ED GUIDELINE

EVALUATION OF POSSIBLE APPENDICITIS

(Patients 5–20 years old)

Children's MINNESOTA

Aim: Utilize standard risk stratification to guide efficient and effective work-up of possible appendicitis.

ED Note 1: Classic Features

- Pain <36 hours duration
- History of focal RLQ pain
- History of migration of pain
- Focal tenderness in RLQ
- Pain with walking/jumping or coughing

If appendicitis is confirmed:

- Refer to Appendicitis Inpatient/Surgical Guideline (page 2-5)
- Consult General Surgery, Hospitalist if suspected perforation OR night admit (page 5)
- Keep NPO (Clear liquids if admitted after hours, must be NPO by 0000), IV fluids, symptom management
- Once diagnosis confirmed, initiate antibiotics while awaiting surgical intervention (page 2)

Patient presents to the ED with abdominal pain

Clinical concern for appendicitis
(ED Note 1)

Initial management:
- NPO
- IV access
- Symptom management

Lab evaluation:**
- CBC w/ diff
- Urine analysis
- Urine pregnancy (if post-pubertal female)

Predicted Risk of Appendicitis
Use pARC Score
(ED Note 2)

ED Note 2: pARC Score Clinical Considerations

- Duration of pain
- Abdominal pain migrates to RLQ
- Pain with walking/jumping or coughing
- Right-sided abdominal tenderness
- Maximal tenderness in RLQ
- Involuntary/voluntary abdominal guarding
- White Blood Cell count (WBC)
- Percent neutrophils
- Absolute neutrophil count (ANC)

Enter this data into: mdcalc.com/calc/10201/pediatric-appendicitis-risk-calculator-parc

****Blood cultures** are not routinely indicated when concerned for appendicitis. Only obtain a blood culture if there is clinical concern for sepsis or bacteremia.

High

Predicted risk >85%

SUGGESTED MANAGEMENT*

For patients *without* uterus/ovaries:
Begin with surgical consult. Obtain diagnostic imaging as per surgeon's recommendation.

For patients *with* uterus/ovaries:
Begin with abdominal/pelvic ultrasound. Consult surgery. If ultrasound is equivocal, consider CT with IV contrast.

Intermediate

Predicted risk 50–84%

SUGGESTED MANAGEMENT*

Begin with abdominal/pelvic ultrasound to rule out appendicitis. If ultrasound is equivocal, consider CT with IV contrast or admission to inpatient for observation.

Predicted risk 11–49%

SUGGESTED MANAGEMENT*
Clinical discretion and family preference

- Perform an abdominal/pelvic ultrasound to rule out appendicitis **OR**
- Observe in the ED for 4–6 hours **OR**
- Admit to short stay for serial exams **OR**
- If risk is between 10–25%, and if family and PCP are agreeable and there are no barriers, such as transportation, follow-up next day may be considered.

Low

Predicted risk <10%

SUGGESTED MANAGEMENT

Patients in this category are at low risk for appendicitis - other etiologies should be considered.

The approximate risk for appendicitis is <10%.

Observation at home with follow-up within 12–24 hours is appropriate for well appearing, stable patients with no barriers to follow-up (e.g., transportation). Must ensure follow-up.

CLINICAL GUIDELINE

APPENDICITIS: Admission and pre-surgical management

(Age ≥ 2 year old)

Children's MINNESOTA

Aim: To standardize the management of children with appendicitis.

NOTES: see page 6, 7

Concern for Appendicitis

Intermediate or High pARC score or strong clinical suspicion for appendicitis?

Risk stratify using ED Guidelines (Page 1)

No → Manage off guideline

Yes → **Admit**
- See admission work flow (Page 5)
- **General surgery consult** – notify prior to 0600 if after hours/overnight admission

Pre-/Perioperative management:
- NPO: If admitted after hours, Clear Liquid Diet until NPO at 0000 or per 'NPO Guideline'
- IV fluids
- Pain management: PRN acetaminophen, ibuprofen/ketorolac, and morphine
- Nausea management: PRN ondansetron

See page 7 for medication dosing and alternative options

Confirmed Appendicitis
based on clinical presentation and/or imaging?

No → Surgical consult and serial exam. Antibiotics not recommended until diagnosis is established unless clinically unstable.

