Evaluation of Acute Abdominal Pain

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Objectives

• Review a systematic approach to the emergent evaluation of children with acute abdominal pain
• Identify common and serious causes that require a greater degree of concern and need for further evaluation and intervention
• Introduce us to our own limitations
• Exhaustive review of all causes of acute abdominal pain and evaluation of chronic abdominal pain beyond scope of presentation
Introduction

• Abdominal pain is a common pediatric complaint
  – History provides vast majority of information to create a differential diagnosis
  – Physical Exam increases or decreases evidence for elements of the differential

• Most cases do not require emergent interventions
  – In ED/UC settings 22% required surgery or antibiotics\(^1,2\)
History

• Patient age
• Timing (onset, waxing/waning, constant, intermittent)
• Location*
• Pain type-radiation of pain?*
• Modifying factors (what makes it better or worse)
• Associated symptoms (vomiting, diarrhea, fever, anorexia etc.)
• Recent trauma#
• PMH
• Medicines

* Difficult to assess < 5yo
# Lack of reporting in NAT

Children’s Healthcare of Atlanta
History Hallmarks

• The more centralized or generalized the pain, the less likely to be dangerous
  – Pitfall: The younger the patient the less able to localize

• The fewer associated symptoms (fever, vomiting, etc.), the less likely to be dangerous
  – Pitfall: Kids vomit with a change in the wind and have frequent fevers
    • 64% Fever²
    • 42% Vomiting²
## Causes of acute abdominal pain in children by age

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<thead>
<tr>
<th>Neonate</th>
<th>1 month to 2 years</th>
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<td>Foreign body ingestion*</td>
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<td>Appendicitis**</td>
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* Life-threatening condition.
† Common condition.
Timing

• Gradually increasing
  – Appendicitis

• Waxing/waning
  – Intussusception
  – Biliary and renal colic
  – Obstruction
  – Constipation

• Abrupt or Rapidly worsening
  – Torsions
  – Ruptured appendix
  – Biliary or renal colic
Location and Radiation

- Periumbilical
  - Many things initially
- RLQ
- RUQ
- LLQ
- LUQ
- Flank
- Epigastric
- Suprapubic

- Periumbilical to RLQ
- Flank to groin
- Epigastric radiates to back
Modifying factors

• Movement makes worse
  – Any peritoneal irritation
  – In contrast, visceral pain often produces writhing

• Vomiting makes better
  – Upper tract disease

• Eating makes better or worse
  – Upper tract disease

• Defecation or flatus make better
  – Lower tract disease
Associated Symptoms

- Fever
- Vomiting
- Diarrhea
- Anorexia
- Cough or SOB
- Dysuria
- Polyuria/polydipsia
- Hematuria
- Sore throat
Trauma

• As soon as you realize trauma is part of presentation switch to...

ATLS

– Do what you can for the A, B, C, D, Es without any delay in transfer!!
  • IV placement and start fluids; remember IOs *
  • Provide oxygen *
  • Immobilize
  • Stop external bleeding and keep warm
  • Transfer them to the closest appropriate facility
Traumatic Intra-abdominal Injury

• Best location for care
  – Specialized Pediatric Trauma Centers
    • Fewer than 40 fellowship trained pediatric surgeons graduated per year
    • Only 30 Pediatric Trauma Centers in 21 states in 2000 review
    • Only 18 states with Level I or II centers in 2008
      » Of 32 without PTC, only 22 had Adult Trauma Centers
    – CDC Mortality rates 2008
      » No PTC-19.5
      » 1 PTC- 15.8
      » 2 PTC- 11.8
      » ≥ 3 PTC- 13.2
Past History

• Medical
  – Sickle Cell Disease
  – Cystic Fibrosis
  – Nephrotic Syndrome
  – Diabetes

• Surgical
  – Adhesions from previous surgery
  – Hirschsprung’s
  – Anal stenosis
  – Known hernias awaiting repair
Physical Exam

