



Abdominal Pain in Children: When is it More than a Stomachache?

“My stomach hurts” is a frequently encountered childhood complaint. The challenge to the emergency physician is to recognize which of these children have a true abdominal emergency. Through the use of case studies, the presenter will discuss the differential diagnosis, physical examination techniques, and the rational use of studies that will enable the emergency physician to recognize and manage the child with an abdominal emergency.

- Develop a comprehensive differential diagnosis for the chief complaint of abdominal pain in children.
- Discuss the laboratory and imaging adjuncts to diagnosis.
- Recognize potential child abuse and discuss appropriate intervention.

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FACULTY

Martin G Hellman, MD, FACEP

Assistant Clinical Professor,
Department of Medicine, Case-
Western Reserve University;
Attending Physician, Department of
Emergency Medicine, PHS-Mt. Sinai
Medical Center, Cleveland, Ohio

ABDOMINAL PAIN IN CHILDREN: WHEN IS IT MORE THAN A STOMACH ACHE?

Presented by Martin G. Hellman, M.D. FAAP, FACEP

Attending Physician, Meridia Southpointe Hospital, Cleveland, Ohio

Assistant Clinical Professor of Medicine, Case Western Reserve University

I. General Considerations

A. Historical issues

1. Variety of symptoms may indicate a problem; yet, the same illness may manifest itself differently in various age groups.
2. Infants can't help localize pain; preschoolers are often imprecise with details, adolescents sometimes shy and unwilling to talk.
3. Though abdominal pain is a frequent complaint in ED's (about 10%), parents or caretakers are often unclear as to exact time course of problem. By their nature, many abdominal problems have intermittent and very vague symptoms!

B. Physical Exam

1. In all ages, general assessment and evaluation should be done before getting the child upset; watch from across the room etc.
2. Abdominal exam preferably done after chest exam and before ENT to avoid crying.
3. Inspection first! (in parent's lap for infants and younger kids); note distention of abdomen, respiratory rate and pattern, movement of legs
4. Auscultation second:
 - a. have infants below six months suck on a nipple or pacifier
 - b. between 6 and 36 mos.- "walk" your way up to abdomen with scope; touch parent's arm then child's arm, then move to abdomen-hopefully distracting child for seconds and gains trust
 - c. ages 2-4 can be distracted with object in other hand or fingers moving to enable a 10-15 second listen
 - d. with older children (age 3-6) in lap or on exam table, ask simple question to allay fears and distract them
5. Palpation third:
 - a. infants- have them suck on bottle of water to allow deep palpation; you may have to lay your hands on abdomen and feel between cries
 - b. 6-36 mos: Difficult! Palpate with scope so they don't think you're touching them! check for rebound, areas of tenderness; if crying, be attuned for level and intensity of crying, watch facial expressions
 - c. have parent hold child facing away from you over the shoulder-sneak your hand in gently between child and parent to palpate belly
 - d. have 3-6 year old on exam table with hips flexed and knees bent; distract with small talk/ questions while gently palpating
 - e. always make a walking child walk, and jump up and down if possible!
 - f. rectal exam-why not! it's necessary in any unexplained problem; explain to parent and older child first-use small finger under 6 mos, index finger after remove diaper!!! check genitalia, ? hernia, torsion, hair tourniquet
 - g.

6. Percussion-last
 - a. usually not as helpful as other parameters; patient is probably crying by now!
 - b. may aid in determining most painful area

C. Radiological Aids

1. plain films indicated with:
 - a. distention
 - b. abnormal bowel sounds
 - c. peritoneal signs
 - d. previous surgery (usually rare in kids)
 - e. possibility of foreign body, fecalith
2. Ultrasound: fast becoming diagnostic tool for pyloric stenosis, adjunct for appendicitis,(AP) evaluation for intussusception, gallbladder,
3. Barium enema: previous standard of care for intussusception, but being replaced by air enema in many centers
4. Computed Tomography-appendicitis, unexplained masses,

D. Laboratory Data

1. Electrolytes may guide type of solution necessary after vomiting and diarrhea but usually not necessary. Don't use to decide about state of hydration-use physical exam and vital signs.
2. Urinalysis may clarify unexplained vomiting especially with infants; renal colic rare
3. Checking stool for fecal leukocytes-rarely needed in ED unless strong possibility of bacterial gastroenteritis

