GI EMERGENCIES

From Pediatric Emergency Medicine, sponsored by the Center for Emergency Medical Education

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Pediatric “Gastro-tastrophes”

**Appendicitis**

Case 1: boy aged 5 yr; generalized abdominal pain for 3 hr beginning 1 hr after last meal; vomited twice; no fever, diarrhea, or associated signs or symptoms; presentation — vital signs normal (temperature 99.1°F; heart rate 110 beats/min); speaker recommends taking vital signs before they are skewed by pediatric patient becoming anxious or excited; physical examination (PE) — bowel sounds; mild epigastric tenderness; no rebound tenderness

Diagnosis: gastroenteritis; treatment — information on vomiting and influenza; follow-up with primary care physician (PCP) next day; speaker’s view — follow-up with PCP may not be appropriate for patients (of any age) with acute abdominal pain; speaker recommends follow-up with emergency medicine physician, and possible involvement of surgeon

Follow-up with PCP: failed to take patient’s vital signs; reported patient had slight abdominal tenderness and appeared ill; performed complete blood count (CBC) and radiography (acute abdominal series); patient returned to emergency department (ED) in evening

Examination by resident at ED: patient had abdominal pain for 24 hr; vomited 3 times; felt warm; could sip fluid; tenderness near navel; vital signs (low-grade fever, heart rate 130 beats/min) meet diagnostic criteria for systemic inflammatory response syndrome; patient able to sit up; appeared tired but not in distress; some tenderness in epigastrium; attending physician agreed with resident’s report

Second diagnosis: gastroenteritis; treatment — more informational material; instructions to consume only clear fluids for 24 hr; follow-up with PCP in 3 days

Outcome: patient in pain all night; parents unable to rouse patient next morning and called 911; patient died on way to ED; autopsy — found patient had perforated appendix; blood cultures grew streptococci

**Presentation:** appendicitis most common nontraumatic surgical disorder in children aged >2 yr; diagnosed in 1% to 8% of children presenting to pediatric ED with chief complaint of abdominal pain; perforation — found in <15% of adolescents with appendicitis; seen in ~100% of patients with appendicitis aged <3 yr; association with enteric infections — 11% more cases of appendicitis between May and August; may be caused by virus or virus-associated inflammatory response in bowel; genetic predisposition — relative risk for appendicitis increased 3.5 to 10 times if patient has first-degree relative with history of appendicitis; diet — sufficient fiber intake associated with 30% reduction in risk for appendicitis

**Recurrent appendicitis:** 10% to 36% of patients with appendicitis reported previous symptoms (implies possible resolution and recurrence of appendicitis); surgery — not required in many cases; however, rate of recurrence ≤30% within 1 yr (often within first month) of initial diagnosis when patients treated with nonsurgical approach; incomplete surgical removal of appendix may explain phantom pain

**Signs and environmental factors:** signs — change in bowel habits (diarrhea or constipation); dysuria (appendix may irritate bladder or ureter); pain associated with movement (eg, coughing [cough sign], driving over bump [cat’s eye sign], jumping or striking heel [heel drop sign]) may be signs of peritonitis; etiology — increased incidence of appendicitis during viral outbreaks (particularly with mumps virus, coxsackievirus, and adenovirus), amebiasis, and bacterial enteritis; probably caused by subsequent and concurrent inflammatory response in bowel to pathogens; extended breastfeeding — alteration of immune response induced by breast milk; lymphoid tissue at base of appendix less reactive when baby fed breast milk

**Clinical mismanagement:** misdiagnosis — study shows initial rates of misdiagnosis 28% to 57% for patients aged ≤12 yr, and ±100% for patients aged <2 yr; perforation — patients aged <3 yr likely to perforate appendix because of misdiagnosis; perforated appendix in very young patients likely to result in intra-abdominal sepsis and death; gastroenteritis — most common misdiagnosis in patients aged ≤12 yr (second most common misdiagnosis upper respiratory infection [URI]); misdiagnosed cases often result in severe complications (eg, ruptured appendicitis); digital rectal examination (DRE) — unhelpful in diagnosis of appendicitis; causes unnecessary discomfort; study found that DRE for appendicitis has high rate of false-negative (46%) and false-positive (53%) results; study of 1204 patients (Dixon et al, 1991) found no difference in management of appendicitis occurred when DRE performed; current protocol for diagnosis — send patient to operating room if PE clearly indicates appendicitis; confirm diagnosis with ultrasonography (US) of appendix if results of PE unclear; use computed tomography (CT) if US inconclusive; speaker prefers US for assessment of appendix; study of 631 pediatric patients found US had 98.6% sensitivity for appendicitis and rate of missed

