

## Acute Abdominal Pain in Children

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Acute abdominal pain in children is a common and challenging problem for the family physician. The many causes of this problem require a systematic approach to making the diagnosis and planning specific therapy. A careful history and physical examination, together with a small number of selected laboratory studies, provide a rational basis for effective management in most cases. This paper reviews the more common causes of acute abdominal pain in children with special emphasis on their clinical differentiation.

Abdominal pain in a child is always an emergency. The primary physician must identify a "medical" cause in order to prevent unnecessary interference and yet be on the alert for any condition requiring surgery. This can be done by a detailed history, a full physical examination, and a few simple laboratory tests — never forgetting the urine. This article will review the more common causes of acute abdominal pain in children and suggest a problem-solving approach whereby the family physician can make the diagnosis as the basis for effective therapy.

The causes of acute abdominal pain may be either extra or intra-abdominal (Table 1). Almost one third of cases admitted to the hospital remain undiagnosed (Table 2). The main actors in the drama of the acute abdomen are pain, vomiting, localized tenderness, swelling in the abdomen, and changes in the stools. The diagnosis can be made by their order of appearance. Extra-abdominal causes are either secondary to vomiting or to pain referred to the abdomen from irritated pleura, pericardium, spine, or diaphragm. As a general rule, vomiting followed by pain is extra-abdominal whereas pain

followed by vomiting is more likely an intra-abdominal disorder.

### Common Medical Causes

One cannot stress enough that the child with abdominal pain must be fully examined.

1. *Gastroenteritis*. This is frequently confused with acute appendicitis. Table 3 demonstrates the similarities and differences. The most important single sign favoring appendicitis is increasing localized tenderness.

2. *Mesenteric Lymphadenitis*. After certain viral or bacterial infections, there may develop a syndrome of abdominal pain with nausea, vomiting, and tenderness with enlarged lymph nodes in the right iliac fossa. This syndrome is completely benign and is often confused with appendicitis. As a general rule the child feels hungry, and abdominal tenderness, unaccompanied by the rigidity of appendicitis, decreases as the hours pass. The W.B.C. count is usually low.

Every physician has seen the doubtful appendicitis resolve spontaneously and called it mesenteric lymphadenitis, while every surgeon has at times operated on an "acute appendix" and found only "mesenteric lymphadenitis."

3. *Urinary Tract Infection* with right-sided renal colic is easily confused with appendicitis. The young child has high fever, vomiting, and abdominal pain and is less likely to complain of

dysuria. The older child may start bed-wetting with or without dysuria. A drop of fresh, clean unspun urine will usually reveal pyuria, but in the early case relatively few white blood cells may be seen compared to gross bacilluria. The infection may have underlying urinary tract abnormality, stone, hydronephrosis, polycystic kidney or renal neoplasms. The IVP is important in detecting these underlying problems.

4. *Viral Hepatitis*. Malaise, anorexia, abdominal pain, and tenderness over the liver occur with hepatitis A or B. Later, patients who become jaundiced have dark urine and pale stools. In teenagers, "needle tracks" suggest syringe transmitted Type B (H.A.A.) hepatitis. Youngsters with infectious mononucleosis may present as hepatitis.

5. *Upper Respiratory Tract*. Streptococcal pharyngitis, a common cause of vomiting and abdominal pain, can be recognized by looking at the throat with confirmatory throat culture. An infant with otitis media draws up the legs and cries, which may be misinterpreted by the mother and physician as "colic." Pain referred to the abdomen by pleural irritation, pneumonia, or pleurodynia can easily mimic a surgical catastrophe. Yet, gentle palpation will usually distinguish the unyielding guarding of peritoneal involvement from the softer, more yielding abdominal wall of referred pain. Pneumonia is associated with high fever, cough, pain aggravated by breathing, and crackles in the chest. It may be confirmed by x-ray.

6. *Henoch-Schönlein Purpura* is a diffuse vasculitis with pain in the abdomen or joints. A characteristic anaphylactoid purpura involves the buttocks, legs, and arms but avoids the trunk. Stools may contain blood, as may the urine. Henoch-Schönlein may either simulate an intussusception or actually provoke one. Hemophilia often causes painful retroperitoneal bleeding.

7. *Acute Rheumatic Fever* may present with abdominal pain and tenderness in the right iliac fossa. A preceding history of sore throat and fever with raised ASO titer and sedimentation rate is suggestive. The presence of other criteria of rheumatic fever will clinch the diagnosis.