II. Common things are Common-The Three C's

A. Colic

1. attacks usually start 7-10 days after arrival home; occurs equally in breast fed or bottle fed infants. It occurs in 10-25% of all infants.
2. characterized by episodes of screaming with distended or tight abdomen; some infants draw up legs, pass gas, act miserable and cry more than 3 hours per day!
3. episodes last minutes to hours, usually peak in evening time but can last longer
4. severity of attacks can increase daily with peak around 4-6 weeks of age; episodes abate at age 3 mos.
5. growth and development otherwise normal; physical exam fine also-parents usually frazzled and frustrated!
6. some switch formulas, try anti-gas or anti-spasmodic meds; usually fruitless measures; most important therapy is REASSURANCE!
7. KEY for ED physicians-DON'T make this dx with an irritable or poor feeding infant presenting with NO prior problems at 1-3 months! Colic doesn't just suddenly happen when the infant is 6-8 weeks old! Look elsewhere: corneal abrasion, hernia, reaction to decongestant, hair tourniquet, constipation should be

considered in an
afebrile, fussy infant in first few months.

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B. Constipation

1. Remember, it's defined by stool nature not frequency! Parents have different views.
2. It's very rare in breast fed babies.
3. Formula with iron does NOT predispose infants to hard stools.
4. Frequent cause of abdominal pain and cramping in school aged children. After age 4-5, most children attend to own toilet needs; parents unaware of routine! Children reluctant to use school bathroom; diet low in bulk, high in junk! Usual presentation is LLQ discomfort with palpable distended bowel loops, can present with RLQ pain. Rectal exam is usually confirmatory. It's the most common condition confused with appendicitis.
5. WBC may be increased, but no bands present.
6. An initial cleaning enema in ED to alleviate symptoms is usually warranted;
advocate dietary changes and discourage reliance on enemas.
7. Plain film maybe helpful in obese children.

C. "Crud" (Gastroenteritis-GE)

1. Most common GI reason for children presenting to ED; overwhelming majority viral. In USA, 200K hospitalized per year, 300-400 deaths due to diarrheal disease.¹
2. Estimate of 9% of all hospitalization in kids < 5 years for diarrhea. Costs to health care estimate at \$2 billion per year.¹
3. Rotavirus leads worldwide in etiology, but new Rotashield^R vaccine should have marked impact. Vaccine already shown to decrease incidence especially with the more severe episodes.² Oral dose given at 2,4,6 months of age. ***As of 7/16/99 vaccine being held due to possible link to cases of intussusception!!! Nationwide!
4. Initial wave of vomiting and abdominal pain usually subsides after 1st 12-18 hours, onset of diarrhea usually heralds the end of emesis.
5. Surprisingly, relatively few younger children become dehydrated enough for IV therapy (? because parents are more cautious). Oral rehydration therapy (ORT) shown effective in infants and toddlers. Older children / teens may benefit from IV fluid bolus in ED.
6. Bacterial causes rare; consider with bloody diarrhea, severe cramps, epidemic!
7. Bowel sounds usually hyperactive but not always; though patient reports diffuse tenderness, careful deep palpation usually finds little tenderness.
8. Ileus can be seen with severe cases, parenteral fluids necessary.
9. Oral rehydration is the mainstay in most countries for mild to moderate cases of dehydration. Guidelines established in 1985, but still not followed in USA or other countries by most practitioners.^{3,4}

D. Oral Rehydration (ORT) Guidelines

1. Applicable to children 1 month to 5 years old without coexisting problems.

2. Key goal is to replace fluid and electrolyte losses; ORT successful with decreased cost and complications. Frequency of stools, duration of diarrhea and weight gain are similar with ORT and IV therapy; important for families to know!

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3. Use of glucose-electrolyte solutions (GES) is crucial for success.
4. Optimal rehydrating solution (WHO) has 60-90 meq Na and D = 2.0%.
5. Commercially available solutions (Pedialyte and Infalyte) have slightly less Na. (45-50 meq) , D= 2.5 % . Best used after initial rehydration or for dehydration prevention, but they are successful for rehydration.
6. During vomiting stage, offer **small** amounts **frequently**.
7. Avoid apple juice, colas, "sport drinks": Na too low, D too high.
8. Continue breast feeding with increased frequency.
9. Resume formula feeding early in infants; diluting formula is **not** necessary.
10. Age appropriate diet can be restarted. No universal agreement on foods; Complex carbs such as rice, wheat, potatoes, bread, cereals OK with lean meats, yogurt, fruits and vegetables also. BRAT is OK but too low in energy, protein. Avoid tea, juices and soft drinks.