**Educational Objectives**

The goal of this program is to improve the diagnosis of commonly misdiagnosed gastrointestinal disorders in pediatric patients. After hearing and assimilating this program, the clinician will be better able to:

1. Diagnose and treat appendicitis in children.
2. Assess the signs and risk factors for intestinal malrotation.
3. Detect atypical cases of pyloric stenosis in children.
4. Differentiate between the diverse presentations and etiologies of intussusception.
5. Detect and diagnose rare congenital defects such as Meckel diverticulum and aganglionic megacolon.

**Faculty Disclosure**

In adherence to ACCME Standards for Commercial Support, Audio Digest requires all faculty and members of the planning committee to disclose relevant financial relationships within the past 12 months that might create any personal conflicts of interest. Any identified conflicts were resolved to ensure that this educational activity promotes quality in health care and not a proprietary business or commercial interest. For this program, Dr. Klauer and the planning committee reported nothing to disclose.
appendicitis 0.5%; speaker recommends US by experienced pediatric sonographers

**Obstructions**

**Case 2:** girl aged 6 wk; severe vomiting for 24 hr; no fever, diarrhea, or URI symptoms; “seemed hungry for last 3 hr”; constant crying; PE — heart rate 180 beats/min; respirations 36/ min; temperature normal; crying but consolable by mother; sucking vigorously on pacifier; audible bowel sounds; no palpable abdominal masses; fussy; good muscle tone; slightly dry mucous membranes; rectal examination yielded copious stool

Differential diagnosis: diabetic ketoacidosis (DKA); urinary tract infection (UTI); pyloric stenosis; intestinal obstruction; speaker states differential insufficient

Diagnostic tests: white blood cell (WBC) count of 12,500 cells/µl and 21% bands; x-ray showed significant stool in rectal vault and dilatation of large and small bowel proximal to stool; no signs of pyloric stenosis on US (speaker suggests that physicians searched for wrong disease)

Treatment: disimpaction; patient tolerated fluids by mouth without vomiting; patient discharged; surgeon recommended that patient be observed but parents refused

Diagnosis: vomiting; possible ileus; constipation

Outcome: patient returned to ED 48 hr later; diagnosis of volvulus with necrotic bowel led to surgical removal of large portion of bowel; patient faced long-term health issues (eg, short gut syndrome); lawsuit filed

**Malrotation-midgut volvulus:** due to disrupted embryologic development; 3 stages of rotation result in 270° rotation of bowel during embryonic development; disruption at any stage of rotation of bowel increases risk for malrotation and volvulus (these congenital malformations can remain undetected for long periods); bariatric surgery also increases risk; clockwise rotation at superior mesenteric pedicle blocks superior mesenteric artery, and leads to ischemic bowel and necrotic bowel

Incidence: 1 in 500; male to female ratio 2 to 1; 40% of cases present in first week of life (75% of patients present within first year); mortality 2% to 24%; risk for death increased by 25 times if bowel necrotic at time of surgery; ≤30% of patients with midgut volvulus also have congenital cardiac anomalies (these patients have mortality rate >60%)

Presentation: *acute midgut volvulus* — most common during first year of life; results in sudden onset of bilious vomiting; *chronic midgut volvulus* — intermittent; results in lymphatic and venous obstruction; multiple episodes of colic (warning sign); *acute duodenal obstruction* — forceful vomiting (bilious or nonbilious); *chronic duodenal obstruction* — seen in infancy to preschool age; bilious vomiting; intermittent abdominal pain; failure to thrive; frequently misdiagnosed as colic; *internal herniation* — bowel wraps around Ladd bands; misdiagnosed as psychosocial problem

Imaging: “double bubble” sign on x-ray (air fluid levels in stomach and distended duodenum) in active case; diagnostic method of choice upper gastrointestinal (GI) series; normally, duodenal C-loop crosses midline and puts everything to left of spine at level of pylorus or greater; proximal obstruction suspected if bowel image ends abruptly or tapers off (contrast does not completely flow through bowel)

