Table 2. Clinical Features of Selected Causes of Acute Abdominal Pain in Children

Condition	*Clinical findings*	*Age*	*Comments*
Abdominal migraine	Anorexia, nausea, vomiting, headache, photophobia	3 to 10 years	Boys and girls equally affected[8]
Colic	Persistent crying without apparent cause	Younger than 3 months	Nonacute abdominal examination
Constipation	Hard, infrequent stooling	All age groups	May be most common cause of abdominal pain[1]
Gastroenteritis or colitis	Diarrhea, with vomiting or fever	All age groups	*Campylobacter*, *Cryptosporidium*, *Escherichia coli*, *Salmonella*, *Shigella*, rotavirus
Hirschsprung disease	Constipation, severe diarrhea, bowel obstruction, perforation, sepsis	Infant	Delayed passage of meconium (more than 24 hours) in about 57% of cases[9]
Inflammatory bowel disease	Bloody diarrhea	Primarily adolescents	Childhood prevalence of Crohn disease is 43 per 100,000; of ulcerative colitis, 28 per 100,000[10]
Omental infarction	Lower abdominal pain, vomiting, diarrhea	School-aged, overweight males[11]	Self-limiting, diagnosed on computed tomography[12]
Ovarian cyst	Lower abdominal pain	Adolescent females	Types include hemorrhagic, ruptured, and ovulatory, and torsion of a cyst
Pneumonia	Cough, shortness of breath, fever, tachypnea	All age groups	Lower lobe pneumonia
Pyelonephritis	Flank tenderness, fever, nausea and vomiting	All age groups	Oral antibiotics for 10 to 14 days as effective as intravenous antibiotics[13]
Sexually transmitted infection	Vaginal or penile discharge, fever	Adolescent	*Chlamydia trachomatis*, *Neisseria gonorrhoeae*
Streptococcal pharyngitis	Sore throat, fever	Older than 3 years	Rapid strep test or culture
Urinary tract infection	Dysuria, urinary frequency, urinary urgency, hematuria	All age groups, primarily females and uncircumcised infants	Point prevalence in children older than one year is 7.8%[14]

Information from references 1, and 8 through 14.

Common or critical causes of vomiting in the pediatric age range

Neonate	Infancy	Childhood	Adolescence
Physiologic reflux or GERD*	Physiologic reflux or GERD*	Gastroenteritis*	Gastroenteritis*
Dietary protein intolerance* or allergy (eg, milk protein-induced enteritis)	Gastroenteritis*	Streptococcal pharyngitis*	Posttussive* (asthma, infection, foreign body)
Pyloric stenosis	Dietary protein intolerance* or allergy (eg, milk protein-induced enteritis)	Posttussive* (asthma, infection, foreign body)	Functional dyspepsia*
Necrotizing enterocolitis	Obstruction (eg, intussusception, malrotation, Hirschsprung disease, pyloric stenosis)	Functional dyspepsia*	GERD*
Malrotation with midgut volvulus	Inborn errors of metabolism (eg, hereditary fructose intolerance, galactosemia, organic acidemias, urea cycle disorders)	GERD*	Streptococcal pharyngitis
Congenital atresias, stenoses, webs	Infant rumination	Peptic ulcer	Pregnancy
Gastroenteritis	Otitis media	Cyclic vomiting	Bulimia
Hirschsprung disease	Urinary tract infection	Psychogenic	Drugs of abuse
Inborn errors of metabolism (eg, organic acidemias, urea cycle disorders, galactosemia, hereditary fructose intolerance)	Toxic ingestion	Increased intracranial pressure (tumor, hydrocephalus, subdural hematoma from child abuse)	Suicide attempt
Feeding intolerance (may be associated with cardiac, pulmonary, renal, or neuromotor disorders)	Increased intracranial pressure (subdural hematoma from child abuse, hydrocephalus)	Otitis media	Peptic ulcer
Adrenal crisis	Hepatobiliary disease	Urinary tract infection	Appendicitis
Hepatobiliary disease	Renal disease (obstructive uropathy, renal insufficiency)	Toxic ingestion	Psychogenic
Medical child abuse	Pancreatitis	Diabetic ketoacidosis	Gastroparesis
	Adrenal crisis	Eosinophilic esophagitis	Intracranial mass
	Medical child abuse	Obstruction (eg, malrotation, intussusception, incarcerated hernia)	Cyclic vomiting
		Hepatobiliary disease	Eosinophilic gastroenteritis/esophagitis
		Renal disease (renal insufficiency)	Diabetic ketoacidosis
		Pancreatitis	Obstruction (eg, malrotation, intussusception, incarcerated hernia)
		Gastroparesis	Hepatobiliary disease
		Adrenal crisis	Renal disease (renal insufficiency)
		Medical child abuse	Pancreatitis
			Adolescent rumination syndrome
			Adrenal crisis
			Medical child abuse

