- Compressible: [Yes]
- Maximum diameter with compression (outer wall to outer wall): [ ]
- Appendicolith: [No]
- Wall:
  - Hyperemia: [No]
  - Thickening (>2 mm): [No]
  - Loss of mural stratification: [No]

Free Fluid: [Physiologic]

Increased conspicuity of peri-appendiceal fat: [No]

Abscess: [No]

Additional findings: [None]

**Addendum 4**

**Antimicrobial Dosing Guide for Appendicitis**

**Intravenous Antimicrobial Recommendations:**

Antimicrobial	Dose	Dosing Interval	Surgical Prophylaxis Instructions	
			Infusion & Starting Time	Pre-Operative Re-dosing Interval
<b>1st Line agents: If patient penicillin allergic: Ceftriaxone &amp; metronidazole</b>				
Ceftriaxone	50 mg/kg (Max: 2 gram)	Every 24 hours	Infuse over 30 minutes within 60 minutes of incision	2 hours
Metronidazole	15 mg/kg IV x1 (Max: 500mg per dose)	Every 24 hours	Infuse as slow infusion over 30-60 minutes (maximum rate 25 mg/min)	N/A
<b>2nd line agent: If patient has a history of Type I reaction or SEVERE adverse reaction to cephalosporin</b>				
Piperacillin/tazobactam (Zosyn®)	100 mg/kg based on piperacillin component (Max: 4.5 gram)	Every 8 hours	Infuse over 30 minutes within 60 minutes of 2 hours incision	within 60
<b>If patient has a history of Type I reaction or SEVERE adverse reaction to penicillin and/or cephalosporins: Clindamycin &amp; gentamicin &amp; metronidazole</b>				
Clindamycin	13 mg/kg/dose (Max: 600 mg)	Every 8 hours	Infuse at 30 mg/minute within 60 minutes of incision	2 hours
Metronidazole	30 mg/kg (Max: 2 gram)	Every 24 hours	Infuse as slow infusion over 30-60 minutes (maximum rate 25 mg/min)	N/A
Gentamicin	5 mg/kg (No Max)	Every 24 hours	Infuse over 20-30 minutes	N/A
	Use actual body weight unless patient is > 20% of their ideal body weight. In these patients, use an adjusted body weight = (Actual-Ideal) x 0.4 + Ideal.			

**DELL CHILDREN'S MEDICAL CENTER**  
**EVIDENCE-BASED OUTCOMES CENTER**

**Oral Antimicrobial Recommendations:**

<b>Antimicrobial</b>	<b>Dose</b>	<b>Dosing Interval</b>	<b>Dosage Forms</b> <i>*available Inpatient</i>
Amoxicillin/clavulanate (Augmentin)	25 mg/kg (Max: 875 mg)	Every 12 hours	200 mg/5 mL suspension 400 mg/5 mL suspension 600 mg/5 mL suspension* 250*, 500*, 875 mg tablets*
Sulfamethoxazole/trimethoprim (Bactrim, Septra)	5 mg/kg based on trimethoprim component (Max: 480 mg trimethoprim)	Every 12 hours	200/ <del>40</del> mg/5mL suspension* 400/ <u>80</u> *, 800/ <u>160</u> mg tablets* <i>Trimethoprim component</i>
Metronidazole (Flagyl)	10 mg/kg IV (Max: 500 mg)	Every 8 hours	50 mg/mL suspension* <i>(requires compounding)</i> 250*, 500 mg tablet*
Ciprofloxacin (Cipro)	15 mg/kg (Max: 500 mg)	Every 12 hours	250 mg/5 mL suspension 500 mg/5 mL suspension* 250*, 500*, 750 mg tablets

## Addendum 5

# Austin Pediatric Surgery Appendectomy Discharge Instructions

*Please refer to this information after your child is discharged from the hospital.*

Q: What do I do if my child is having pain?

A: Pain at the incisions is expected after surgery. First, begin with giving your child the prescribed pain medication you were given. This is usually Tylenol with hydrocodone. You may alternate this medication with ibuprofen also if needed. If your child's pain does not improve with pain medicine or if it is getting worse, please notify our office.

Q: What do I do if my child is constipated?

A: Constipation is common after surgery. The pain medication prescribed after surgery, Tylenol and hydrocodone, may also cause constipation. Begin by making sure your child is drinking plenty of water. You may also increase fiber rich foods in your child's diet, including leafy green vegetables and whole grains. If your child remains constipated, you may give him or her prune or apple juice. If these attempts are unsuccessful, we then suggest over the counter stool softeners such as Miralax or Colace.

Q: What do I do if my child has a fever?

A: First, treat the fever with Tylenol or ibuprofen. If the fever is greater than 101.4, please call the surgery office. You may also remove the outer bandages on your child's incisions to look for signs of wound infection. Make sure to leave the steri strips in place (these are small white pieces of tape). You should notify our office if the incisions are red, swollen or draining any fluid. Encourage liquids.

Q: What do I do if my child is vomiting?

A: It is important to first make sure your child is drinking. Your child should drink liquids at least every 2 hours and go to the bathroom (make urine) at least 4 times per day. If your child is not able to tolerate any food or liquids by mouth, you should call our office or bring them to the ER at Dell Children's. If your child is having green vomit, it is important to call our office or go to the ER immediately.

Q: When can my child return to school?

A: He or she may return to school when the Tylenol and hydrocodone pain medication is no longer required. You may continue to give regular Tylenol or ibuprofen as needed for pain control. If the appendix did not burst

(rupture), most children are able to return to school within 2 to 4 days after discharge. If the appendix did burst (rupture), most children are able to return to school within 3 to 5 days after discharge.

Q: How long does my child have to stay out of P.E. or sports?

A: For two weeks after surgery your child should not participate in difficult physical activity or sports. They should also not lift more than 10 pounds. However, it is important to walk frequently. It is important to move around and not stay in bed.

Q: Will my child need antibiotics after discharge?

A: Your child may be given antibiotics to take at home. It is very important to complete any prescribed antibiotics. They will be given either by mouth or through a special type of IV called a PICC line. This will be provided to you prior to discharge.

Q: In summary, when should I call the surgery office?

A: Please call Austin Pediatric Surgery at 512-708-1234 for the following concerns:

- For fever greater than 101.4
- Pain not controlled with oral pain medication
- Persistent vomiting or vomiting bile (green vomit)
- If the incisions are red, swollen, painful or draining fluid
- Worsening constipation

You may call our office 24 hours a day. After hours, a page will be sent to the on call nurse practitioner and we will contact you as soon as possible.

## Cirugía pediátrica de Austin

### Instrucciones para paciente dado de alta de una apendicectomía

*Por favor referirse a esta información después de que se dé de alta a su hijo o hija del hospital.*

P: ¿Qué hago si mi hijo tiene dolor?

R: El dolor en las incisiones es de esperarse después de la cirugía. Primero, comience por darle a su hijo el medicamento que se le recetó para el dolor. Generalmente es Tylenol® con hidrocodona. También puede alternar este medicamento con Ibuprofeno si lo necesita. Si el dolor de su hijo no mejora con los calmantes para el dolor o si este empeora, por favor notifique a nuestro consultorio.

P: ¿Qué hago si mi hijo está estreñido?

R: El estreñimiento es común después de la cirugía. El medicamento recetado después de la cirugía, Tylenol® e hidrocodona también pueden ocasionar estreñimiento. Comience por asegurarse que de su hijo beba suficiente agua.

También puede incrementar alimentos ricos en fibra en la dieta de su hijo, incluyendo vegetales de hojas verdes y granos integrales. Si su hijo continúa estreñido puede darle jugo de ciruela pasa o manzana. Si estos intentos no tienen éxito, le sugerimos ablandadores de la materia fecal que puede conseguir sin receta, tales como Miralax® o Colace®

P: ¿Qué hacer si mi hijo tiene fiebre?