Yes → **Antibiotics** (See Note 1)
- Ceftriaxone 50 mg/kg IV Q24H (max dose 2,000 mg)
- Metronidazole 30 mg/kg IV Q24H (max dose 1,500 mg)

If beta-lactam allergy:
- Ciprofloxacin 10 mg/kg IV Q12H (max dose 400 mg)
- Metronidazole 30 mg/kg IV Q24H (max dose 1,500 mg)

- Uncomplicated appendicitis or suspected early ruptured appendicitis (Page 3)
- Ruptured appendicitis with advanced disease (phlegmon, abscess) (Page 4)
- Contraindication to surgical intervention/Non-operative management of unruptured appendicitis (see Note 6)

Surgical and Post-operative Pathways

(Page 3, 4)

EXCLUSION GUIDELINES

Patients **excluded** from this guideline:
- Uncertain diagnosis
- ICU admission/severe illness
- Significant comorbidities
- Immunocompromised state
- Recent hospitalization
- Previous history of appendicitis (Note 9)

CLINICAL GUIDELINE

APPENDICITIS: Surgical and Post-operative Pathways
Uncomplicated and Early Ruptured Appendicitis (Age ≥ 2 year old)

Children's MINNESOTA

Aim: To standardize the management of children with appendicitis.

NOTES: see page 6, 7

Uncomplicated Appendicitis or suspected early ruptured appendicitis

- Ensure pre-op antibiotics given (page 2)
- Surgery within 24 hours

Post-op management

Ruptured?

- Yes → Ensure admission to PHM with Gen Surg consult for co-management
  - Continue IV antibiotics for a minimum of 72 hours post-operatively
- No → Discontinue antibiotics – no further antibiotics needed
  - Continue symptomatic management
  - **Discharge to home** when meeting discharge criteria (Note 2)

Early Ruptured Appendicitis without advanced disease (early ruptured appendicitis)

- Ensure pre-op antibiotics given (page 2)
- Surgery within 24 hours

Post-op management

- Ensure admission to PHM with Gen Surg consult for co-management
- Continue IV antibiotics for a minimum of 72 hours post-operatively

72 hours post-op

Discharge criteria met? (Note 2)

- Yes → Discontinue antibiotics – no further antibiotics needed
  - Continue symptomatic management
  - **Discharge to home** when meeting discharge criteria (Note 2)
- No
  - Continue IV antibiotics
  - Consider TPN (Note 3)
  - Continue to assess DC criteria regularly

Discharge criteria met prior to or on POD7?

- Yes → Discontinue antibiotics – no further antibiotics needed
  - Continue symptomatic management
  - **Discharge to home**
- No

POD7 and DC criteria not met

- Obtain abdominal US
- Labs to screen for adverse drug reactions (Note 8)

Abscess present on US?

- Yes → **Consultation with Interventional Radiology**
  Transition to **Ruptured Appendicitis with Advanced Disease** algorithm (Page 4)
- No
  - Continue IV antibiotics until meeting DC criteria (Note 2)
  - Once meeting criteria, discontinue antibiotics and **discharge to home.**
  - If greater than 10 days of total therapy and continues to not meet DC criteria, consider ID consultation (Note 7) and manage off guideline.

EXCLUSION GUIDELINES

Patients **excluded** from this guideline:

- Uncertain diagnosis
- ICU admission/severe illness
- Significant comorbidities
- Immunocompromised state
- Recent hospitalization
- Previous history of appendicitis (Note 9)

PHM = Pediatric Hospital Medicine

CLINICAL GUIDELINE

APPENDICITIS: Surgical and Post-operative Pathways
Ruptured Appendicitis with Advanced Disease (Age ≥ 2 year old)

Children's MINNESOTA

Aim: To standardize the management of children with appendicitis.

NOTES: see page 6, 7

Ruptured appendicitis with Advanced Disease
(phlegmon, abscess)

Consultation with Interventional Radiology

Candidate for IR drainage?

No

- Arrange for PICC placement
- Continue with IV antibiotics for at least 10 total days of therapy
- May DC to home with PICC and outpatient IV antibiotics after at least 72 hours of therapy AND when meeting clinical criteria (Note 5)
- Check CRP prior to discharge
- Check labs screening for adverse drug reactions if not yet obtained prior to discharge (Note 8)

Recheck CRP on day 10 of treatment (may be as an outpatient)

CRP down-trending AND continued clinical improvement?