E. Other Management Issues ¹

1. First, establish degree of dehydration; mild = 3-5 % , moderate = 6-9% , severe is greater than 10%.
2. Measuring electrolytes unnecessary, most episodes are isonatremic.
3. Prevailing opinion is against use of anti-emetics. Administer very small volumes frequently with gradual increases as indicated.
4. Use flavored GES as needed, also popsicle form.
5. Give 50 ml / kg ORT for mild plus add 10 ml / kg for each stool; reassess q 2 hr..
6. Give 100 ml / kg ORT for moderate; reassess q 1 hour.
7. Use of loperamide, anticholinergics, bismuth preps, or adsorbents not recommended, while opiates are contraindicated.

III. Acute Abdomen-"Call the surgeon!"

A. Appendicitis

1. Most common surgical emergency in childhood, it can occur at any age; approx. four /1000 kids
2. Appendix is longer and thinner than adults, omentum is shorter until age 10; therefore it is walled off less well.
3. 60% of children < 5 yrs. will be perforated by the time they are seen by surgeon! Peak incidence is 10-15 years age group.
4. Most typical thing in children is that most are NOT typical! It can mimic other conditions so serial exams are key.
5. Periumbilical pain results from appendix peristalsis. Localized RLQ pain usually ensues. Mild temp >38.5 is usual (60%)
6. Vomiting usually present, anorexia common but NOT always!

7. Diarrhea does not rule out the dx!!! (present 10%)
8. Be extra cautious in obese child as symptoms may be obscured!

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9. Lab studies: WBC generally elevated; CRP positive with symptoms greater than 12 hours; negative CRP does NOT rule it out.
10. It's the most common cause of small bowel obstruction without explanation
11. Fecalith present on plain film about 10%; other signs (loss of psoas, lumbar spine scoliosis) not reliable.
12. BE can demonstrate a non-filling appendix, but seen in 10% of normals
13. Graded compression ultrasonography useful adjunct for equivocal cases.
 - a. can be operator/ interpreter dependent
 - b. look for appendiceal diameters greater than 6 mm. (however normals can be this!)
 - c. entire appendix needs to be visualized to avoid false negative if only distal tip inflamed at time of study)
14. CT scans sensitive to identify uncomplicated appendicitis and may identify abscesses.
15. Insure adequate hydration while deciding disposition..
16. Operation done by some via laparoscope.
17. Common mishaps in diagnosis: no rectal exam, no documented follow-up instructions, use of IM pain meds and misdiagnosis of GE.

B. Intussusception

1. ALWAYS think of this with the **afebrile**, truly **irritable** infant!
2. Occurs from 4-24 months, with peak at 6-12 months; boys greater than girls 2:1.
3. Typical episodes of pain entail sudden screaming and drawing of knees to abdomen in otherwise healthy child. In between episodes, infants may look OK but usually don't look or act "well" or normal; overall a slow but steady downhill course ensues. Episodes last 5-10 minutes.
4. Don't lead the parents into the history! Have them describe or demonstrate what the child was doing. (i.e. don't ask "was the child drawing the legs up and screaming?")
5. Vomiting is universal-it will become bilious as time progresses.
6. Bowel sounds are diminished, absent or high pitched; a right lower quadrant mass may be palpable as almost all are ileocolic.
7. If you're unsure, just watch child for defined length of time in ED. Symptoms will return shortly!
8. Currant jelly stool is a late and unreliable sign-it's extremely foul smelling.
9. Plain films NORMAL early on. Later, obstructive signs with possible mass seen.
10. While awaiting radiological support, aggressively replenish fluids via IV. Involve surgery consult early.
11. Ultrasound useful to detect it- a bulls eye or target lesion on transverse section while a pseudo kidney sign seen on longitudinal cuts, representing edematous bowel walls.

12. Hydrostatic barium enema is diagnostic and usually (3/4) therapeutic unless obstruction is present or delay (more than 24 h).

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13. Air contrast enemas used widely in USA instead of barium, depending on radiologist preference. Vast experience in Japan and China. Advantages: Less risk if perforation occurs, less fluoroscopic radiation necessary, better reduction percentage (95%).
14. There is a 4-10% reoccurrence rate; so be wary of child with previous history!