R: Primero, trate la fiebre con Tylenol® o Ibuprofeno. Si la fiebre es mayor de 101.4 °F (38,5° C), por favor llame al consultorio de cirugía. También puede quitar las vendas externas de las incisiones de su hijo para ver si hay signos de infección en las heridas. Asegúrese de dejar las cintas adhesivas esterilizadas en su lugar (estas son las pequeñas tiras adhesivas blancas). Debe notificar a nuestro consultorio si las incisiones están rojas, inflamadas o supuran. Anime a su hijo a beber líquidos.

P: ¿Qué hago si mi hijo está vomitando?

R: Primero es importante asegurarse de que su hijo esté bebiendo. Su hijo debe beber líquido por lo menos cada 2 horas e ir al baño (a orinar) por lo menos 4 veces al día. Si su hijo no puede tolerar ningún alimento ni líquido por la boca, usted debe llamar a nuestro consultorio o

llevarlo a la sala de urgencias del hospital Dell Children's. Si su hijo tiene vómito verde es importante que llame a nuestro consultorio o vaya a Urgencias inmediatamente.

P: ¿Cuándo puede regresar mi hijo a la escuela?

R: Él o ella puede regresar a la escuela cuando ya no necesite el calmante del dolor Tylenol con hidrocodona. Puede seguir dándole Tylenol® o Ibuprofeno según lo necesite para calmar el dolor. Si el apéndice no se reventó (ruptura) la mayor parte de los niños pueden regresar a la escuela en 2 a 4 días después del alta. Si el apéndice se reventó (ruptura) la mayoría de los niños regresan a la escuela en 3 a 5 días después del alta.

P: ¿Por cuánto tiempo no puede mi hijo participar en la clase de educación física o en deportes?

R: Por dos semanas después de la cirugía, su hijo no debe participar en actividades físicas ni deportes difíciles. Su hijo tampoco debe levantar más de 4,5 kg de peso. Sin embargo, es importante que camine frecuentemente, que se mueva y que no permanezca en cama.

P: ¿Mi hijo necesitará antibióticos después del alta?

R: Probablemente le receten antibióticos para que su hijo tome en casa. Es muy importante que complete el curso de cualquier antibiótico que le receten. Se le recetarán ya sea por vía oral o vía intravenosa especial llamada catéter central de acceso periférico (línea PICC por sus siglas en inglés). Se le proveerá esto antes de darle de alta.

P: En resumen, ¿cuándo debo llamar al consultorio de cirugía?

R: Por favor llame a Cirugía pediátrica de Austin al 512-708-1234 si tiene las siguientes preocupaciones:

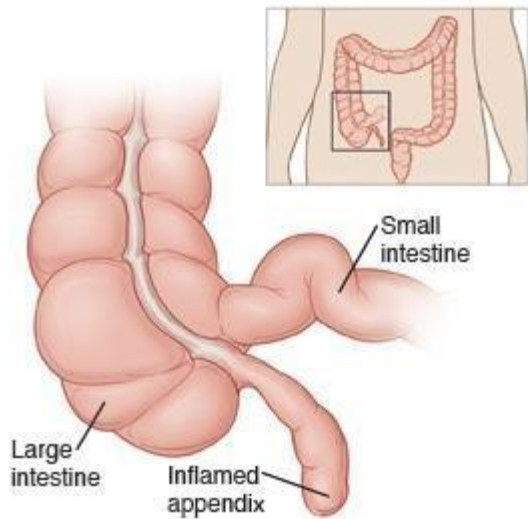
- Fiebre de más de 101.4 °F (38,5°C).
- Dolor que no se controle con el calmante oral para el dolor.
- Vómito persistente o de bilis (vómito verde).
- Las incisiones están rojas, inflamadas, adoloridas o supurantes.
- Empeora el estreñimiento

Puede llamar a nuestro consultorio las 24 horas del día. Si llama fuera de horarios de oficina, se enviará un mensaje a la enfermera especialista de guardia y le llamaremos tan pronto como sea posible

## **Addendum 6**

### **Emergency Department Discharge Instructions**

## **ABDOMINAL PAIN, POSSIBLE APPENDICITIS, Repeat Exam, Male**



Based on your visit today, the exact cause of your abdominal (stomach) pain is not certain. However, you do have some of the early signs of appendicitis. Early in an appendix infection the symptoms can be similar to a simple "stomach ache" or "stomach flu". Therefore, the diagnosis can be hard to make. Since an appendix infection is a serious condition, it is important to know if this is the cause of your symptoms.

WAITING for more time to pass and repeating the exam is the best way to find out whether you have appendicitis. Within the next 12-24 hours the cause of your stomach pain should become clear. It is important for you to watch for any new symptoms or worsening of your condition. (See below).

### **HOME CARE:**

Rest until your next exam. No strenuous activities.

Eat a diet low in fiber (called a low-residue diet). Foods allowed include refined breads, white rice, fruit and vegetable juices without pulp, tender meats. These foods will pass more easily through the intestine.

Avoid whole-grain foods, whole fruits and vegetables, meats, seeds and nuts, fried or fatty foods, dairy, alcohol and spicy foods until your symptoms go away. In some cases, you may be asked not to eat or drink anything until you are re-examined.

Return for another exam exactly as directed.

**FOLLOW UP** with your doctor or this facility as directed.

[NOTE: If you had an X-ray, CT scan, ultrasound, or EKG (cardiogram), it will be reviewed by a specialist. You will be notified of any new findings that may affect your care.]

**RETURN PROMPTLY** before your next appointment or contact your doctor if any of the following occur:

- Pain gets worse or moves to the right lower abdomen
- New or worsening vomiting or diarrhea
- Swelling of the abdomen
- Unable to pass stool for more than three days
- New fever over 100.4° F (38.0° C), or rising fever
- Blood in vomit or bowel movements (dark red or black color) Weakness, dizziness or fainting



## **DOLOR ABDOMINAL, POSIBLE APENDICITIS [ABDOMINAL PAIN, POSSIBLE APPENDICITIS, Repeat Exam, Male]**

Basado en el examen que le hicimos en esta visita, no estamos seguros cual es la causa del dolor abdominal (de estómago). No obstante, usted tiene algunas de las señas tempranas de APENDICITIS. Los síntomas tempranos de una infección de la apéndice son similares a los de un simple "dolor de estómago", así que el diagnóstico es difícil. Una infección de la apéndice necesita de una operación y por eso es muy importante estar seguros de la causa de sus síntomas.

Lo mejor es esperar un tiempo, para asegurarnos si tiene apendicitis o una infección menos seria. La causa de su dolor va a aclararse dentro de 12 a 24 horas. Por esta razón es importante que usted observe si aparecen nuevos síntomas o si se le empeora su condición, y regresa para otro examen según las instrucciones dadas por nuestro personal.

### **CUIDADO EN CASA:**

Descanse hasta el siguiente examen. No debe hacer actividades extenuantes.

Coma una dieta baja en fibra (llamada dieta baja en residuos). Los alimentos permitidos incluyen los panes refinados, el arroz blanco, los jugos de frutas y vegetales sin pulpa, las carnes tiernas. Estos alimentos pasarán más fácilmente por el intestino.

Evite los alimentos de grano integral, las frutas y los vegetales enteros, las carnes, las semillas y las nueces, los alimentos fritos o grasosos, los lácteos, el alcohol y los alimentos condimentados, hasta que desaparezcan sus síntomas. En algunos casos, se le puede pedir que no coma o beba nada hasta que vuelva a ser examinado.

Vuelva para que se realice otro examen exactamente según le indiquen.