No

- Reengage General Surgery if not still following
- Consider consultation with Infectious Disease (Note 7)
- Management off-guideline

Yes

- Discontinue antibiotics
- Remove PICC
- If still inpatient, discharge to home when meeting DC criteria (Note 2) with no further antibiotics

Yes

- Arrange for IR drainage
- Continue IV antibiotics until drain (Note 4) is removed and meeting DC criteria (Note 2)
- If remains on IV antibiotics x 7 days, obtain labs to screen for adverse drug reactions (Note 8)

Drain removed and meeting DC criteria
- Discontinue antibiotics
- **Discharge to home** with no further antibiotics

EXCLUSION GUIDELINES

Patients **excluded** from this guideline:
- Uncertain diagnosis
- ICU admission/severe illness
- Significant comorbidities
- Immunocompromised state
- Recent hospitalization
- Previous history of appendicitis (Note 9)

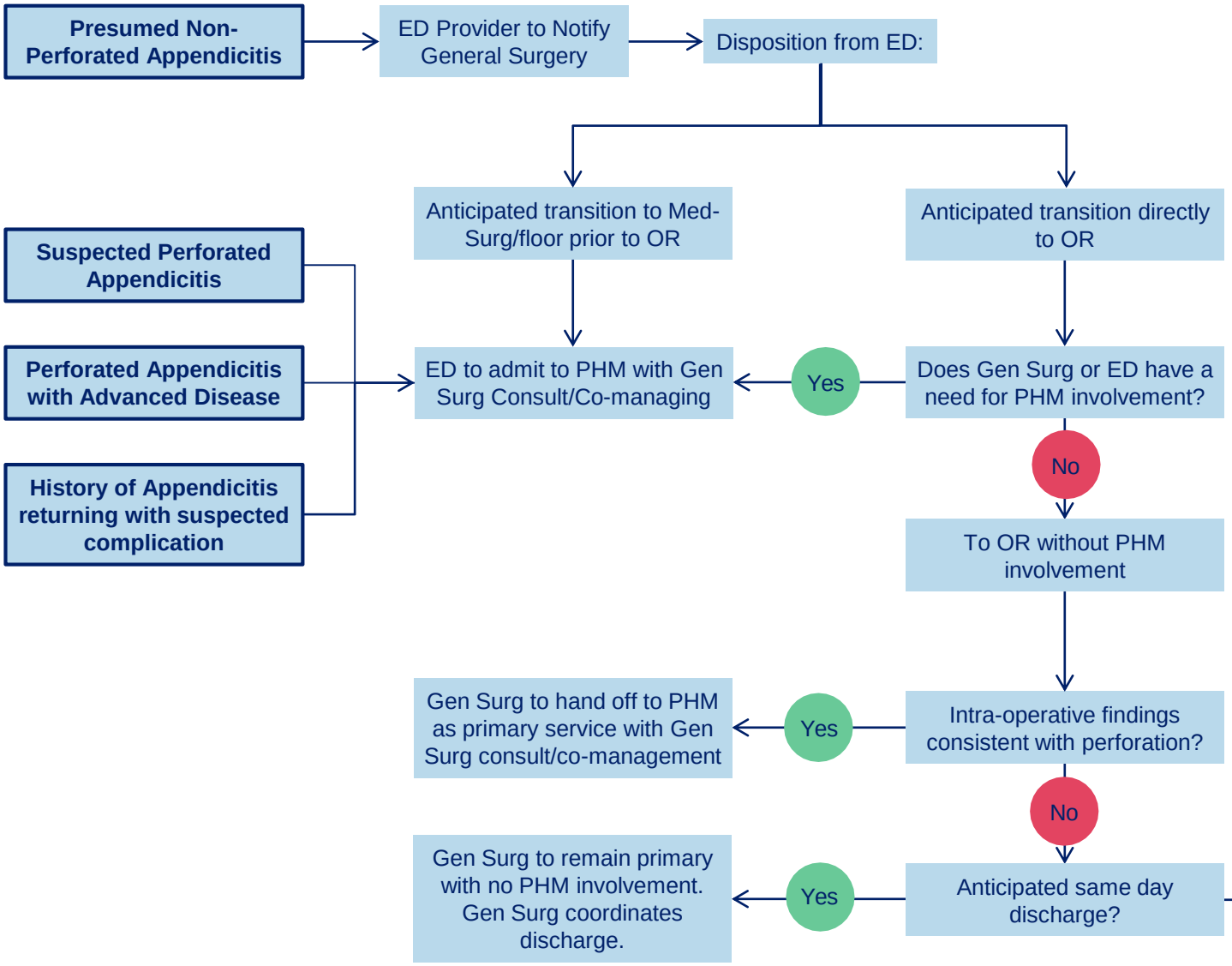
CLINICAL GUIDELINE

APPENDICITIS: Care team workflow for admissions

(Age ≥ 2 year old)

Children's MINNESOTA

Aim: To standardize the management of children with appendicitis.



Communication:

- It is expected that the ED will communicate with Gen Surg on all appendicitis patients and that they will directly communicate with the PHM service on patients being admitted with PHM involvement.

Direct Admissions:

- If a patient is being directly admitted from an outside facility – PHM will be the primary service with Gen Surg co-managing.

Documentation:

- ED note is sufficient for H&P prior to the OR
- Non-perforated appendicitis patients will transition to Outpatient-in-a-Bed status (OPIB) post-operatively. Narrative summaries are not required on discharge for patients in OPIB status.
- PHM should document and bill commensurate with their level of involvement when non-perforated/OPIB status.

PHM = Pediatric Hospital Medicine

CLINICAL GUIDELINE

APPENDICITIS: Notes and Medications

(Age ≥ 2 year old)

Children's MINNESOTA

NOTE 1

- Surgery is important to prevent recurrence but is not the primary treatment for appendicitis.
- Previous studies have found that after initiation of antibiotics, there was no difference in outcomes (including likelihood of perforation) in patients who had surgery shortly after arrival to the hospital vs. up to 24 hours after arrival.

NOTE 2 – DISCHARGE CRITERIA

- Afebrile (x 24 hours if perforated)
- Completed at least 3 days (72 hours) of antibiotics post-op (if perforated)
- Pain controlled on oral analgesics
- Diarrhea is improving (if present)
- Tolerating PO intake
- Caregiver/child feel comfortable with discharge

Discharge instructions:

- Okay to bathe/shower 2 days after surgery