• Vital signs
  — Fever
  — Tachypnea
  — Tachycardia
  — Hypotension

• General appearance

• Pt shows you where he/she has pain

• Abdominal Exam
  — Tenderness

• Chest/Respiratory Exam

• GU and other “peripheral” exam

• Rectal exam?
Rectal exam

• Not very useful!!!
  – Not good indicator of appendicitis\(^5\)
  – Not even useful in acute trauma\(^6,7,8\)

• Frequent findings and pitfalls
  – Hard stool may suggest constipation, but may not be cause of acute pain
  – Blood in stool very non-specific
Abdominal Exam

- Listen before palpation
- Palpate quadrants of abdomen, suprapubic, CVA area for tenderness
- HSM, masses
  - Rare finding of mass in intussusception

- Peritoneal signs and other signs of inflammation/irritation
  - “Jump test”
  - Rebound
  - Obturator sign
  - Psoas sign
  - Rovsing’s sign
Peritoneal Signs in Appendicitis

- **Rebound**
  - Soft easy pressure for 15 seconds followed by quick release

- **Rovsing’s sign**
  - Pain in RLQ on palpation of LLQ

- **Psoas sign**
  - Pain on passive extension of right hip; mostly retrocecal appendicitis

- **Obturator sign**
  - Pain with flexion of right hip and internal rotation
Peritoneal Signs in Appendicitis cont.

- Low overall sensitivity, but high specificity
  - Adult studies \(^{10}\)
    - Rovsing’s
      - Sens 22-68%
      - Spec 58-96%
    - Psoas
      - Sens 13-42%
      - Spec 79-97%
    - Obturator
      - Sens 8% (No longer used)
      - Spec 94%
  - Pediatric studies \(^{11}\)
    - Presence of any of these signs 0.86-0.98 specificity, but very low sensitivity
Extra-abdominal Exam

• **Infection**
  • Abdomen often benign
    – Strep pharyngitis
    – Pneumonia
    – Discitis
    – PID/Epididymitis

• **Systemic disease**
  • Abdomen generally general
    – Diabetes-DKA
    – Sickle cell-Pain Crisis
    – HUS
    – HSP
    – Viral syndromes
    – Colic
Examine the genitals

- **Males**
  - Low lying fruit-so to speak
    - Document swelling and/or tenderness
    - Document any masses

- **Females**
  - Hidden secrets
    - Document presence or absence of CMT
    - Document tenderness or masses in adnexal regions
Ovarian pathology

– Ovarian pathology mimics appendicitis

  • 1/5 occurrence of appendicitis

-Increase consideration for imaging in adolescent females with RLQ pain (predominantly recommend CT)

    Many Radiologist reluctant to define torsion by imaging so keep clinical suspicion high and call Surgery consult even if imaging doesn’t “prove” torsion
Laboratory Use to confirm or deny DDx not form one

• WBC and differential
  – The most sensitive lab indicator of appendicitis\textsuperscript{11}
    • WBC <10,000 (ANC <7500) greatest negative predictive value of any laboratory in appendicitis \textsuperscript{12}

• CRP
  – Variable sensitivities and specificities
  – Increasing levels with symptoms > 24 hours suggestive of rupture\textsuperscript{13}
Laboratory Use to confirm or deny DDx not form one

• Hemoglobin
  – Misleading due to multiple factors which falsely increase or decrease
    • Most useful to see hemoglobinopathies or hemolysis

• Chemistries
  – Useful to document acidosis due to dehydration, bowel ischemia or other metabolic derangement such as DKA
  – Hepatic and Pancreatic enzymes may offer diagnosis

• Urinalysis
  – Exclude pregnancy
  – Look for pyuria or other signs of systemic disease
Imaging

- Plain films including fluoroscopy
- Ultrasonography
- Computerized tomography
- Magnetic resonance imaging
Plain films and fluoroscopy