8. *Pancreatitis*. Severe, constant abdominal pain in the upper abdomen radi-

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**Table 1. Causes of Abdominal Pain**

Medical		
Extra-Abdominal	Review of Systems	Clue
Head	Migraine	Scintillating aura, hemicrania
	Raised intracranial pressure (tumor) Lead poisoning Meningitis Epilepsy	Fundi Pica Neck stiffness History, EEG
Ear	Otitis media	Bulging, red ear drums
Throat	Pharyngitis Streptococcal	Sore throat
Chest (referred pain)	Pleurisy	Cough, tachypnea, pain worse on breathing
	Pneumonia	Symptoms & signs, x-ray chest
	Pericarditis Epidemic myalgia	Epidemic
Joints	Rheumatic fever Rheumatoid disease Henoch-Schönleins	Symptoms and signs  Purpura
	Hepatitis Herpes zoster Henoch-Schönleins	Jaundice Shingles Purpura
Urine	Diabetes mellitus Urinary tract infection Nephritis	Glycosuria, ketonuria Pyuria Casts, albuminuria, hematuria
	Renal colic Porphyria	Hematuria, crystalluria Burgundy red urine
Blood	Hemophilia, Purpura Sickle cell disease Hemolytic crisis Electrolyte disturbances	History, bleeding elsewhere Negro History Vomiting, diarrhea, dehydration
	Familial mediterranean fever	
Intra-abdominal		
Liver	Hepatitis	Jaundice, dark urine pale stools, abnormal liver, enzymes and tests
Pancreas	Pancreatitis	Serum and urine amylase
Spleen	Infectious mononucleosis	Abnormal mononuclears Monospot test
Nodes	Mesenteric lymphadenitis	Tender right iliac fossa
Kidney	Urinary tract infection	History, urine, abdomen exam.
	Hydronephrosis Stones	IVP
Testis	Torsion, epididymitis	Swollen testis
Ovary	Mittelschmerz Ovarian cyst or tumor	History Pelvic exam
Fallopian tubes	Salpingitis, ectopic	Adenexal tenderness, missed period
Gallbladder	Cholecystitis	History, physical examination
	Stone	Cholecystogram
Gastrointestinal	Overeating, overdrinking, constipation	History, rectal
	Gastroenteritis, dysentery	Vomiting, diarrhea
	Poisonings	Ingestion
	Regional enteritis	History, diarrhea
	Ulcerative colitis	History, diarrhea
	Peptic ulcer	
	Worms	Stools, ova, parasite
	Milk allergy	History, eczema
Typhoid fever Necrotizing enterocolitis	History Bloody diarrhea, exchange transfusion	

**Table 1 Continued**

**More Common Surgical Causes of Acute Abdomen**

Appendicitis  
Hernia strangulation  
Intussusception  
Meckel's diverticulum  
Volvulus  
Adhesions  
Gallbladder, Kidney  
Trauma — blunt or penetrating  
Perforations

**Psychological** — These are the most common causes of recurrent abdominal pain over a period of more than three months in children over age six and often called 'spastic colon.'

ating through to the back may be associated with nausea, vomiting, diarrhea, distension, and shock in acute pancreatitis. The serum amylase is raised for a few hours, while the amylase in the urine is raised for a few days. Mumps pancreatitis is now rare. The more common causes include: (1) prolonged steroid therapy, (2) trauma-blunt injury, (3) hyperlipidemia, (4) ascaris obstruction of the bile or pancreatic duct, (5) idiopathic, and (6) azathioprine.<sup>3</sup>

9. *Sickle Cell*. A routine sickle cell preparation is indicated for black children with abdominal pain. During a hemolytic crisis the splanchnic circulation is impaired. Pallor and listlessness with abdominal pain, tenderness, distension, and decreased borborygmi accompany an enlarged spleen. The physician should suspect a surgical problem if the pain persists after administration of intravenous fluids.

10. *Primary Peritonitis*. Nowadays this is usually found in children with idiopathic nephrosis. A known nephrotic loses appetite and develops severe abdominal pain with high fever. Paracentesis reveals purulent fluid with pneumococcus or streptococcus which usually responds to penicillin.

11. *Lead Poisoning*. Abdominal pain, constipation and vomiting may follow with pica for lead-containing substances. X-rays may reveal radiopaque lead paint in the abdomen or lead lines in the long bones. A high blood lead level is confirmatory.

12. *Poisoning*. An abrupt onset of generalized illness in the high-risk group aged one to four years with a history of ingestion followed by vomiting, abdominal pain, and diarrhea should suggest poisoning. Some of the more common poisons are: salicylates, arsenicals, aminophylline, bacterial food poi-

