BayCare Best Practice Medical Standard

Reduction of CT use in Evaluating for Pediatric Appendicitis

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Endorsed by: ED Collaborative

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BayCare Medical Standard

This BayCare Best Practice Medical Standard endorses the pediatric appendicitis pathway. This standard focuses on decreasing unnecessary Computed tomography scans (CTs) while determining a pediatric appendicitis diagnosis. This is done through assessing with the pediatric appendicitis score (PAS) and using radiation-free diagnostic imaging.

Purpose

Unnecessary radiation places patients at risk. A risk that is profound in the pediatric population.[10] Appendicitis is the most common pediatric abdominal surgical problem.[3] Non-children's hospitals have increased rates of pediatric CT scans when compared to freestanding children's hospitals.[7] This provides an opportunity for improvement throughout the BayCare system by decreasing the risk of radiation-induced malignancies through utilizing the appropriate diagnostic pathway.

Procedure

Utilizing the pediatric appendicitis pathway, which highlights best use of diagnostic imaging based on PAS score. This applies to pediatric patients, 3 to 18 years old.

*Complete pediatric appendicitis pathway available on **Next Page***

Strength/Level of Evidence

- A retrospective review of diagnostic imaging for susceptive appendicitis compared radiation-free imaging with ultrasound (US) selectively followed by MRI to CT. It found no difference in time to antibiotic administration, time to appendectomy, negative appendectomy rate, perforation rate, or length of stay.[12]
- A prospective, observational study demonstrated a high sensitivity and specificity for a protocol (utilizing PAS score and US as primary diagnostic imaging modality) used to diagnosis of pediatric appendicitis. The protocol may also decreased unnecessary radiation exposure.[1]
- A retrospective study using a pediatric database noted an increase in US for abdominal imaging and a decrease in CT use from 2010 to 2013. At the same time appendicitis-related quality measures remained stable.[6]
- A prospective study of 849 children found PAS score of ≤ 2 has a high validity for ruling out appendicitis and a score of ≥ 7 had a high of validity for predicting the presence of appendicitis.[13]

History and physical examination concerning for Appendicitis

Obtain labs: CBC, +/- CRP, and UA, chart PAS, consider Chest x-ray, correlate symptoms with time course

Pediatric Appendicitis Score (PAS)

Anorexia	1
Nausea/Vomiting	1
Migration of pain	1
Fever > 38° C	1
Pain with cough, Hopping, Percussion	2
RLQ tenderness	2
WBC > 10,000 mm^3	1
Neutrophils + Bands > 7500 (75%)	1

Total PAS Score 1-10

PAS ≤ 2
Appendicitis **Unlikely**

PAS 3-6
Possible Appendicitis

PAS ≥ 7
Probable Appendicitis

Workup other etiology or if admitted, no antibiotics for "rule out appendicitis"

Negative for Appendicitis

Imaging (US first, if US inconclusive, then MRI or CT)
Consider Surgery Consult, ED physician with clinical decision capacity, Surgical exam if available

Equivocal but high suspicion

Imaging (US) and/or Consult Surgery and discuss antibiotics (see below)

Diagnosis of Appendicitis

Presumed Non-Ruptured
No Phlegmon, perforation or abscess:
Start Anitbiotics in the ED (Zosyn)
Orders: NPO, 1.5 MIVF

Presumed Ruptured
Evidence of Phlegmon, perforation or abscess:
Start Antibiotics in the ED (Zosyn)
Orders: NPO, 1.5 MIVF

Operative Management

Non-Operative

Non-Ruptured
Diet: Clears → Regular
Heplock IV once tolerating diet
IV Pain Control
Preoperative Antibiotics only

Ruptured
+/- PO diet and 1.5 x MIVF
Continue IV Zosyn
+/- Home antibiotics at discharge

Operation Deferred
NPO and 1.5 x MIVF
Consider IR drainage
IV Zosyn at least for 48 hours
Home Antibiotics: PO vs IV via PICC
Total ABX course TBD

Yes

Discharge Criteria
Afebrile (T < 38°C) x 24 hours, Resolutions of leukocytosis, Tolerating diet, PO pain control, f/u with surgery in 2-3 weeks

No

Persistent/Recurrent Symptoms:
(Fever, pain, etc.) Repeat labs +/- imaging
Consider Change in Antibiotics

- *For patients age 3 – 18 years*
- *Document Pediatric Appendicitis Score (PAS) in note AND put PAS score in Radiology order.*
- *US over CT Preferred: CT criteria: Pass ≥ 3, if less discuss with radiology, CT Scan only if needed*
- *If anticipate prolonged NPO, consider H2 blocker*
- *On Day of Discharge check CBC and CRP,*
  - *if elevated discharge on PO antibiotics – to complete 7 day course*
  - *IF CBC/CRP normal, consider no further antibiotics at discharge*
- *Postoperative imaging (US or CT) may not be clinically useful at <4-5 days post-op*
- *For PCN allergy: Use Cipro/Flagyl or Meropenem*

Strength/Level of Evidence *continued*

- MRI has 100% sensitivity and 96% specificity for acute appendicitis in pediatric patients with RLQ pain and inconclusive ultrasound.[15]

American Board of Internal Medicine (ABIM) Foundation

- ABIM foundation launched the "Choosing Wisely" campaign, which has four components that must be met: Supported by evidence, not duplicate of other tests or procedures, free from harm, and truly necessary. The next bullet is a joint statement from the American College of Surgeons (ACS) and American College of Radiology (ACR),
- Don't do computed tomography (CT) for the evaluation of suspected appendicitis in children until after ultrasound has been considered as an option.

Guidelines by the Surgical Infection Society and the Infectious Diseases Society of America[5]

- Although no clinical findings are unequivocal in identifying patients with appendicitis, a constellation of findings, including characteristic abdominal pain, localized abdominal tenderness, and laboratory evidence of acute inflammation, will generally identify most patients with suspected appendicitis (A-II).
- Local hospitals should establish clinical pathways to standardize diagnosis, in-hospital management, discharge, and outpatient management (B-II).

Definitions

Pediatric Appendicitis Score (PAS) [2] was developed in 2002 by Sameul (an analysis of a prospectively collected cohort of 1,170 children aged 4-15 years)[14] and consists of eight variables (all highly statistically significant) that form a complete score. Based on this score, the clinical pathway has appropriate next steps. Its precursor was the Alvarado score developed in 1986 for use in adults.[8]

Citations

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