• **May** shows signs of obstruction or abnormal gas patterns
• Show free air
• **Radiopaque** foreign bodies, stones or fecalith
  – Pitfalls:
    • variable dynamic environment so changes minute to minute. Not good for “constipation”.
    • Depends on radiopaque material to see
      – Partial solution
        » Add contrast material such as barium or air
Ultrasonography

- Ultrasound has become the preferred choice of imaging over CT in most cases of abdominal pain in children\textsuperscript{14}
  - Emphasis on reducing harmful effects of ionizing radiation
  - Despite the increased use of USG and decreased use of CT in suspected appendicitis, the frequency of perforation and recurrent ED visits remained stable and a slight decrease was seen in negative appendectomies\textsuperscript{15}
Ultrasonography

• Can detect echogenic structures such as stones
• Assess vascular flow in torsion
• Look for fluid filled structures
  – Or baby filled structures
• Detect intussusception\textsuperscript{16}
  – Sensitivity 97.9%
  – Specificity 97.8% (Neg pred value 99.7%)
• Evaluate for appendicitis
  – Pitfalls:
    • User dependent and many centers lack experience with children
Computed tomography

• High sensitivity and specificity in detecting acute appendicitis
• Most sensitive test for nephrolithiasis

  – Pitfall: Growing body of knowledge on lifetime risk of ionizing radiation
    • Risk of Abd CT on 1 yo child lifetime mortality from cancer is 0.18% (1 in 550)\textsuperscript{17}
Magnetic resonance imaging

- Up and coming for abdominal studies in ED, but limited experience
  - Some studies suggest similar diagnostic accuracy for appendicitis as CT$^{18}$
    - Sensitivity and specificity of 96%

- Pitfalls:
  - Few centers ready with limited experience
  - Younger children will require sedation
Treatment while we wait

- IVFs
  - Abdominal pain originating in the gut is very sensitive to low flow states and may resolve with simple fluid bolus

- Analgesia
  - No good argument against giving
    - Opiates may altered exam, but no published reports have found major change in M/M due to opiate use in acute abdominal pain\(^{19}\)

- Antibiotics
  - Depending on clinical situation
Disposition

• Strongest evaluation tool in our arsenal is the serial exam
  – Admit for serial exams if you feel still without definitive diagnosis and concerned
  – Discharge and have return for repeat serial exam within 24 hours if reliable situation and clinically permissible

• Give detailed return precautions thinking of the most dangerous pathology you are thinking of
Case 1

- 2wk male presents with vomiting x 1 day
  - No fever
  - Bilious vomiting x 5
  - Unable to keep any liquids down
  - No PMH / Nl birth Hx
  - No meds
  - BW 4.3 kg
Case 1 ...

- **Physical Exam**
  - General – somnolent arousable
  - VS T36 / P160 / R48 / BP 65/32 / Wt 4 kg
  - Exam unremarkable except
    - Abdominal distension, firm
    - Hypoactive bowel sounds
    - Cap refill 3 sec

- **Differential ?**
- **Investigations?**
Case 1 …

- **Plain film abdomen**
  - Dilated proximal large bowel and stomach
  - Paucity of distal air

- **Lytes**
  - Na 140 / K 5 / Cl 100 / Bicarb 10 / Glu 40
Volvulus

- Young infant most common age
- Gut twisting on itself
- Loss of blood supply can occur
- Presentation – acute onset vomiting, abd pain, shock
- NPO / IV hydration
- Surgical repair
Case 2

- 8wk male presents with vomiting and irritability x 2 days
  - Worsening now with every feed – forceful
  - Non-bilious / non-bloody
  - Subjective fever
  - Stools loose
  - NI birth history
  - Tried changing formula in past for irritability and colic
Case 2...

• Physical Exam
  – Tired appearing infant; irritable with exam
  – VS T 37.8 / P 160 / R 38 / BP 84/45
  – Abd mostly soft and NT; small hematoma left parietal scalp

• Differential?