GERD: gastroesophageal reflux disease
*Common cause in this age group

Key elements of the history and physical examination in a pediatric patient with nausea or vomiting

Symptoms	Diagnostic considerations
History	
Contacts with vomiting or diarrhea	▪ Gastroenteritis
Acute onset of diarrhea and fever	▪ Viral gastroenteritis (if typical features) ▪ Infection (sepsis, infectious enteritis/colitis, appendicitis, IBD) ▪ Hirschsprung-associated enterocolitis
Early morning vomiting	▪ Pregnancy (adolescent females), increased ICP, or cyclic vomiting syndrome
Vomiting without nausea	▪ Increased ICP
Effortless vomiting	▪ Gastroesophageal reflux ▪ Rumination syndrome
Chronic or recurrent infections	▪ Immunodeficiency ▪ Tracheoesophageal fistula (infant with recurrent pneumonia)
Periodic episodes of vomiting	▪ Cyclic vomiting syndrome ▪ Inborn error of metabolism ▪ Migraine (usually with headache and family history) ▪ Porphyria, carcinoid, pheochromocytoma, familial dysautonomia
Vomiting triggered by specific foods	
Vomiting begins within minutes to two hours of ingesting the food, usually with cutaneous or respiratory symptoms	▪ Food allergy (eg, anaphylaxis)
Subacute or chronic, with diarrhea	▪ Food protein-induced enteropathy or FPIES
Triggered by introduction of lactose	▪ Galactosemia
Triggered by introduction of fructose or sucrose	▪ Hereditary fructose intolerance
Undigested food in vomitus	▪ Achalasia
Heartburn	▪ Esophagitis (peptic or eosinophilic)
Physical examination	
Marked abdominal distension; visible bowel loops; bilious vomitus (green or yellow); absent bowel sounds or increased high-pitched bowel sounds ("borborygmi"); or feculent (with the odor of feces)	▪ Intestinal obstruction
Focal tenderness	▪ RLQ: Appendicitis or Crohn disease ▪ RUQ: Gallbladder disease, pancreatitis ▪ Costovertebral angle: Pyelonephritis ▪ Epigastric: Pancreatitis, peptic ulcer disease/gastritis
Hepatomegaly, splenomegaly, jaundice	▪ Hepatitis, viral infection (eg, EBV), metabolic disorders
Ataxia, dizziness, nystagmus	▪ Vestibular neuronitis or acute cerebellar ataxia
Papilledema	▪ Increased ICP
Ambiguous genitalia	▪ Congenital adrenal hyperplasia with vomiting due to adrenal crisis
Unusual odor	▪ Inborn error of metabolism
Enlarged parotid glands	▪ Bulimia

IBD: inflammatory bowel disease; ICP: intracranial pressure; FPIES: food protein-induced enterocolitis syndrome; RLQ: right lower quadrant; RUQ: right upper quadrant; EBV: Epstein-Barr virus.

Courtesy of Dr. Carlo Di Lorenzo.