C. Malrotation with Midgut Volvulus

1. Usually presents in first few months, but can be later. Volvulus occurs around narrowed mesenteric pedicle which compromises circulation.
2. Sudden bilious vomiting ensues; there may have been previous brief episodes which resolved. Abdomen distends with **ILL** appearing infant in shock. Consult surgeon **ASAP**.
3. Plain film may show gastric distention and lack of distal air or can be normal! Double bubble sign is dilated stomach and duodenum.
4. Rapid massive fluid resuscitation is crucial! Place NG for decompression!
5. Ultrasound may show distended fluid-filled duodenum, peritoneal fluid and dilated bowel loops to the right of the spine.
6. UGI demonstrates malposition of duodenum at obstruction site. Typical corkscrew pattern visible. Barium can be instilled via catheter directly into stomach.
7. Delays in obtaining these should be minimized! **Urgent** operative intervention imperative!

D. Hypertrophic Pyloric Stenosis

1. Males 4:1 over females; first born males are affected more than first girls!
2. It's 2-3 times more in whites than blacks; rare in Asians. Increased risk in affected families; highest when mother was affected!
3. Symptoms begin in first three weeks; rare after 7-8 weeks old.
4. Many infants have chalazia and are "spitters" but grow well and are normal.
5. Vomiting is NON-bilious and may be projectile.
6. Try to palpate the olive while infant is sucking on small amount of water; easier in OR when abdomen relaxed!
7. Seeing peristaltic waves is rare.
8. Usage of volumetric study via NG recently proposed to be cost effective to decide between doing UGI or US to first make diagnosis in non-bilious vomiting; if NG aspirate > 5mL, US to be done first. If aspirate volume < 5mL, do UGI first.⁶
9. Upper GI demonstrating "string" sign was the original major diagnostic tool and still useful and utilized to clarify other problems.
10. Ultrasound has replaced UGI as first line diagnostic tool. Muscle thickness greater

- than 4 mm or length greater than 16 mm confirms it.
11. Attend to hydration and check electrolytes; surgery is **not** urgent.

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IV. Other Conditions (fairly common)

A. Foreign Body Ingestions

1. Ongoing literature controversy whether a locating x-ray necessary if asymptomatic.
2. Consider using a hand held metal detector instead to locate site!
3. Once foreign bodies are in abdomen, little needs to be done. Add bulk, etc to diet.
4. Button batteries: need immediate removal from esophagus!
5. Removal of coins can be done via fluoro, endoscope, or with foley catheter technique.

B. Sickle Cell Anemia

1. Preschool and school age kids may present with diffuse abdominal pain during a vaso-occlusive crisis; they usually lie and rub their abdomens!
2. Be wary of appendicitis!
3. Increased risk of gallstones and acute cholecystitis at any age. (ultrasound can help)

C. Respiratory Problems

1. Younger asthmatics or new onset asthma may present with abdominal pain or vomiting secondary to aerophagia.
2. Lower lobe pneumonia can cause diaphragmatic irritation. Pneumonia can also cause ileus and abdominal distention from aerophagia (present with chief complaint of "hard stomach").

D. Henoch-Schonlein Purpura (anaphylactoid purpura)

1. It's a systemic vasculitis-cause unknown.
2. Typical rash is the tip-off; usually in dependent areas from buttocks inferiorly. Purpuric rash can also be on arm extensor surfaces.
3. GI complaints: pain and cramping are common, arthralgias in lower extremities.
4. It can be accompanied by intussusception; micro to macro GI bleeding, nephritis also seen. Steroids reserved for those with GI bleeding.

E. Hemolytic-Uremic Syndrome

1. Prodrome phase of URI or gastroenteritis; bloody diarrhea, pain and vomiting follow. Recent outbreaks associated with toxic *E.coli*. O157:H7.
2. Atypical cases of HUS without infectious diarrhea; associated with *S. Pneumoniae* recently reported.⁵

F. Psychological / Abuse problems

1. Children troubled for a variety of reasons may complain of abdominal pain. Exam and any lab data within normal limits. Kids internalize their feelings and express them in this manner.
2. School phobias-especially at beginning of year!

3. Always consider child abuse or sexual abuse if things don't seem right!

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4. Munchausen Syndrome by Proxy (MBP) usually occurs in children under 6.
 - a. repeated and varied presentations, not fitting usual disease patterns
 - b. parents desire invasive procedures, ultimately want attention for themselves
 - c. symptoms usually precipitated by toxic but non-fatal ingestions
 - d. recent national cases!- in Florida, girl with 40 surgeries in 9 years, all symptoms ceased when child removed from mom!

G. Infections

1. Strep pharyngitis-often has abdominal pain unlike viral pharyngitis
2. Herpes Zoster-though uncommon in kids, will give dermatomal pain before rash
3. Rocky Mountain Spotted Fever, Kawasaki's -both may have abdominal discomfort.