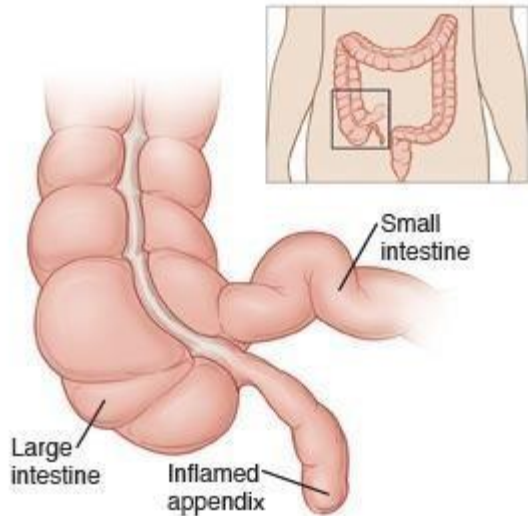
**SEGUIMIENTO** con su médico o en este centro según las instrucciones dadas.

**BUSQUE PRONTAMENTE ATENCIÓN MÉDICA** antes de su próxima cita si algo de lo siguiente

ocurre:

- El dolor empeora o se mueve al lado derecho inferior (la parte baja) del abdomen (estómago)
- Vómito nuevo o que empeora o diarrea
- Hinchazón del abdomen
- No puede evacuar el intestino durante más de tres días
- Fiebre nueva por encima de 100.4°F (38.0°C), o que aumenta
- Sangre en el vómito o las heces (color rojo oscuro o negro) Debilidad, mareo o desmayos

## ABDOMINAL PAIN, POSSIBLE APPENDICITIS [Repeat Exam, Female]



Based on your visit today, the exact cause of your abdominal (stomach) pain is not certain. However, you do have some of the early signs of APPENDICITIS. Early in an appendix infection the symptoms can be similar to a simple "stomach ache" or "stomach flu". Therefore, the diagnosis can be hard to make. Since an appendix infection is a serious condition, it is important to know if this is the cause of your symptoms.

WAITING for more time to pass and repeating the exam is the best way to find out whether you have appendicitis. Within the next 12-24 hours the cause of your stomach pain should become clear. It is important for you to watch for any new symptoms or worsening of your condition. (See below).

### HOME CARE:

- Rest until your next exam. No strenuous activities.
- Eat a diet low in fiber (called a low-residue diet). Foods allowed include refined breads, white rice, fruit and vegetable juices without pulp, tender meats. These foods will pass more easily through the intestine.
- Avoid whole-grain foods, whole fruits and vegetables, meats, seeds and nuts, fried or fatty foods, dairy, alcohol and spicy foods until your symptoms go away. In some cases, you may be asked not to eat or drink anything until you are re-examined.
- Return for another exam exactly as directed.

**FOLLOW UP** with your doctor or this facility as directed.

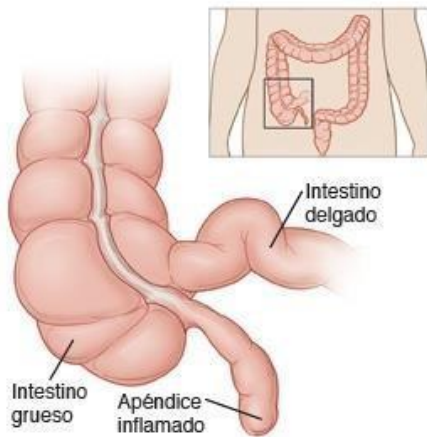
[NOTE: If you had an X-ray, CT scan, ultrasound, or EKG (cardiogram), it will be reviewed by a specialist. You will be notified of any new findings that may affect your care.]

**GET PROMPT MEDICAL ATTENTION** if any of the following occur:

- Pain gets worse or moves to the right lower abdomen
- New or worsening vomiting or diarrhea
- Swelling of the abdomen
- Unable to pass stool for more than three days
- Fever of 100.4°F (38°C) or higher, or as directed by your healthcare provider
- Blood in vomit or bowel movements (dark red or black color)
- Weakness, dizziness or fainting
- Unexpected vaginal bleeding

## DOLOR ABDOMINAL, POSIBLE APENDICITIS [Mujer, (Niña)] [Repeat Exam, Female]

Según su visita de hoy, no se pudo determinar exactamente por qué siente dolor abdominal (en el estómago). Sin



embargo, si presenta algunos de los signos tempranos de APENDICITIS (APPENDICITIS). En las primeras etapas de una infección del apéndice, los síntomas pueden ser similares a un simple “dolor de estómago” o una “gripe estomacal” (stomach flu). Por ello, puede resultar difícil hacer un diagnóstico. Dado que una infección del apéndice (appendix infection) es una afección seria, es importante saber si ésta es la causa de sus síntomas.

ESPERAR que pase algo más de tiempo y repetir el examen es la mejor manera de saber si lo que usted tiene es apendicitis. Es posible que la causa de su dolor de estómago se pueda determinar con mayor claridad dentro de las próximas 12-24 horas. Es importante que usted preste atención para ver si aparecen nuevos síntomas o si se agrava su afección. (Vea más abajo.)

### CUIDADOS EN LA CASA:

Descanse hasta el siguiente examen. No haga actividades que requieran mucho esfuerzo.

Coma una dieta baja en fibra (llamada “dieta de bajos residuos” [low-residue diet]). Los alimentos permitidos en esta dieta son los panes refinados, el arroz blanco, los jugos de frutas y verduras sin la pulpa, y las carnes tiernas. Esos alimentos pasan con mayor facilidad por el intestino.

Evite los alimentos integrales, las frutas y verduras enteras, las carnes, las semillas y las nueces, las comidas fritas o grasosas, los lácteos, el alcohol y las comidas condimentadas hasta que sus síntomas desaparezcan. Regrese para otro examen exactamente según le hayan indicado.

Programe una **VISITA DE CONTROL** con su médico o este centro, según le indiquen. [NOTA: Si le han hecho una radiografía (X-ray), una tomografía computarizada (CT scan), una ecografía (ultrasound) o un electrocardiograma (EKG), éstos serán evaluados por un especialista. Le informarán de los nuevos hallazgos que puedan afectar la atención médica que necesita.]

### **BUSQUE PRONTAMENTE ATENCIÓN MÉDICA** si algo de lo siguiente ocurre:

- El dolor aumenta o se transfiere al lado derecho inferior del abdomen.
- Se presenta vómito o diarrea, o empeoran, en caso de que ya los tuviera.
- Hinchazón del abdomen.
- No ha podido evacuar el intestino (defecar) durante más de tres días.
- Fiebre de 100.4°F (38°C) o más alta, o como le haya indicado su proveedor de atención médica.
- Sangre en el vómito o en la materia fecal (de color negruzco o rojizo oscuro).
- Debilidad, mareo o desmayo.

Sangrado vaginal inesperado o falta de período menstrual.

## ABDOMINAL PAIN, Unknown Cause, Male (Child)

Abdominal (stomach) pain is a common complaint in children. Abdominal pain is very difficult to diagnose in young children. Nonverbal children cannot describe their symptoms. In addition, many disorders have abdominal symptoms. For this reason, frequent recheck examinations may be necessary to determine the real cause. Most cases of abdominal pain in children are due to nonserious causes that will go away.

The abdominal pain may come and go or be continuous. Common symptoms include nausea and vomiting. Some children have constipation, diarrhea, and a fever along with the pain. Your child may also have pain in the scrotum or genital area.

Lab and radiology tests are often used to help make a diagnosis. Pain medication may be given as soon as possible. Further treatment depends on the cause of the pain. Some abdominal and pelvic disorders may require surgery. Disorders caused by an infection may be treated successfully with medications.

### HOME CARE:

**Medications:** The doctor may prescribe medications for pain and infection. Follow the doctor's instructions for giving these medications to your child.

### General Care:

Comfort your child as needed. Try to find positions that ease your child's discomfort. A small pillow placed on the abdomen may help provide pain relief. Distraction may also help. Some children may enjoy listening to music or having someone read to them.

Offer emotional support to your child. Pain can trigger some intense, negative emotions, including anger.

**FOLLOW UP** as advised by the doctor or our staff. If tests or studies were done, they will be reviewed by a doctor. You will be notified of any new findings that may affect your child's care.

**SPECIAL NOTES TO PARENTS:** Keep a record of symptoms such as vomiting, diarrhea, or fever. This may help the doctor make a diagnosis.