**Pyloric stenosis:** pathophysiology — idiopathic hypertrophy of pyloric muscle; *incidence* — 1 in 250 births; males at 4 times greater risk than females; presents within first 2 to 5 wk of life; rarely seen in patients aged >8 wk

Symptoms: patient may appear healthy for first few weeks of life; sudden onset of vomiting ≤30 min after feeding; progression of symptom severity to nonbilious projectile vomiting; hematemesis may occur after forceful vomiting; patient may have nonspecific hyperbilirubinemia

PE: patient often appears active and well-hydrated; condition deteriorates as disease progresses; moderate to severe dehydration (abdomen feels soft and nondistended); palpable “olive” may be present, but tenderness and distention may make it undetectable; failure to thrive; prominent gastric peristalsis

Diagnostics: US helpful in diagnosis of hypertrophic pyloric stenosis even in absence of palpable distention; laboratory tests show hypochloremic metabolic alkalosis (ie, low chloride, low potassium, and elevated bicarbonate levels); however, extreme dehydration may later cause acidosis; US front-line radiologic method; upper GI series also helpful (look for narrow connection [“string sign”] between stomach and pylorus) and may show other pathologies

Surgical management: remove excess pyloric muscle tissue

**Case 3:** boy aged 15 yr with lower abdominal pain and cramps and vomiting for 3 hr; PE — heart rate slightly elevated; low-grade fever; soft abdomen; right midabdominal tenderness; hyperactive bowel sounds

Diagnosis: dehydration and gastroenteritis; speaker recommends adding symptoms (eg, nausea, vomiting, dehydration) to chart; speaker advises against use of term “gastroenteritis”

Outcome: patient returned to ED 18 hr later; pronounced dead soon after arriving in ED; patient had intussusception

**Intussusception:** leading cause of intestinal obstruction in infants (aged 2–12 mo); ileocolic intussusception most common; usually ileoileal via ileocecal valve; bowel can extend to rectum in severe cases

Presentation: sausage-shaped mass in right upper abdomen (classic finding); colocolic intussusception rare; may be caused by hypertrophied Peyer patches in infants; regions of hypertrophy can act as “lead points” that start intussusception; in patients aged ≥2 yr, consider alternative lead points (Meckel diverticulum, polyps, intestinal duplications, or tumors); frequently preceded days before by diarrheal illness, viral syndrome or URI, and Henoch-Schonlein purpura; *classic triad of symptoms* — colicky abdominal pain, vomiting, and rectal bleeding (present in only 20% of cases, so do not rely on triad)

Symptoms: colicky or episodic abdominal pain; patient may have irritability, anorexia, and vomiting; patient may appear well or lethargic; partial or complete small bowel obstruction with generalized distention; mass reported in right upper quadrant of abdomen in 66% of patients; 50% to 75% of patients have occult blood (lack of bleeding does not exclude intussusception); *4 classic x-ray findings* — target sign; crescent sign; absent liver edge; bowel obstruction; *currant jelly stool* — result of compression of mesenteric vein; arterial supply preserved, but increased pressure leads to expression (may be spontaneous or occur during rectal examination); bleeding may decrease; bowel ischemia occurs, with possible perforation of intestinal wall

Imaging: plain films may show nonspecific bowel obstruction; CT helpful; US sensitivity 98%

Diagnosis: plain x-ray (may be unreliable), US, or barium enema (look for “coiled spring sign”)