**Table 2. Children with Acute Abdominal Pain Admitted to Hospital<sup>1</sup>**

Group	Number
I. Appendicitis confirmed histology	114
II. Preoperative appendicitis	
Mesenteric adenitis	11
Appendix with threadworm	2
Ovarian cyst	1
Leukemia	1
No cause	5
Total	21
III. Medical disorder no operation	
Urinary tract infection	17
Pneumonia	10
Dysentery	6
Paratyphoid	2
Tonsillitis	2
Diabetes	1
Inguinal adenitis	1
Total	43
IV. No diagnosis	119
V. Other surgical emergencies	
Obstructions	11
Injuries	7
Total	18
Grand Total	315

of diagnosis compounded by the misuse of purges, paregoric, or antiemetic lead to a perforation rate of about 80 percent. The classical sequence found in the older child of crampy periumbilical pain (which later moves to the right iliac fossa), followed by vomiting, followed by localized tenderness in the right iliac fossa is acute appendicitis until proven otherwise. Whenever the inflamed appendix is located in other parts of the abdomen or pelvis there will be corresponding sites of tenderness. Practically all these children lose their appetite. The white blood count and temperature usually remain near normal for the first 24 hours, but after perforation both will rise and the vomiting becomes more frequent. The physician should be wary of the "treacherous lull" which may precede perforation. Such a child usually lies quietly in bed with legs drawn up and is reluctant to move. If the appendix is retrocecal, the child walks with a stoop and complains of pain when the thigh is extended. A gentle rectal examination may reveal tenderness or a mass. In about 50 percent a diagnostic fecalith is revealed by x-ray.

If the appendicitis irritates the bladder, confusing pyuria and hematuria may be found. Often the symptoms and signs are highly suggestive but not absolute. Repeated evaluation will usually determine whether the process is progressing or decreasing. If in serious doubt, a laparotomy is better than the risk of a perforated appendix.

2. *Intussusception*. A common cause of intestinal obstruction reaches a peak incidence at age six months. The classical triad of intermittent abdominal pain, vomiting, and blood in stools occurs in all but a small minority. Intermittent abdominal pain will be found in over 90 percent, vomiting in 60 percent, blood in stools in 16 percent and a palpable mass in 24 percent.<sup>5</sup> The infant who intermittently draws up the leg, cries out in pain, becomes pale, and vomits probably has an intussusception. An immediate barium enema is both diagnostic and therapeutic.<sup>5</sup> Delay in diagnosis is disastrous.

3. *Meckel's Diverticulum*. A Meckel's diverticulum occurs in only two percent of the population, about 50 percent containing heterotopic gastric mucosa. In about 30 percent, the fol-

lowing complications may occur: rectal bleeding (either bright red or melena), intestinal obstruction, intussusception, or inflammation (with perforation which mimics an acute appendicitis). A Meckel's diverticulum is frequently suspected, often looked for, but seldom found. Barium studies are usually useless. More recently, technetium scanning has located the heterotopic gastric mucosa.<sup>6</sup>

4. *Trauma*. After an automobile accident or fall from a height or bicycle, abdominal pain should suggest an intra-abdominal catastrophe and all such children should be hospitalized until asymptomatic.<sup>7</sup> The spleen, liver, kidney, pancreas, gastrointestinal or genitourinary tract may be injured or ruptured. Suggestive signs are pallor, tachycardia, tenderness, distension, a fractured rib or pelvis, and hematuria. The girth of the abdomen should be measured. A plain x-ray of the abdomen may reveal free intraperitoneal air. The serum amylase may be raised and the hematocrit may fall. A child with a head injury showing signs of "shock" usually is bleeding in the abdomen. Ringer's lactate should be started, the

**Table 3. Comparison of Appendicitis and Gastroenteritis<sup>2</sup>**

Symptoms	Percent in appendicitis	Percent in enteritis
Abdominal pain	95.2	96.9
Vomiting	56.1	44.3
Nausea	22.0	11.6
Diarrhea	8.4	9.7
Constipation	1.1	2.8
Localized pain on pressure	96.2	16.7
Diffuse pain on pressure		58.5
Rebound tenderness	65.4	
Muscle guarding	61.3	11.3
Pain in Douglas' cul-de-sac	18.6	
Evident intestinal sounds (borborygmi)		25.2
Tympanism		6.6

soning, phenol, corrosives, various houseplants, and mushrooms.<sup>4</sup>

13. *Diabetes*. Diabetic keto-acidosis is notoriously associated with abdominal pain, vomiting, and tenderness. A preceding polyuria and polydipsia is usually found with glycosuria, ketonuria, and hyperglycemia. A child should never be taken to surgery before the urine is examined for sugar, blood, albumin, bile, and pus cells.

14. *Allergy*. Allergy to milk occasionally causes "colic" and bleeding. Substituting a soybean formula for cow's milk can bring dramatic improvement and confirms the diagnosis.

#### Intra-abdominal Surgical Causes

1. *The Acute Appendix*. The narrow lumen of the appendix is easily obstructed. Removal before perforation entails little morbidity; after perforation the peritonitis or abscess leads to significant morbidity and, even in the best centers, a mortality of two percent. In the young, difficulties

blood typed and cross-matched, and a catheter passed if the child cannot void. Call the surgeon at once.