**GET PROMPT MEDICAL ATTENTION** if any of the following occur:

- Fever greater than 100.4°F (38°C)
- Continuing symptoms such as severe abdominal pain, bleeding, painful or bloody urination, nausea and vomiting, constipation, or diarrhea
- Abdominal swelling

Painful, swollen, or inflamed scrotum

## **DOLOR ABDOMINAL, Causa desconocida, Varones (Niños)** **[ABDOMINAL PAIN, Unknown Cause, Male, Child]**

El dolor abdominal (en el vientre) es una afección común en los niños. La causa de este tipo de dolor es muy difícil de diagnosticar en los niños pequeños, ya que éstos, si todavía no saben hablar, no pueden describir sus síntomas. Además, muchos trastornos diferentes presentan síntomas abdominales. Por este motivo, puede ser necesario hacer frecuentes exámenes adicionales para determinar la verdadera causa. La mayor parte de los casos de dolor abdominal en los niños se debe a causas que no son graves y desaparecerán.

El dolor abdominal puede ser intermitente o continuo. Entre los síntomas más comunes se encuentran las náuseas y el vómito. Algunos niños pueden tener estreñimiento, diarrea y fiebre además de dolor. El niño también podría tener dolor en el escroto o en la zona genital.

Es posible que se lleven a cabo pruebas de laboratorio y radiografías para ayudar a establecer el diagnóstico. Los medicamentos contra el dolor pueden darse lo antes posible. El tratamiento adicional dependerá de la causa del dolor. Algunos trastornos pélvicos y abdominales pueden requerir cirugía. Los trastornos causados por infección pueden tratarse exitosamente con medicamentos.

### **CUIDADOS EN LA CASA:**

**Medicamentos:** El médico podría recetarle medicamentos para el dolor y la infección. Siga las instrucciones del médico al darle estos medicamentos a su hijo.

### **Atención general:**

Conforte al niño según sea necesario. Intente encontrar posiciones que alivien su dolor. Una almohada pequeña colocada en el abdomen puede ayudar a aliviar el dolor. Ciertas distracciones, como escuchar música o que alguien les lea una historia, también pueden ser útiles con algunos niños.

Ofrezca apoyo emocional a su hijo. El dolor puede desencadenar un fuerte enojo y otras reacciones negativas en el niño.

Haga una **VISITA DE CONTROL** según le indique el médico o el personal del centro. Si le hicieron pruebas, estas serán examinadas por un médico y le notificarán de los nuevos hallazgos que puedan afectar la atención que debe dar al niño.

**NOTA ESPECIAL PARA LOS PADRES:** Tome nota por escrito de todos los síntomas, como vómito, diarrea o fiebre. Esto podría ayudar al médico a establecer el diagnóstico.

**OBTENGA ATENCIÓN MÉDICA INMEDIATA** en cualquiera de los siguientes casos:

- Fiebre superior a 100.4°F (38°C)
- Síntomas constantes como dolor abdominal intenso, sangrado, dolor al orinar o sangre en la orina, náuseas, vómito, estreñimiento o diarrea.
- Hinchazón abdominal

Dolor, hinchazón o inflamación en el escroto

## ABDOMINAL PAIN, Unknown Cause, Female (Child)

Abdominal (stomach) pain is a common complaint in children. Abdominal pain is very difficult to diagnose in young children. Nonverbal children cannot describe their symptoms. In addition, many disorders have abdominal symptoms. For this reason, frequent examinations may be necessary to determine the real cause. Most cases of abdominal pain in children are due to nonserious causes that will go away.

The abdominal pain may come and go or be continuous. Common symptoms include nausea and vomiting. Some children have constipation, diarrhea, and a fever along with the pain.

Lab and radiology tests are often used to help make a diagnosis. Pain medication may be given as soon as possible. Further treatment depends on the cause of the pain. Some abdominal and pelvic disorders may require surgery. Disorders caused by an infection may be treated successfully with medications.

### HOME CARE:

**Medications:** The doctor may prescribe medications for pain and infection. Follow the doctor's instructions for giving these medications to your child.

### General Care:

Comfort your child as needed. Try to find positions that ease your child's discomfort. A small pillow placed on the abdomen may help provide pain relief. Distraction may also help. Some children may enjoy listening to music or having someone read to them.

Offer emotional support to your child. Pain can trigger some intense, negative emotions, including anger.

**FOLLOW UP** as advised by the doctor or our staff. If tests or studies were done, they will be reviewed by a doctor. You will be notified of any new findings that may affect your child's care.

**SPECIAL NOTES TO PARENTS:** Keep a record of symptoms such as vomiting, diarrhea, or fever. This may help the doctor make a diagnosis.

**GET PROMPT MEDICAL ATTENTION** if any of the following occur:

- Fever greater than 100.4°F (38°C)
- Continuing symptoms such as severe abdominal pain, bleeding, painful or bloody urination, nausea and vomiting, constipation, or diarrhea
- Abdominal swelling

Vaginal discharge or bleeding that is unrelated to menstruation

## **DOLOR ABDOMINAL, Causa desconocida, Mujeres (Niñas)** **[ABDOMINAL PAIN, Unknown Cause, Female, Child]**

El dolor abdominal (en el vientre) es una afección común en los niños. La causa de este tipo de dolor es muy difícil de diagnosticar en los niños pequeños, ya que éstos, si todavía no saben hablar, no pueden describir sus síntomas. Además, muchos trastornos diferentes presentan síntomas abdominales. Por este motivo, puede ser necesario hacer frecuentes exámenes adicionales para determinar la verdadera causa. La mayor parte de los casos de dolor abdominal en los niños se debe a causas que no son graves y desaparecerán.

El dolor abdominal puede ser intermitente o continuo. Entre los síntomas más comunes se encuentran las náuseas y el vómito. Algunos niños pueden tener estreñimiento, diarrea y fiebre además de dolor.

Es posible que se lleven a cabo pruebas de laboratorio y radiografías para ayudar a establecer el diagnóstico. Los medicamentos contra el dolor pueden darse lo antes posible. El tratamiento adicional dependerá de la causa del dolor. Algunos trastornos pélvicos y abdominales pueden requerir cirugía. Los trastornos causados por infección pueden tratarse exitosamente con medicamentos.

### **CUIDADOS en la casa:**

**Medicamentos:** El médico podría recetarle medicamentos para el dolor y la infección. Siga las instrucciones del médico al darle estos medicamentos a su hija.

### **Atención general:**

Conforte a la niña según sea necesario. Intente encontrar posiciones que alivien su dolor. Una almohada pequeña colocada en el abdomen puede ayudar a aliviar el dolor. Ciertas distracciones, como escuchar música o que alguien les lea una historia, también pueden ser útiles con algunas niñas.

Ofrezca apoyo emocional a su hija. El dolor puede desencadenar un fuerte enojo y otras reacciones negativas en la niña.

Haga una **VISITA DE CONTROL** según le indique el médico o el personal del centro. Si le hicieron pruebas, estas serán examinadas por un médico y le notificarán de los nuevos hallazgos que puedan afectar la atención que debe dar a la niña.

**NOTA ESPECIAL PARA LOS PADRES:** Tome nota por escrito de todos los síntomas, como vómito, diarrea o fiebre. Esto podría ayudar al médico a establecer el diagnóstico.

**OBTENGA ATENCIÓN MÉDICA INMEDIATA** en cualquiera de los siguientes casos:

- Fiebre superior a 100.4°F (38°C)
- Síntomas constantes como dolor abdominal intenso, sangrado, dolor al orinar o sangre en la orina, náuseas, vómito, estreñimiento o diarrea.
- Hinchazón abdominal


Descarga vaginal o sangrado no relacionados con la menstruación.