Treatment: air contrast enema; possibly surgery

**Meckel diverticulum:** remnant of omphalomesenteric duct forms bulge in small intestine; can be misdiagnosed as omphalitis (do not incise what appear to be cysts or abscesses, because they may connect to bowel)
Presentation: usually asymptomatic; painless rectal bleeding
classic presentation; less commonly, presentation similar to
diverticulitis (with or without perforation)
Study: 45 patients with Meckel who had surgery; 3 times as
many boys as girls; median age 10 yr; in 25 cases, Meckel
incidental finding while looking for appendicitis; study
shows many presentations (eg, peritonitis, lower GI bleed-
ing, intussusception, obstruction) of Meckel
Diagnosis: presumptive; accurate if bleeding presenting symp-
tom; diagnosis based on other symptoms only 11% accurate;
Meckel scan (sensitivity 80%–90%); x-ray and CT not help-
ful; upper GI series has fallen out of favor; use barium enema
if intussusception suspected
Case 4: boy aged 12 days; no bowel movement for 2 days; young
mother; patient fed baby formula with iron; no fever or anorexia;
PE — heart rate 180 beats/min; respirations 32/min; current
weight 2 oz less than birth weight; patient appeared well but had
slight abdominal distention; hyperactive bowel sounds
Diagnostic tests: abdominal series showed mild distention
and constipation; suppository produced “large defecation”;
diagnosis — constipation induced by iron in baby formula;
treatment plan — change baby formula
Outcome: patient returned to ED 9 days later with swollen
abdomen and fever of 101.4°F; PE showed subcostal retrac-
tions and distended abdomen with tympany; abdominal series
showed multiple dilated loops of bowel consistent with intus-
susception; patient died; patient had aganglionic megacolon
Aganglionic megacolon (Hirschsprung disease): absence of
parasympathetic ganglia of Auerbach plexus between circular
and longitudinal muscle layers of colon; spasms and abnormal
motility cause chronic constipation; presentation — persistent
abdominal distention; possible malnourishment; failure to pass
meconium; vomiting uncommon; obstruction more common in
infants; diagnostic tests — plain x-rays; barium enema (without
bowel preparation) to identify transition zone (contracted agan-
glionic bowel and proximal dilated ganglionic segment); reten-
tion of barium proximal to transition point at 24 hr suggestive
of megacolon; perform anorectal manometry if necessary (only
in patients aged >3 wk)

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Suggested Reading

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Ultrasonography aids decision-making in children with abdomi-

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<tr>
<td>Review Educational Objectives on page 1</td>
<td>5 minutes</td>
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<td>Take pretest</td>
<td>10 minutes</td>
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<td>Listen to audio program</td>
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<td>Review written summary and suggested readings</td>
<td>35 minutes</td>
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<tr>
<td>Take posttest</td>
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1. All the following statements about appendicitis are true, except:
   (A) Most common nontraumatic surgical disorder in pediatric patients aged >2 yr
   (B) Found in 1% to 8% of pediatric patients in the emergency department with chief complaint of abdominal pain
   (C) Equally prevalent throughout the year
   (D) Genetic factors put some patients at a higher risk for appendicitis than others

2. Potential signs of appendicitis include which of the following?
   1. Change in bowel habits
   2. Dysuria
   3. Bilious vomiting
   4. Pain from inadvertent movement
   (A) 2,3  (B) 1,2,3  (C) 1,2,4  (D) 1,4

3. Breastfeeding may reduce a child’s risk for appendicitis.
   (A) True  (B) False

4. Which of the following is the most common incorrect diagnosis in patients aged ≤12 yr presenting with abdominal pain?
   (A) Constipation
   (B) Appendicitis
   (C) Upper respiratory infection
   (D) Gastroenteritis

5. Identify the incorrect statement about intestinal malrotation-midgut volvulus:
   (A) 75% of midgut volvulus cases present within the first year of life
   (B) Almost one-third of patients with midgut volvulus also have congenital cardiac anomalies
   (C) Computed tomography (CT) is the diagnostic method of choice
   (D). Male to female ratio 2 to 1

6. Characteristics of pyloric stenosis include which of the following?
   1. Patient may appear well for first few weeks of life
   2. Sudden onset of vomiting ≤30 min after feeding
   3. Progression of symptoms to nonbilious projectile vomiting
   4. Nonspecific hyperbilirubinemia
   (A) 1,2,3  (B) 1,2  (C) 1,3,4  (D) 1,2,3,4

7. Which of the following is the leading cause of intestinal obstruction in patients aged 3 to 12 mo?
   (A) Intussusception
   (B) Pyloric stenosis
   (C) Aganglionic megacolon
   (D) Chronic midgut volvulus

8. The classic triad of rectal bleeding, colicky abdominal pain, and vomiting is seen in ______% of patients with intussusception.
   (A) 10%  (B) 20%  (C) 30%  (D) 50%

9. Although the Meckel scan is 80% to 90% sensitive for diagnosis of Meckel diverticulum, barium enema can also be used.
   (A) True  (B) False

10. Signs and symptoms of aganglionic megacolon include all the following, except:
    (A) Nonbilious vomiting  (B) Constipation
    (C) Persistent abdominal distention  (D) Failure to pass meconium