Clinical utility of various diagnostic studies in the diagnosis of vomiting in a child

Name of study	Utility
Complete blood count	Anemia and iron deficiency may be associated with obstruction, IBD, gastritis, and ulcer disease.
	Elevated white blood cell count is associated with bacterial infections and sepsis.
Electrolytes, BUN/Creatinine	Electrolyte abnormalities are associated with pyloric stenosis, adrenal insufficiency, and metabolic diseases.
	Elevated BUN/Creatinine are seen in renal disease.
Liver function tests	Elevated AST, ALT, total bilirubin, and GGT are seen in liver and gallbladder disease.
Amylase, lipase	Elevated in pancreatitis.
Plasma ammonia, urine reducing substances	If an inborn error of metabolism is suspected. Ammonia is elevated in urea cycle disorders and organic acidemias. Non-glucose reducing substances are usually present in the urine in galactosemia or hereditary fructose intolerance.
Plain radiograph of the abdomen	If intestinal obstruction is suspected.
Upper gastrointestinal series	If an anatomic abnormality of upper GI tract is suspected (eg, neonate with bilious vomiting).
CT of the head	If increased intracranial pressure is suspected (rule out mass).
Abdominal ultrasound	If pyloric stenosis or intussusception are suspected; also useful for evaluation of liver, gallbladder, kidneys, and pancreas.
Radionucleotide gastric emptying study	If gastroparesis is suspected.
Endoscopy	If peptic disease, eosinophilic esophagitis, IBD, or other causes of intestinal inflammation are suspected.

IBD: inflammatory bowel disease; BUN: blood urea nitrogen; AST: aspartate aminotransferase; ALT: alanine aminotransferase; GGT: gamma-glutamyl transpeptidase; GI: gastrointestinal; CT: computerized tomography.

Etiology of diarrhea in children by age

Cause	Infants and young children	Older children and adolescents
Gastrointestinal infections	Viruses* Bacteria* Parasites	Viruses* Bacteria* Parasites
Nongastrointestinal infections (parenteral diarrhea)	Otitis media* Urinary tract infections* Other systemic infections	Systemic infections Staphylococcal toxic shock syndrome¶
Dietary disturbances	Functional diarrhea (eg, excess fructose and/or sorbitol intake [fruit juices])/overfeeding* Food allergy* Starvation stools*	Starvation stools*
Anatomic abnormalities	Intussusception¶ Hirschsprung-associated enterocolitis (± toxic megacolon¶) Partial bowel obstruction¶ Blind loop syndrome (also in patients with dysmotility) Intestinal lymphangiectasis Short gut syndrome	Appendicitis¶ Partial obstruction¶ Blind loop syndrome
Inflammatory bowel disease	Early onset inflammatory bowel disease (rare, monogenic)	Ulcerative colitis (± toxic megacolon¶) Crohn disease (± toxic megacolon¶)
Malabsorption or increased secretion	Cystic fibrosis Celiac disease Disaccharidase deficiency (eg, lactase deficiency due to infectious diarrhea)* Acrodermatitis enteropathica Congenital secretory diarrhea	Celiac disease Disaccharidase deficiency (primary or secondary)* Acrodermatitis enteropathica Neuroendocrine secretory tumors
Immunodeficiency	Severe combined immunodeficiencies and other genetic disorders HIV infection	HIV infection
Endocrinopathy	Congenital adrenal hyperplasia	Hyperthyroidism Hypoparathyroidism
Miscellaneous	Antibiotic-associated diarrhea* *Clostridioides* (formerly *Clostridium*) *difficile* colitis (± pseudomembranous colitis¶) Toxins$^{\Delta}$ Hemolytic uremic syndrome¶ Neonatal drug withdrawal	Antibiotic-associated diarrhea* *C. difficile* colitis (± pseudomembranous colitis¶) Toxins$^{\Delta}$ Irritable bowel syndrome* Psychogenic disturbances*

HIV: human immunodeficiency virus.
* Common cause.
¶ Life-threatening cause.
Δ Potential toxins include foodborne toxin disease, poisonous plants or mushrooms, and organophosphates or carbamates.