- Okay to swim 5 days after surgery
- No other activity restrictions (may limit gym/ sports for 2 weeks if family preference)
- Regular diet
- Follow-up with surgery in 2–4 weeks as needed

NOTE 3

- **Start TPN** when patient has been NPO for a total of seven days (including days prior to presentation)
- Consider initiation earlier in younger children, particularly if concern for decreased nutritional reserves

NOTE 4 - Drain Removal

- Drain to be managed and followed by general surgery and IR. Removal will be at the discretion of the surgical service and IR based on clinical course and any additional imaging.

NOTE 5 – Discharge planning for home antibiotics

- General Surgery team to order home IV antibiotics, PICC line supplies and cares, and outpatient labs (unless specifically communicated to the Hospital Medicine Team).
- Follow-up lab and evaluation can be done in the General Surgery clinic as an outpatient or through a patient's PCP office.

NOTE 6 – Non-operative Management of Non-perforated Appendicitis

- Instances in which operative management may be contraindicated include:
  - Hemodynamic instability
  - Co-occurring disease states such as respiratory infections/pneumonia
  - Concern for inflammatory bowel disease (Ulcerative colitis, Crohn's disease)
- There may be rare instances of parental refusal of surgery
- In these instances, patients will be managed off guideline and with close surgical collaboration.
- Suggested management:
  - Admission, IV fluids, IV antibiotics for minimum of 24 hours, NPO for minimum of 12 hours and until improving
  - If no improvement within 24 hours then consider surgical management
  - If after IV antibiotics administered and 12 hour NPO status, may have clear liquid diet and advance if tolerated if all of the following criteria are met:
    - Decreased tenderness compared to presentation
    - Decreased pain compared to presentation
    - Resolution of nausea if present on admission
    - Decreased temperature/afebrile if fever present on or prior to admission
  - May transition to oral/PO antibiotics (first line: ciprofloxacin/metronidazole; second line: amoxicillin-clavulanate) once tolerating regular diet
    - Consider probiotics and/or yogurt supplementation
  - Discharge home to complete total course of 7 days of antibiotics once discharge criteria met
    - Completion of minimum of 24 hours of IV antibiotics
    - Completion of minimum of 24 hours of inpatient observation
    - Tolerating regular diet and at least one dose of oral antibiotics
    - Absence of abdominal pain
    - Afebrile
    - Agreement of any other consulting services (ex. GI)

