Appendicitis

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What is a Clinical Pathway?

An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective, and consistent patient care.
Objectives of Pathway

• To standardize care of patients with both acute simple (non-perforated) appendicitis and complicated (acute perforated) appendicitis in the pediatric population
• To provide evidence-based recommendations for key elements of care for appendicitis
• To clearly delineate discharge criteria
Why is Pathway Necessary?

• Abdominal pain is a common reason for presentation to the Emergency Department, pediatric and surgical offices.
• Appendicitis is a common surgical etiology for this type of pain.
• American Pediatric Surgical Association has altered their guidelines to help decrease the following:
  o number of CT scans used for diagnosis,
  o inappropriate antibiotic choices and duration,
  o need for inpatient management post-operatively.
• Pathway was developed to ensure an optimal consistent approach to the surgical management of children who present with appendicitis.
Epidemiology of Appendicitis

• Overall lifetime risk is 8.6% in males, 6.7% in females
• Luminal obstruction that subsequently leads to infection
  • Fecaliths are the most common cause; however the cause of the obstruction may not always be clear
  • Hyperplasia of appendiceal lymphoid follicles
    • Associated with:
      • Bacterial Infections: Yersinia, Salmonella, Schistosoma, Enterobius, Ascaris
      • Viral Infections: Measles, Chicken Pox, CMV
This is the Appendicitis Clinical Pathway.

We will be reviewing each component in the following slides.
Initial care:

- Work up includes:
  - History and physical
  - CBC with diff, CRP; consider iStat chem 7 at providers discretion
  - U/A, bHCG in females >10 yrs
  - Ultrasound appendix
  - Consider Morphine 0.1 mg/kg/dose x 1 PRN pain (max 5 mg)
- Suspicious for appendicitis?
  - Surgery consult
- Normal labs and/or patient's history not consistent?
  - Consider alternative differential diagnoses
Confirming Appendicitis and Admission to Surgery Service:

- Case discussed with attending surgeon who agrees with diagnosis
- Surgery to give the “OK” for ED provider to order Ceftriaxone AND Metronidazole given as 24 hour dosing
  - Antibiotics to be given prior to incision
  - If Penicillin and/or Ceftriaxone allergy, use Ciprofloxacin AND Metronidazole
- Perioperative pain control includes Ketorolac

**Possible Appendicitis**: Confirm diagnosis with Ceftriaxone and Metronidazole:
- Ceftriaxone 50 mg/kg q24hr (max 2 g/dose) AND Metronidazole 30 mg/kg q24hr (max 1.5 g/dose)
- If Ceftriaxone allergy:
  - Ciprofloxacin 10 mg/kg/dose q8hr (max 400 mg/dose) AND Metronidazole 30 mg/kg q24hr (max 1.5 g/dose)

**Peri-Operative (Pre-Op, OR, PACU)**:
- Ketorolac 0.5 mg/kg/dose (max 30 mg/dose)

**Laparoscopic Appendectomy**

**Consult Surgery**
Simple Appendicitis:

During surgery the appendix is noted to be normal, inflamed, or abnormal without perforation

- No additional antibiotics post-op
- Consider conditional discharge

Post-Op Antibiotics:
- Stop all antibiotics

Post-Op Pain Control:
- Initial:
  - Ketorolac 0.5 mg/kg/dose (max 30 mg/dose) IV q6hr
  - Morphine 0.1 mg/kg/dose (max 5 mg/dose) IV q3hr PRN pain

When Pain Well Controlled:
- Change Ketorolac to Ibuprofen
- Change Morphine to: Hydrocodone/Acetaminophen (325 mg) 0.2 mg Hydrocodone/kg/dose PO q4hr PRN pain (max 5-10 mg hydrocodone/dose; max acetaminophen 4000 mg/day or 75 mg/kg/day) OR Oxycodone/Acetaminophen (325 mg) 0.1 mg oxycodone/kg/dose PO q4hr PRN pain (max 5-10 mg oxycodone/dose; max acetaminophen 4000 mg/day or 75 mg/kg/day)

FEN/GI:
- Diet: Clears, advance to regular diet as tolerated
- Once taking diet:
  - Miralax 1g/kg/day to a max of 17g a day until stooling
Simple Appendicitis:

- Pain control:
  - Ketorolac
  - Morphine

- Change to oral pain regimen once pain well controlled
  - Ketorolac → Ibuprofen
  - Morphine → Hydrocodone/acetaminophen OR Oxycodone/acetaminophen
Perforated Appendicitis:

Either on imaging or during surgery, the appendix is noted to be ruptured. There is often purulent fluid in the abdomen.