**Addendum 7: DCMC Appendicitis Scorecard**

Type of Measure	Domain	Measure Definition	Donabedian Classification	IOM Domain(s)	
Care Process Team	Efficiency in Diagnosis	Utilization of Computed Tomography and Ultrasound Scans	Process	Effective, Efficient, Equitable, Safe	
		Accuracy of Ultrasound Scan for the diagnosis of appendicitis	Outcome	Effective, Efficient	
	Appendicitis Stage/ Severity	Pediatric Appendicitis Score assessed and documented in patient medical record	Process	Effective, Efficient, Safe	
		Correlation between Pediatric Appendicitis Score and positive appendicitis diagnosis	Process	Effective	
	Post Op Resource Utilization (Complicated Only)	Average Length of Stay	Process	Effective, Efficient,	
		PICC Line Utilization	Process	Effective, Efficient, Equitable, Safe	
		TPN Utilization	Process	Effective, Efficient, Equitable, Safe	
	Infection	Abscess Rate	Outcome	Effective, Safe	
		Post-operative Surgical Site Infection rate	Outcome	Effective, Safe	
	Medications	SCIP pre-op dose administration	Process	Effective, Efficient, Safe	
	Education	Post-operative education provided and in the patients'/families' preferred language	Process	Effective, Equitable, Patient Centered	
	Avoidable Events	Hospitalizations	Rate of readmission to hospital within 30 days	Outcome	Effective, Efficient, Safe
	Throughput		ED LOS	Outcome	Care Coordination, Effective, Efficient, Safe, Timely
Financial	Financial	Total Average Cost of Care	Outcome	Efficient, Effective	



### Addendum 8: DCMC Pediatric Appendicitis Score Sheet

		patient label				
<b>Dell Children's Medical Center of Central Texas</b>						
<b>Pediatric Appendicitis Score Sheet</b>						
<b>Year:</b>		<b>Date (month &amp; day)</b>				
		<b>Time</b>				
		<b>Name</b>				
<b>Circle all applicable clinical findings</b>						
<b>Symptoms</b>	Migration of pain	1	1	1	1	1
	Anorexia	1	1	1	1	1
	Nausea/Vomiting	1	1	1	1	1
<b>Signs</b>	Tenderness in the right lower quadrant (RLQ)	2	2	2	2	2
	Cough/Hopping/Perussion tenderness in RLQ	2	2	2	2	2
	Elevation of temperature	1	1	1	1	1
<b>Laboratory Findings</b>	Leukocytosis (WBC > 10,000/ $\mu$ L)	1	1	1	1	1
	Shift Left of Leukocytes (Neutrophils plus bandforms >7500/ $\mu$ L)	1	1	1	1	1
<b>Total Pediatric Appendicitis Score</b>						
<small>(Pediatric Appendicitis Score is the cumulative point total from all clinical findings)</small>						
<b>NOTES</b>						
Score	Assessment					
≤ 4	Low suspicion for appendicitis*					
Between 5 & 7	Equivocal for appendicitis					
≥ 8	High suspicion for appendicitis**					
<small>*NOTE: sensitivity of 97.6%, with a negative predictive value of 97.7%</small>						
<small>**NOTE: specificity of 95.1%, with a positive predictive value of 85.2%</small>						

### Background and Incidence

1. Humes, D. J., & Simpson, J. (2007). Acute appendicitis. *BMJ*, 333(7567), 530-534.
2. American Pediatric Surgical Association. Resources: Appendicitis. Adapted from: O'Neill, J., Grosfeld, J., & Fonkalsrud, E. (2003). Principles of Pediatric Surgery, Mosby.

### Diagnosis, Laboratory and Cultures

3. Goldman, R. D., Carter, S., Stephens, D., Antoon, R., Mounstephen, W., & Langer, J. C. (2008). Prospective validation of the Pediatric Appendicitis Score. *The Journal of Pediatrics*, 153(2), 278-282.
4. Bhatt, M., Joseph, L., Ducharme, F. M., Dougherty, G., & McGillivray, D. (2009). Prospective validation of the Pediatric Appendicitis Score in a Canadian pediatric emergency department. *Academic Emergency Medicine*, 16(7), 591-596.
5. Samuel, M. (2002). Pediatric appendicitis score. *Journal of Pediatric Surgery*, 37(6), 877-881.
6. Lintula, H., Kokki, H., Kettunen, R., & Eskelinen, M. (2009). Appendicitis score for children with suspected appendicitis. A randomized clinical trial. *Langenbeck's Archives of Surgery*, 394(6), 999-1004.
7. Bundy, D. G., Byrley, J. S., Liles, E. A., Perrin, E. M., Katznelson, J., & Rice, H. E. (2007). Does this child have appendicitis? *JAMA*, 298(4), 438-451.
8. Kwan, K. Y., & Nager, A. L. (2010). Diagnosing pediatric appendicitis: Usefulness of laboratory markers. *The American Journal of Emergency Medicine*, 28(9), 1009-1015
9. Anderson RE. Meta-analysis of the clinical and laboratory diagnosis of appendicitis. *Br J Surg*. 2004;91(1):28-37 (Meta-analysis; 5833 patients)
10. Kharbada AB, et al. Discriminative accuracy of novel and traditional biomarkers in children with suspected appendicitis adjusted for duration of abdominal pain. *Acad Emerg Med*. 2011;18(6):567-574 (prospective, 280 patients)
11. Erkasap S, et al. Diagnostic value of interleukin-6 and CRP in acute appendicitis. *Swiss Surg*. 2000;6(4):169-172 (prospective, 102 patients)
12. Sengupta A, et al. White blood cell count and CRP measurement in patients with possible appendicitis. *Ann R Coll Surg Engl*. 2009;91(2):113115 (prospective, 98 patients)
13. John SK, et al. Avoiding negative appendectomies in rural surgical practice: Is CRP estimation useful as a diagnostic tool? *Natl Med J India*. 2011;24(3):114-147 (prospective, 238 patients)
14. Siddique K, et al. Diagnostic accuracy of WBC and CRP for assessing the severity of paediatric appendicitis. *JRSM Short Rep*. 2011;2(7):59(prospective, 204 patients)
15. Kharbada, A. B., Fishman, S. J., & Bachur, R. G. (2008). Comparison of pediatric emergency physicians' and surgeons' evaluation and diagnosis of appendicitis. *Academic Emergency Medicine*, 15(2), 119-125.
16. Moawad, M. R., Dasmohapatra, S., Justin, T., & Keeling, N. (2006). Value of intraoperative abdominal cavity culture in appendectomy: A retrospective study. *International Journal of Clinical Practice*, 60(12), 1588-1590.
17. Gladman, M., Knowles, C., Gladman, L., & Payne, J. (2004). Intra-operative culture in appendicitis: Traditional practice challenged. *Annals of The Royal College of Surgeons of England*, 86, 196-201.
18. Soffer, D., Zait, S., Klausner, J., & Kluger, Y. (2001). Peritoneal cultures and antibiotic treatment in patients with perforated appendicitis. *European Journal of Surgery*, 167(3), 214-216.
19. Foo, F. J., Beckingham, I. J., & Ahmed, I. (2008). Intra-operative culture swabs in acute appendicitis: A waste of resources. *Surgeon (Edinburgh University Press)*, 6(5), 278-281.
20. Aslan, A., Karaveli, Ç., Ogunc, D., Elpek, O., Karaguzel, G., & Melikoglu, M. (2007). Does noncomplicated acute appendicitis cause bacterial translocation? *Pediatric Surgery International*, 23(6), 555-558.