NOTE 7 – Considerations for ID consultation

Consider formal consultation with the Infectious Disease service in the following patient populations:

- Severe illness or immunocompromise
- History of recent hospitalization
- History of recent appendicitis – Patients presenting after initial management with concern for complication
- Persistent fever and/or lab abnormalities after 3 days despite adequate source control (if appropriate) and appropriate empiric antibiotic coverage

Disclaimer: This guideline is designed for general use with most patients; each clinician should use their own independent judgment to meet the needs of each individual patient. This guideline is not a substitute for professional medical advice, diagnosis or treatment.

APPENDICITIS: Notes and Medications

(Age ≥ 2 year old)

Children's MINNESOTA

NOTE 8– Monitoring for adverse drug reactions

For patients on IV antibiotics for 7 days, it is recommended to obtain the following to monitor for potential adverse drug reactions. If signs of reaction, recommend discussion with pharmacy and/or ID.

- CBC with differential
- Hepatic panel with GGT
- Creatinine

NOTE 9– Patients returning after initial management of appendicitis with concern for complication

- These patients should not be managed on this guideline, but with close surgical consultation and strong consideration for Infectious Disease consultation.
- If patients are presenting within the first 4 weeks following initial management, it may be appropriate to re-initiate empiric antimicrobial therapy with ceftriaxone and metronidazole utilizing Q24H dosing regimens. This decision should be made in conjunction with the surgical service and potentially the ID service.
- For patients presenting greater than 4 weeks after initial intervention, ID should be consulted in conjunction with general surgery.

Common Medications in the Management of Appendicitis			
Antibiotics	Ceftriaxone	50 mg/kg IV Q24H – max dose 2,000 mg	Peer reviewed data does support the use of once daily administration of ceftriaxone and metronidazole in the treatment of appendicitis and complicated appendicitis (rupture, abscess).
	Metronidazole	30 mg/kg IV Q24H – max dose 1,500 mg	
		10 mg/kg PO Q8H – max dose 500 mg	For off-guideline reference – there may be indications to transition to oral therapy in consultation with ID
	Ciprofloxacin	10 mg/kg IV Q12H – max dose 400 mg	For use in place of ceftriaxone if beta-lactam allergy
		15 mg/kg PO Q12H – max dose 500 mg	For off-guideline reference – there may be indications for transition to oral therapy in consultation with ID
	Amoxicillin-clavulanic acid	22.5 mg/kg PO BID – max dose of 875 mg (Use a 7:1 formulation. If liquid, use 200-28.5 mg/5 mL, 400-57 mg/5 mL suspension)	For off-guideline reference - Second line after ciprofloxacin/metronidazole. Data supports the use of amox-clav in the management of some appendicitis and associated infections, particularly after a period of broad-spectrum IV antibiotic therapy
Pain medications	Acetaminophen	15 mg/kg PO, PR, or IV Q6H scheduled or PRN – max of 75 mg/kg/**day** (or 4,000 mg/day – whichever is less)	
	Ibuprofen	10 mg/kg PO Q6H PRN – max of 40 mg/kg/day (or 2,400 mg/day – whichever is less	
	Ketorolac	0.5 mg/kg/dose IV Q6H PRN – max of 15 mg/dose	Not to exceed 5 days of treatment
	Morphine	0.05-0.1 mg/kg/dose IV Q2-4H PRN	When using opioids, ensure Naloxone 10 mcg/kg IV Q2-3min PRN is available Consider early initiation of a bowel regimen post-operatively Patients managed for appendicitis typically do not require opioids once meeting discharge criteria.
	Hydromorphone	15 **mcg**/kg/dose (or 0.015 mg/kg/dose) Q2-4H PRN	
	Oxycodone	0.1-0.2 mg/kg/dose PO Q4-6H PRN	
Nausea medications	Ondansetron	0.15 mg/kg/dose IV/PO Q6H PRN – max of 8 mg/dose	

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