5. *Foreign Bodies in the G.I. Tract.* A variety of objects are swallowed by children but most of them pass through. If they stop in the esophagus (chicken bones are notorious offenders), they can be removed by endoscopy. A pin in the bowel should be watched radiographically, and if it stays in one place for more than five days it has probably pierced the gut and should be removed. In certain areas obstruction by round worms is still common.

6. *Abdominal Mass.* If an abdominal mass is found, the common retroperitoneal causes are either a neuroblastoma, hydronephrosis, multicystic kidney or a Wilms' tumor. An IVP is essential in the workup. The common intraperitoneal causes are enlargement of liver, spleen or uterus, an ovarian cyst, hydrometrocolpos, intussusception, and an appendix abscess. Constipation is common in childhood because of the unfortunate popularity of refined foods and sugar-coated cereals. Fecal impaction is a frequent cause of abdominal pain and the mass in the belly can be remarkable. Occasionally the cause of the constipation might be Hirschsprung's disease.

7. *Stones.* Stones in the gallbladder or urinary tract can cause severe colic. Gallstones may be suspected when there is tenderness in the right upper quadrant, signs of obstructive jaundice, and a history of a hemolytic disease. X-rays or cholecystograms will confirm their presence. Urinary tract stones are suggested by abdominal pain, fever, pyuria, hematuria, family history of cystinuria, or other metabolic defects. Most calculi are radiopaque but uric acid and xanthine stones are radiolucent.

8. *Surgical Problems in Infancy and Newborn.* In one series of 87 infants<sup>8</sup> from birth to one year, the following surgical disorders were found: strangulated hernia 36 percent; malformations 20 percent; intussusception 16 percent; perforation nine percent; obstruction and volvulus eight percent; ascariis one percent and acute appendicitis one percent. Biliary vomiting occurs if the obstruction is below the ampulla of Vater or with peritonitis. Distension is common but rigidity unusual. One should always examine the

hernial orifices and request radiography for signs of obstruction or intussusception.

*Obstruction in the Newborn* may be due to a meconium plug, atresia of the duodenum, ileum, or rectum, meconium ileus of fibrocystic disease or with Hirschsprung's disease. The classical signs are bilious vomiting, abdominal distension, and failure to pass meconium. Suspect an obstruction if the mother has hydramnios, especially if the amniotic fluid is green and the newborn has not passed meconium. X-rays of the abdomen will usually reveal the site of obstruction. Early diagnosis before aspiration or dehydration is mandatory since the ideal time for surgery is in the first 24 hours.

### Gastrointestinal Bleeding

Bleeding from above the ileocecal valve produces black, tarry stools. Bleeding from the small bowel or colon colors the stools brick red. Bright red blood on the outside of the stool, on paper, or in the toilet bowl usually comes from the lower colon or anorectal area. The most common cause of bleeding by far is the fissure in ano with its history of constipation, painful defecation, and a streak of blood on the hard stool.

One should always test with guaiac or hematest to verify that blood is present and look for signs of bleeding elsewhere. If gastrointestinal bleeding is diagnosed and significant, a nasogastric tube will determine if there is blood in the stomach. Other investigations include barium studies, endoscopy, and selective celiac and superior mesenteric arteriography. The following are the more common causes of gastrointestinal bleeding in children:

- A. Swallowed blood, especially
  - from a nose bleed
  - Esophageal varices
  - Peptic ulcer
  - Intussusception
  - Meckel's diverticulum
  - Blind gut
  - Tumors and polyps
  - Peutz-Jegher's syndrome
- B. Dysentery
  - Henoch-Schönlein
  - Regional enteritis
  - Ulcerative colitis
  - Anal fissure
- C. Generalized bleeding disorder

### Discussion

After a detailed history, the child with abdominal pain must be fully examined, looking for infections of the respiratory, gastrointestinal, and urinary tract. Exclude raised intracranial pressure and remember that constipation commonly causes cramps. Examine for strangulated hernia and note presence of abdominal scars which may indicate an obstruction secondary to adhesions. Careful palpation and rectal examination will usually identify a mass or inflamed appendix which at times will be confused with a mesenteric lymphadenitis. If an intussusception is suspected, immediate barium enema will be both diagnostic and therapeutic. The urine must always be examined for red and white blood cells, sugar, and bile. A sickle cell preparation should be ordered for black children. When the diagnosis is in doubt after initial examination, the evaluation is repeated after an hour, consultation arranged, or the child admitted to the hospital. The anxious child resisting examination can be relaxed by a rapidly acting barbiturate capsule inserted into the rectum. The child should never be given a purgative, antiemetic, powerful analgesic, or antibiotic before the diagnosis is definite. These will mask symptoms and signs, delay diagnosis, and expedite the pathological process. A careful history and physical examination, together with laboratory studies, provide a rational basis for effective management in most cases.

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