• Investigations?
  – Chem :
    • Na 136 / Cl 98 / Bicarb 20 / Bun 12 / Cr 0.7/ Glu 64
    • AST/ALT-360/400
Non-accidental Trauma
Case 3

- 12 month female presents with abdominal pain and irritability x 1 day
  - No fever
  - Intermittent abdominal pain
  - No vomiting
  - Normal stools
  - No meds
  - No trauma
  - No PMH
Case 3...

• Physical Exam
  – Normal except:
    • Quiet appearing
    • Mild abdominal distension
    • Tenderness to palpation
    • ? Mass in RUQ

• Differential?

• Investigations?
  – Stool guaiac – positive
  – Abd Film – paucity of air in sigmoid and rectum
Intussusception

- Age – infant – 5 y.o. (most common 1st year)
- Telescoping of intestine into intestine
- Abd pain can be colicky
- Heme positive stools
- Sausage shaped mass on exam RUQ
- Current jelly stools late finding
- Air contrast enema - surgery
Case 4

• 16 y.o. female presents with worsening abdominal pain x 1 day
  – Tactile fever
  – No vomiting, but nausea
  – LMP 3-4 weeks ago
  – Sexually active
  – No dysuria or vaginal discharge
  – Last BM today, soft
  – Anorexia
  – Movement painful
  – No PMH
Case 4...

- Uncomfortable, legs in flexion
- VS - T 38.6 / R 22 / P 110 / BP 130/80
- Exam – normal except
  - Hypoactive bowel sounds
  - Tenderness to McBurney’s point
  - Positive psoas and Rovsing’s signs
  - No rebound however voluntary guarding

- Differential?

- Investigations?
Case 4...

- BHCG - negative
- UA – negative
- Guaiac – negative
- Abdominal film – negative
- CBC
  - WBC 18,000 / 70 S / 5 B / 15 L / PLT 325
  - Hgb 11.5
Acute Appendicitis

• Most common in adolescence

• Migratory pain from L side or umbilicus to RLQ

• Anorexia / nausea common

• +/- fever

• Hematuria / pyuria can occur from bladder irritation

• RLQ tenderness, rebound, guarding, percussion pain
The Experienced Physician

• What makes us experienced?
• What makes us better than our younger selves?
  – Is it knowledge?
  – Is it all of the cases we have evaluated and dispositioned?
  – Is it all of the times we were proven right?
Missed Appendicitis\textsuperscript{19}
Summary

• Keep age related illnesses in mind

• History and physical will usually lead to an answer

• Common processes are common

• Diseases don’t read textbooks
Acute abdominal pain in postmenarchal girls

Yes

Trauma

Perforated viscus
Hemorrhage
Hematoma
Contusion

Distension or previous abdominal surgery

Obstruction

Peritoneal signs

Yes

Appendicitis
Ruptured ovarian cyst
Pelvic inflammatory disease
Cholecystitis
Pancreatitis
Perforated ulcer

Imperforate hymen on physical examination

Yes

Imperforate hymen
Vaginal septum
Vaginal agenesis

Pregnancy

Ectopic pregnancy
Intrauterine pregnancy
Extraabdominal findings

Mass

Tumor
Intraabdominal abscess
Focal tenderness

Definitive imaging study

Yes

Appendicitis
Pelvic inflammatory disease
Viral illness
Gastroenteritis
Pneumonia
Pharyngitis
Intraabdominal abscess
Appendicitis
Inflammatory bowel disease

Yes

Pelvic inflammatory disease
Diabetic ketoacidosis
Pancreatitis
Urolithiasis
Viral syndrome

No

Inflammatory bowel disease
Sickle cell syndrome painful crisis
Dysmenorrhea
Constipation
Functional

Red: Life-threatening conditions
Green: Common conditions
References

19. Ranji SR, etal. Do opiates affect the clinical evaluation of patients with acute abdominal pain? JAMA 2006; 296:1764