H. Gastrointestinal Bleeding

1. Anal fissures are the most common cause under age two. Excessive crying with hard stools is noted. Advocate local care, stool softeners. Ingesting large amounts of colored fruit juices can give bright red, heme negative coloring in diapers! Melena imitated by iron preparations, licorice, blueberries, beets, bismuth, dirt.
2. Polyps - the most common cause in preschoolers; bleeding is bright-red but painless.
3. Though uncommon, Meckel's Diverticulum should be considered with any rectal bleeding. It's usually painless but sudden.
 - a. If diverticulum's inflamed (20%), children present with like appendicitis.
 - b. Most commonly seen with obstruction if intussusception is present.
 - c. A "Meckel's Scan is still most sensitive.

I. Genitourinary Problems

1. Inguinal hernias occur from 1-4% of population; males:females-6:1; right:left-2:1; prematures at higher risk; most reduced with firm manipulation. Avoid ice; use sedation prn!
2. Caution parents to limit crying episodes until repair. Laparoscope now used for repair and to explore contralateral side.
3. Testicular torsion most common in preadolescent and teen years. Delay for diagnostic tests NOT acceptable; must get to OR in 1st 6 hours!
4. Torsion of appendix testes may be difficult to differentiate; attempt to visualize "blue dot."
5. Epididymitis uncommon in childhood.
6. Ovarian torsion may mimic appendicitis; sudden pain in lower quadrant. US helpful.
7. Renal colic is rare in childhood; urolithiasis is rare in Western Hemisphere children.

8. Most common cause of dysuria in pre-school boys is meatal stenosis; in pre-school girls it is vaginitis, not UTI.

J. Medications

1. Some erythromycin preparations cause GI distress; also tetracyclines.
2. Amoxicillin/clavulanic acid may cause cramps, diarrhea, pain; a lower dose may obviate this. New BID doses for children and adults have greatly reduced this.

BIBLIOGRAPHY

Pediatric Gastrointestinal Disease, Walker et.al, B.C. Decker 1991

Pediatric Emergency Medicine, Reisdorf, Roberts, Wiegenstein W. B. Saunders, 1992

Acra SA, Ghishan FK: Electrolyte Fluxes in the Gut and Oral Rehydration Solutions
Ped. Clin NA Vol. 43 No. 2 April 1996 pp. 433-449

Rusnak, RA et al: Misdiagnosis of Acute Appendicitis: Common Features Discovered in cases After Litigation. *Amer. J. Emerg. Med* 12 (4) 397-402

Caty, MG and Azizkhan, RG: Acute Surgical Conditions of the Abdomen, *Pediatric Annals*
23: 4/ April 1994, pp 192-201

Ashcraft, KW and Holder, TM: PEDIATRIC SURGERY, 2nd ed. WB Saunders, 1993

Miller, James: Laparoscopic Appendectomy, *Pediatric Annals*, 22:11 Nov. 1993 pp.663-667

Filston, Howard C.: What's New in Pediatric Surgery. *Pediatrics* Vol.96 No. 4 Oct. 1995
pp.748-755

1. Practice Parameter: The Management of Acute Gastroenteritis in Young Children. *Pediatrics*
Vol. 97 No. 3 March 1996 pp.424-432
2. Santosham M, Moulton LH, Reid R. et al: Efficacy and Safety of High Dose Rhesus -Human
Reassortant Rotavirus Vaccine in Native American
Populations. *J Pediatrics* 1997; 131:632-8
3. Shamir R, Zahavi I, Abarmovich T. et al: Management of Acute Gastroenteritis in Children in
Israel. *Pediatrics* Vol. 101 No. 5 May 1998 pp. 892-894
4. Snyder John: Use and Misuse of Oral Therapy for Diarrhea: Comparison of US Practices with
AAP Recommendations. *Pediatrics* 1991; 87: 28-33
5. Carera Greg: HUS Syndrome Associated With *S.Pneumoniae* Infection. *Pediatrics*

Vol 101 No. 4 April 1998, pp. 699-703

6. Mandell GA, Wolfson PJ, Adkins ES, et al: Cost Effective Imaging Approach to the Nonbilious

Vomitting Infant. *Pediatrics* 1999; 103: 1198-1202

"Gastroenteritis:, *Pediatrics in Review*, Vol. 15 No 12 Dec 1994

"Evaluation of Rhesus-Rotavirus Vaccines in US Children", *JAMA*, April 19, 1995 Vol 273, No. 15