### Imaging

21. Krishnamoorthi, R., Ramarajan, N., Wang, N. E., Newman, B., Rubesova, E., Mueller, C. M., et al. (2011). Effectiveness of a staged US and CT protocol for the diagnosis of pediatric appendicitis: Reducing radiation exposure in the age of ALARA. *Radiology*, 259(1), 231-239.
22. Tsao, K., St. Peter, S. D., Valusek, P. A., Spilde, T. L., Keckler, S. J., Nair, A., et al. (2008). Management of pediatric acute appendicitis in the computed tomographic era. *Journal of Surgical Research*, 147(2), 221-224.
23. van Randen, A., Bipat, S., Zwinderman, A. H., Ubbink, D. T., Stoker, J., & Boermeester, M. A. (2008). Acute appendicitis: Meta-analysis of diagnostic performance of CT and graded compression US related to prevalence of disease. *Radiology*, 249(1), 97-106.
24. Ramarajan, N., Krishnamoorthi, R., Barth, R., Ghanouni, P., Mueller, C., Dannenburg, B., et al. (2009). An interdisciplinary initiative to reduce radiation exposure: Evaluation of appendicitis in a pediatric emergency department with clinical assessment supported by a staged ultrasound and computed tomography pathway. *Academic Emergency Medicine*, 16(11), 1258-1265.
25. Schuh, S., Man, C., Cheng, A., Murphy, A., Mohanta, A., Moineddin, R., et al. (2011). Predictors of non-diagnostic ultrasound scanning in children with suspected appendicitis. *The Journal of Pediatrics*, 158(1), 112-118.
26. Dilley, A., Wesson, D., Munden, M., Hicks, J., Brandt, M., Minifee, P., et al. (2001). The impact of ultrasound examinations on the management of children with suspected appendicitis: A 3-year analysis. *Journal of Pediatric Surgery*, 36(2), 303-308
27. York, D., Smith, A., Phillips, J. D., & von Allmen, D. (2005). The influence of advanced radiographic imaging on the treatment of pediatric appendicitis. *Journal of Pediatric Surgery*, 40(12), 1908-1911.

### Treatment/Management

28. Simon, P., Burkhardt, U., Sack, U., Kaisers, U. X., & Muensterer, O. J. (2009). Inflammatory response is no different in children randomized to laparoscopic or open appendectomy. *Journal of Laparoendoscopic & Advanced Surgical Techniques*, 19, s71-s76.
29. Schmelzer, T. M., Rana, A. R., Walters, K. C., Norton, H. J., Bambini, D. A., & Heniford, B. T. (2007). Improved outcomes for laparoscopic appendectomy compared with open appendectomy in the pediatric population. *Journal of Laparoendoscopic & Advanced Surgical Techniques*, 17(5), 693-697.
30. Kaselas, C., Molinaro, F., Lacreuse, I., & Becmeur, F. (2009). Postoperative bowel obstruction after laparoscopic and open appendectomy in children: a 15-year experience. *Journal of Pediatric Surgery*, 44(8), 1581-1585.
31. Kouhia, S. T., Heiskanen, J. T., Huttunen, R., Ahtola, H. I., Kiviniemi, V. V., & Hakala, T. (2010). Long-term follow-up of a randomized clinical trial of open versus laparoscopic appendectomy. *British Journal of Surgery*, 97(9), 1395-1400.

32. Markides, G., Subar, D., & Riyad, K. (2010). Laparoscopic versus open appendectomy in adults with complicated appendicitis: Systematic review and meta-analysis. *World Journal of Surgery, 34*(9), 2026-2040
33. Shindoh, J., Niwa, H., Kawai, K., Ohata, K., Ishihara, Y., Takabayashi, N., et al. (2010). Predictive factors for negative outcomes in initial nonoperative management of suspected appendicitis. *Journal of Gastrointestinal Surgery, 14*(2), 309-314.
34. Aprahamian, C. J., Barnhart, D. C., Bledsoe, S. E., Vaid, Y., & Harmon, C. M. (2007). Failure in the nonoperative management of pediatric ruptured appendicitis: Predictors and consequences. *Journal of Pediatric Surgery, 42*(6), 934-938.
35. Ein, S. H., Langer, J. C., & Daneman, A. (2005). Nonoperative management of pediatric ruptured appendix with inflammatory mass or abscess: Presence of an appendicolith predicts recurrent appendicitis. *Journal of Pediatric Surgery, 40*(10), 1612-1615.
36. Puapong, D., Lee, S. L., Haigh, P. I., Kaminski, A., Liu, I.-L. A., & Applebaum, H. (2007). Routine interval appendectomy in children is not indicated. *Journal of Pediatric Surgery, 42*(9), 1500-1503.
37. Raval, M. V., Lautz, T., Reynolds, M., & Browne, M. (2010). Dollars and sense of interval appendectomy in children: A cost analysis. *Journal of Pediatric Surgery, 45*(9), 1817-1825.
38. Andersson, R. E., & Petzold, M. G. (2007). Nonsurgical treatment of appendiceal abscess or phlegmon: A systematic review and meta-analysis. *Annals of Surgery, 246*(5), 741-748
39. Samuel, M., Hosie, G., & Holmes, K. (2002). Prospective evaluation of nonsurgical versus surgical management of appendiceal mass. *Journal of Pediatric Surgery, 37*(6), 882-886.
40. Simillis, C., Symeonides, P., Shorthouse, A. J., & Tekkis, P. P. (2010). A meta-analysis comparing conservative treatment versus acute appendectomy for complicated appendicitis (abscess or phlegmon). *Surgery, 147*(6), 818-829.
41. St. Peter, S. D., Aguayo, P., Fraser, J. D., Keckler, S. J., Sharp, S. W., Leys, C. M., et al. (2010). Initial laparoscopic appendectomy versus initial nonoperative management and interval appendectomy for perforated appendicitis with abscess: A prospective, randomized trial. *Journal of Pediatric Surgery, 45*(1), 236-240.
42. Jen, H. C., & Shew, S. B. (2010). Laparoscopic versus open appendectomy in children: Outcomes comparison based on a statewide analysis. *Journal of Surgical Research, 161*(1), 13-17.
43. Raines A<sup>1</sup>, Garwe T, Wicks R, Palmer M, Wood F, Adeseye A, Tuggle D. J *Pediatr Surg.* 2013 Dec;48(12):2442-5. doi: 10.1016/j.jpedsurg.2013.08.017. Pediatric appendicitis: the prevalence of systemic inflammatory response syndrome upon presentation and its association with clinical outcomes.
44. Goldstein B<sup>1</sup>, Giroir B, Randolph A; International Consensus Conference on Pediatric Sepsis. International pediatric sepsis consensus conference: definitions for sepsis and organ dysfunction in pediatrics. *Pediatr Crit Care Med.* 2005 Jan;6(1):2-8.

#### **Pain Management**

45. Williams, D. G., Patel, A., & Howard, R. F. (2002). Pharmacogenetics of codeine metabolism in an urban population of children and its implications for analgesic reliability. *British Journal of Anaesthesia, 89*(6), 839-845.
46. Bailey, B., Bergeron, S., Gravel, J., Bussi eres, J.-F., & Bensoussan, A. (2007). Efficacy and impact of intravenous morphine before surgical consultation in children with right lower quadrant pain suggestive of appendicitis: A randomized controlled trial. *Annals of Emergency Medicine, 50*(4), 371-378.
47. Green, R., Bulloch, B., Kabani, A., Hancock, B. J., & Tenenbein, M. (2005). Early analgesia for children with acute abdominal pain. *Pediatrics, 116*(4), 978-983.
48. Kim, M. K., Strait, R. T., Sato, T. T., & Hennes, H. M. (2002). A randomized clinical trial of analgesia in children with acute abdominal pain. *Academic Emergency Medicine, 9*(4), 281-287.
49. Kokki, H., Lintula, H., Vanamo, K., Heiskanen, M., & Eskelinen, M. (2005). Oxycodone vs placebo in children with undifferentiated abdominal pain: A randomized, double-blind clinical trial of the effect of analgesia on diagnostic accuracy. *Archives of Pediatrics & Adolescent Medicine, 159*(4), 320-325.
50. Amoli, H. A., Golozar, A., Keshavarzi, S., Tavakoli, H., & Yaghoobi, A. (2008). Morphine analgesia in patients with acute appendicitis: A randomised double-blind clinical trial. *Emergency Medicine Journal, 25*(9), 586-589.
51. Yong, Y., Jia-yong, C., Hao, G., Yi, Z., Dao-ming, L., Dong, Z., et al. (2010). Relief of abdominal pain by morphine without altering physical signs in acute appendicitis. *Chinese Medicine Journal, 123*(2), 142-145.
52. Gasche, Y., Daali, Y., Fathi, M., Chiappe, A., Cottini, S., Dayer, P., et al. (2004). Codeine intoxication associated with ultrarapid CYP2D6 metabolism. *New England Journal of Medicine, 351*(27), 2827-2831.