- Antibiotics to continue for a TOTAL of 7 days of therapy
  - Ceftriaxone AND Metronidazole to be used while inpatient
  - Change to Augmentin when patient being discharged
- Pain control – same as simple appendicitis
- Diet – clear liquids, may advance as tolerated.
- Start bowel regimen of Miralax daily until stooling

**Post-Op Antibiotics:**
- Ceftriaxone 50 mg/kg q24hr (max 2 g/dose) AND Metronidazole 30 mg/kg q24hr (max 1.5 g/dose)
- If Ceftriaxone allergy: Ciprofloxacin 10 mg/kg/dose q8hr (max 400 mg/dose) AND Metronidazole 30 mg/kg q24hr (max 1.5 g/dose)

**Post-Op Pain Control**
- Ketorolac 0.5 mg/kg/dose (max 30 mg/dose) IV q6hr
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**FEN/GI:**
- Diet: Clears, advance to regular diet as tolerated
- Once taking diet: Miralax 1g/kg/day to a max of 17g a day until stooling

Laparoscopic Appendectomy
Perforated Appendicitis: Patient Improving?

Yes
- Proceed to Discharge Criteria

No
- On POD #5, check a CBC and CRP

Labs improved from Preop?

Yes
- Consider imaging
- Continue antimicrobial therapy

No
- Proceed to Discharge Criteria

• Afebrile > 24 hours
• Tolerating diet
• Pain controlled with PO pain medications

CRP normal
- Consider ultrasound or CT
- Organized abscess
- Discharge Criteria:
  • Afebrile > 24 hrs
  • Tolerating diet
  • Pain controlled with PO pain medications
  • <40 ml/day from drain

CRP abnormal
- Consider IR drainage
- Continue IV Abx
Discharge Criteria: For Simple and Perforated

- Afebrile for 24 hours
- Tolerating a regular diet
- Pain adequately controlled with oral medication regimen
  - Acetaminophen and Ibuprofen on discharge
- If JP drain present: Less than 40 mL/day of drain output
  - Drain will be removed prior to discharge

Discharge Medications and Instructions:

- **Acetaminophen** 15 mg/kg/dose every 4-6 hours ATC for 24 hours then PRN pain to max 75 mg/kg/day OR 4000 mg/day
- **Ibuprofen** 10 mg/kg every 4-6 hours ATC for 48 hours post-op then PRN pain to max of 600 mg q8hr
- **Miralax** 1 g/kg/day to a max of 17 g/day until stooling

**For Perforated Appendicitis:**

- Duration: antibiotics to complete a 7 day course.
  - **Augmentin:** <30 kg or unable to take tablets: 250/5 suspension: 40 mg/kg/day div TID (max 500 mg/dose) or 600/5 suspension: 90 mg/kg/day div BID (max 1000 mg/dose); >30 kg and able to take tablets: 875 mg BID
  - If PCN allergy:
    - Ciprofloxacin 20 mg/kg q12hr (max 750 mg/dose) AND Metronidazole 30 mg/kg/day div TID (max 500 mg/dose)
  - Activity as tolerated
  - Follow-up visit in office w/in 4 weeks scheduled

**For Simple Appendicitis:**

Follow up phone call in 2 weeks or office visit within 4 weeks
Once Attending Pediatric Surgeon has confirmed diagnosis of Appendicitis, Ceftriaxone (or Ciprofloxacin) AND Metronidazole should be given promptly
- Antibiotics should be given prior to surgery

- Simple appendicitis does not require additional antibiotic therapy post-operatively

- Duration of antibiotics for perforated appendicitis is 7 days.

- Pain relief should include Ketorolac, and should be transitioned to oral medication as soon as patient is tolerating a regular diet.

- Uncomplicated patients with simple appendicitis may have a conditional discharge order placed in the PACU
Quality Metrics

- Percentage of eligible patients treated per pathway
- Percentage of eligible patients with appendicitis order set usage
- Percentage of patients with appropriate post-op antibiotic selection
- Average duration of post-op antibiotic course (days) for complicated appendicitis
- Mean length of stay (simple, complicated stratified)
Pathway Contacts

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References


About Connecticut Children’s Clinical Pathways Program

Clinical pathways guide the management of patients to optimize consistent use of evidence-based practice. Clinical pathways have been shown to improve guideline adherence and quality outcomes, while decreasing length of stay and cost. Here at Connecticut Children’s, our Clinical Pathways Program aims to deliver evidence-based, high value care to the greatest number of children in a diversity of patient settings. These pathways serve as a guide for providers and do not replace clinical judgment.