#### **Antibiotics in Acute Appendicitis**

53. Andersen BR, Kallehave FL, Andersen HK. Antibiotics versus placebo for prevention of postoperative infection after appendicectomy. *Cochrane Database of Systematic Reviews* 2005, Issue 3. Art. No.: CD001439. DOI: 10.1002/14651858.CD001439.pub2.
54. Goldin, A. B., Sawin, R. S., Garrison, M. M., Zerr, D. M., & Christakis, D. A. (2007). Aminoglycoside-based triple-antibiotic therapy versus monotherapy for children with ruptured appendicitis. *Pediatrics, 119*(5), 905-911.
55. St. Peter, S. D., Little, D. C., Calkins, C. M., Murphy, J. P., Andrews, W. S., Holcomb Iii, G. W., et al. (2006). A simple and more cost-effective antibiotic regimen for perforated appendicitis. *Journal of Pediatric Surgery, 41*(5), 1020-1024.
56. Taylor, E., Berjis, A., Bosch, T., Hoehne, F., & Ozaeta, M. (2004). The efficacy of postoperative oral antibiotics in appendicitis: A randomized prospective double-blinded study. *American Surgeon, 70*(10), 858-862.
57. Adibe, O. O., Barnaby, K., Dobies, J., Comerford, M., Drill, A., Walker, N., et al. (2008). Postoperative antibiotic therapy for children with perforated appendicitis: Long course of intravenous antibiotics versus early conversion to an oral regimen. *The American Journal of Surgery, 195*(2), 141-143.
58. Fraser, J. D., Aguayo, P., Leys, C. M., Keckler, S. J., Newland, J. G., Sharp, S. W., et al. (2010). A complete course of intravenous antibiotics vs a combination of intravenous and oral antibiotics for perforated appendicitis in children: A prospective, randomized trial. *Journal of Pediatric Surgery, 45*(6), 1198-1202.
59. Solomkin, J. S., Mazuski, J. E., Bradley, J. S., Rodvold, K. A., Goldstein, E. J. C., Baron, E. J., et al. (2010). Diagnosis and management of complicated intra-abdominal infection in adults and children: Guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. *Surgical Infections, 11*(1), 79-109.
60. Lee SL, Islam S, Cassidy LD, et al. Antibiotics and appendicitis in the pediatric population: an American Pediatric Surgical Association Outcomes and Clinical Trials Committee Systematic Review. *J Pediatr Surg* 2010;45:2181-2185.

**DELL CHILDREN'S MEDICAL CENTER  
EVIDENCE-BASED OUTCOMES CENTER**

61. Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health-Syst Pharm* 2013;70:195-283.
62. Daskalakis, K, Juhlin C, and Pahlman L. The use of pre-or postoperative antibiotics in surgery for appendicitis: a systematic review. *Scand J Surg* 2014;0:1-7.
63. St. Peter SD, Tsao K, Spilde TL, et al. Single daily dosing of ceftriaxone and metronidazole vs. standard triple antibiotic regimen for perforated appendicitis in children: a prospective randomized trial. *J Ped Surg* 2008;43:981-985.
64. Maltezou HC, Nikolaidis P, Lebesii E, et al. Piperacillin/tazobactam versus cefotaxime plus metronidazole for treatment of children with intraabdominal infections requiring surgery. *Eur J Clin Microbiol Infect Dis* 2001;20:643-646.
65. Nadler EP, Gaines BA. The Surgical Infection Society guidelines on antimicrobial therapy for children with appendicitis. *Surg Infect* 2008;9:7584.
66. Guillet-Caruba C, Cheikhelard A, Guillet M et al. Bacteriologic epidemiology and empirical treatment of pediatric complicated appendicitis. *Diagn Microbiol Infect Dis* 2011;69(4):376-381.
67. Mui LM, Ng CS, Wong SK, et al. Optimum duration of prophylactic antibiotics in acute non-perforated appendicitis. *Aust N Z J Surg* 2005;75:425-428.
68. Coakley BA, Sussman ES, Wolfson TS, et al. Postoperative antibiotics correlate with worse outcomes after appendectomy for nonperforated appendicitis. *J Am Coll Surg* 2011;213(6):778-83.
69. Fishman SJ, Pelosi L, Klavon SL, et al Perforated appendicitis: prospective outcome analysis of 150 Children. *J Ped Surg* 2000;35(6):923-926.
70. Nadler EP, Reblock KK et al. Monotherapy versus multidrug therapy for perforated appendicitis in children. *Surg Infect* 2003;4:333-338.
71. Ciftci AO, Tanyel FC, Buyukpamukcu N, et al. Comparative trial of four antibiotic combinations for perforated appendicitis in children. *Eur J Surg* 1997;163:591-6.
72. Schmitt F, Clermidi P, Corsi M, et al. Bacterial studies of complicated appendicitis over a 20-year period and their impact on empirical antibiotic treatment. *J Pediatr Surg* 2012;47(11):2055-62.
73. Lob SH, Badal RE, Bouchillon SK, et al. Epidemiology and susceptibility of Gram-negative appendicitis pathogens: SMART 2008-2010. *Surg Infect (Larchmt)* 2013; 14(2):203-8.
74. Yu TC, Hamill JK, Evans SM, et al. Duration of postoperative intravenous antibiotics in childhood complicated appendicitis: a propensity score-matched comparison study. *Eur J Pediatr Surg* 2013;June 25 epub.
75. Meier DE, Guzzetta PC, Barber LS, et al. Perforated appendicitis in children: is there a best treatment? *J Pediatr Surg* 2003;38(10):1520-1524.
76. Lelli JL, Drongowski RA, Raviz S, et al. Historical changes in the postoperative treatment of children with appendicitis in children: impact on medical outcome. *J Pediatr Surg* 2000;35:239-245.
77. Perez V, Saenz D, Madriz J, et al. A double-blind study of the efficacy and safety of multiple daily doses of amikacin versus one daily dose for children with perforated appendicitis in Costa Rica. *Int J Infect Dis* 2011;15(8):e569-75.
78. Rice HE, Brown RL, Gollin G, et al. Results of a pilot trial comparing prolonged intravenous antibiotics with sequential intravenous/oral antibiotics for children with perforated appendicitis. *Arch Surg* 2001;136:1391-1395.
79. Gollin G, Abarbanell A, Moores D. Oral antibiotics in the management of perforated appendicitis in children. *Am Surg* 2002;68:1072-4.
80. Snelling CM, Poenaru D, Drover JW. Minimum postoperative antibiotic duration in advanced appendicitis in Children: a review. *Pediatr Surg Int* 2004;20:838-845.
81. Keller MS, McBride MJ, Vane DW. Management of complicated appendicitis. *Arch Surg* 1996;131:261-264.
82. Hoelzer DJ, Zabel DD, Zern JT. Determining duration of antibiotic use in children with complicated appendicitis. *Pediatr Infect Dis J* 1999;18:979-82.
83. Emil S, Gaied F, Lo A, et al. Gangrenous appendicitis in children: a prospective evaluation of definition, bacteriology histopathology, and outcomes. *J Surg Res* 2012 Sep;177(1):123-6.
84. Bonadio, William et al. "Impact of In-Hospital Timing to Appendectomy on Perforation Rates in Children with Appendicitis." *Journal of Emergency Medicine* n. pag. Web. 23 Sept. 2015.

**MRI use to identify Acute Appendicitis**

85. Abdeen, N., Naz, F., Linthorst, R., Khan, U., Dominguez, P. C., Koujok, K., Bettoli, M., & Shenouda, N. (2019). Clinical Impact and Cost-Effectiveness of Noncontrast MRI in the Evaluation of Suspected Appendiceal Abscesses in Children. <https://doi.org/10.1002/jmri.26624>
86. Anderson, K. T., Bartz-kurycki, M., Austin, M. T., Kawaguchi, A., John, S. D., Kao, L. S., & Tsao, K. (2021). Approaching zero : Implications of a computed tomography reduction program for pediatric appendicitis evaluation ☆. *Journal of Pediatric Surgery*, 52(12), 1909–1915. <https://doi.org/10.1016/j.jpedsurg.2017.08.050>
87. Andersson, M., Kolodziej, B., Andersson, R. E., & Study, S. (2017). Randomized clinical trial of Appendicitis Inflammatory Response score-based management of patients with. 1451–1461. <https://doi.org/10.1002/bjs.10637>
88. Blitman, N. M., Anwar, M., Brady, K. B., Taragin, B. H., Freeman, K., Nm, B., Anwar, M., Kb, B., & Bh, T. (2015). Predicting Appendicitis in Children : Can We Reduce the Use of CT ? June. <https://doi.org/10.2214/AJR.14.13212>
89. Chow, D. S., Lampl, B. S., Chen, S., Gordon, S., Mui, L. W., La, R., Ds, C., & Bs, L. (2014). Value of Gadolinium-Enhanced Appendicitis in Children and Adolescents. November. <https://doi.org/10.2214/AJR.13.12093>
90. Clinical, C. A., Sroufe, N. S., Davenport, M. S., Smith, E. A., Chong, S. T., Mazza, M. B., & Strouse, P. J. (2016). Equivocal Pediatric Appendicitis : Unenhanced MR Imaging Protocol Effectiveness Study 1. 279(1).
91. Costing, T. A., Hagedorn, K. N., Hayatghaibi, S. E., Levine, M. H., & Orth, R. C. (2021). Cost Comparison of Ultrasound Versus MRI to Diagnose Adolescent Female Patients Presenting with Acute Abdominal / Pelvic Pain Using. *Academic Radiology*, 26(12), 1618–1624. <https://doi.org/10.1016/j.acra.2019.03.023>
92. Desoky, S., & Udayasankar, U. K. (2021). Unenhanced MRI for Abdominal Pain in the Pediatric Emergency Department : Point — Safe and Comprehensive Assessment While Reducing Delay in Care. April, 874–875.
93. Imler, D., Keller, C., Sivasankar, S., Wang, N. E., Vasanaawala, S., Bruzoni, M., & Quinn, J. (2017). Ultrasound as the Initial Imaging Modality for Pediatric and Young Adult Patients With Suspected Appendicitis. 569–577. <https://doi.org/10.1111/acem.13180>
94. Kim, J., Kim, K., Kim, J., & Yoo, J. (2018). The learning curve in diagnosing acute appendicitis with emergency sonography among novice emergency medicine residents. November 2017, 305–310. <https://doi.org/10.1002/jcu.22577>
95. Lev-cohain, N., Sosna, J., Meir, Y., Dar, G., Shussman, N., Leichter, I., Caplan, N., & Goldberg, S. N. (2021). Dual energy CT in acute appendicitis : value of low mono-energy. *Clinical Imaging*, 77(April), 213–218. <https://doi.org/10.1016/j.clinimag.2021.04.007>
96. Martin, J. F., Mathison, D. J., Mullan, P. C., & Otero, H. J. (2018). Secondary imaging for suspected appendicitis after equivocal ultrasound : time to disposition of MRI compared to CT. 161–168.

**DELL CHILDREN'S MEDICAL CENTER  
EVIDENCE-BASED OUTCOMES CENTER**

97. Mittal, M. K., Dayan, P. S., Macias, C. G., Bachur, R. G., Bennett, J., Dudley, N. C., Bajaj, L., Sinclair, K., & Michelle, D. (n.d.). of Appendicitis in Children in a Multicenter. 697–702. <https://doi.org/10.1111/acem.12161>
98. Podevin, G., Vries, P. De, Lardy, H., Garignon, C., Petit, T., Azzis, O., Mcheik, J., & Roze, J. C. (2021). An easy-to-follow algorithm to improve pre-operative diagnosis for appendicitis in children. *Journal of Visceral Surgery*, 154(4), 245–251. <https://doi.org/10.1016/j.jvisc.2016.08.011>
99. Trout, A. T., Sanchez, R., Ladino-torres, M. F., Pai, D. R., & Strouse, P. J. (2012). A critical evaluation of US for the diagnosis of pediatric acute appendicitis in a real-life setting : how can we improve the diagnostic value of sonography ? 813–823. <https://doi.org/10.1007/s00247-012-2358-6>

**2024 Updates:**

100. Sawyer, R. G., Claridge, J. A., Nathens, A. B., Rotstein, O. D., Duane, T. M., Evans, H. L., Cook, C. H., O'Neill, P. J., Mazuski, J. E., Askari, R., Wilson, M. A., Napolitano, L. M., Namias, N., Miller, P. R., Dellinger, E. P., Watson, C. M., Coimbra, R., Dent, D. L., Lowry, S. F., ... Popovsky, K. (2015). Trial of Short-Course Antimicrobial Therapy for Intraabdominal Infection. *New England Journal of Medicine*, 372(21), 1996–2005. <https://doi.org/10.1056/NEJMoa1411162>

EBOC Project Owner: Sujit Iyer, MD & Tory Meyer, MD

Approved by the Pediatric Appendicitis Evidence-Based Outcomes Center Team

Revision History

Date Approved: June 11, 2014

Last Full Review Date: November 2019

Next Full Review Date: November 2024

June 2021 Updates:

- Update text of guideline and Table Addendum 4 of EBOC Appendicitis Guideline to match our practice regarding using ceftriaxone and metronidazole as first-line IV therapy (not piperacillin-tazobactam)
- Update pathway in EBOC Appendicitis Guideline to remove amoxicillin/ clavulanate (Augmentin)/Metronidazole from outpatient treatment option.
- Update pathway in EBOC Appendicitis Guideline to add ciprofloxacin/ metronidazole as outpatient oral treatment option of penicillin allergic patients in addition to sulfamethoxazole-trimethoprim. Specify that can be used if susceptibility is confirmed. Ciprofloxacin/metronidazole should be used in other cases for penicillin allergic patients.
- Added Antibiotic Allergy Recommendation section to Guideline.

**June 2024 Updates:**

- Removed old "Addendum 5: Emergency Department Pre-Operative Checklist for Appendicitis and renumbered Addendums.
- Updated Addendum 4 "Antimicrobial dosing guide for appendicitis"  
Changed incorrect dosing of Metronidazole from 30 mg/kg/dose, max 2 gram to: 15 mg/kg/dose, max of 500 mg pre-op.

**August 2024 Updates:**

- Updated the guideline and pathway to align with current practice by revising the recommendation for post-operative treatment of perforated appendicitis. The previous recommendation, which suggested a combination of intravenous and oral antibiotics for a total of 7 days, was changed to reflect the current practice of Total IV + PO 4 +/- 1 days for perforated appendicitis, based on the STOP-IT trial reference #100).

Pediatric Appendicitis EBOC Team:

Sujit Iyer, MD

Tory Meyer, MD

Julie Sanchez, MD

Shaheen Hussaini, MD

Kathryn Merkel, Pharmacy

Dana Danaher, Quality Manager

Seth Gregory, Quality

Patrick Boswell, Quality

Denita Lyons, ED

Tony DeDominico, Surgical Services Manager

Frank James, MBA, PMP

EBOC Committee:

Sarmistha Hauger, MD

Dana Danaher RN, MSN, CPHQ

Mark Shen, MD

Deb Brown, RN

Robert Schlechter, MD

Levy Moise, MD

Sujit Iyer, MD

Tory Meyer, MD

Nilda Garcia, MD

Meena Iyer, MD