Courtesy of Gary R Fleisher, MD.

Important aspects of the physical examination in the evaluation of poor weight gain in children

Examination clues	Potential significance
Vital signs	
Hypotension	Adrenal or thyroid insufficiency
Hypertension	Renal disease
Tachypnea/tachycardia	Increased metabolic demands
General appearance	
Pallor	Anemia
Drooling	Oral motor dysfunction
Cachexia, temporal wasting, sparse hair or alopecia	Significant malnutrition
Inadequate adiposity	Indicator of nutritional inadequacy
Dysmorphic features	Clinical or genetic syndrome associated with poor weight gain
Head and neck	
Microcephaly	Neurologic disorder, fetal alcohol syndrome
Delayed closure of fontanelle	Vitamin D deficiency, hypothyroidism
Short palpebral fissures	Fetal alcohol syndrome
Cataracts	Congenital infection, galactosemia
Papilledema	Increased intracranial pressure
Smooth philtrum	Fetal alcohol syndrome
Aphthous stomatitis	Crohn disease
Thin vermillion border	Fetal alcohol syndrome
Oropharyngeal lesions (eg, caries, tongue enlargement, mandibular hypoplasia, tonsillar hypertrophy, defects in soft or hard palate)	May interfere with eating
Delayed tooth eruption	Delayed bone age
Thyroid enlargement	Thyroid disease
Low hairline	Genetic syndrome (eg, Klippel-Feil)
Chest	
Wheezing, crackles, prolonged expiratory phase, hyperexpansion	Cystic fibrosis, asthma
Cardiac murmur	Congenital or acquired heart disease
Abdomen	
Abdominal distension, hyperactive bowel sounds	Malabsorption
Hepatosplenomegaly	Liver disease, glycogen storage disease, malignancy
Genitourinary	
Genitourinary abnormalities	Endocrinopathy
Rectal fistulae, large perianal skin tags	Crohn disease
Musculoskeletal	
Clubbing	Chronic hypoxia due to cardiac or pulmonary disorders
Bony deformities (craniotabes, beading of the ribs, scoliosis, bowing of the legs or distal radius and ulna, enlargement of the wrist)	Rickets
Edema	Protein deficiency
Neurologic	
Abnormal deep tendon reflexes	Cerebral palsy
Hypotonia, weakness, spasticity	May be associated with oral motor dysfunction
Neuropathy	Vitamin deficiencies: B12, B3 (niacin), B6 (pyridoxine), E (tocopherol)
Skin and mucous membranes	
Scaling skin	Zinc deficiency
Candidiasis	Immune deficiency
Spoon-shaped nails	Iron deficiency
Cheilosis	Vitamin deficiency: B2 (riboflavin), B3 (niacin), or B6 (pyridoxine)
Chronic diaper rash	Possible neglect
Bruises in characteristic patterns	Possible abuse

Data from:

1. *Frank D, Silva M, Needlman R. Failure to thrive: Mystery, myth and method. Contemp Pediatr 1993; 10:114.*
2. *American Academy of Pediatrics Committee on Nutrition. Failure to thrive. In: Pediatric Nutrition, 7th ed, Kleinman RE, Greer FR (Eds), American Academy of Pediatrics, Elk Grove Village, IL 2014. p.663.*

Physical findings of volume depletion in infants and children

Finding	Mild (3 to 5%)	Moderate (6 to 9%)	Severe (≥10%)
Pulse	Full, normal rate	Rapid	Rapid and weak **or** absent
Systolic pressure	Normal	Normal to low	Low
Respirations	Normal	Deep, rate may be increased	Deep, tachypnea **or** decreased to absent
Buccal mucosa	Tacky or slightly dry	Dry	Parched
Anterior fontanelle	Normal	Sunken	Markedly sunken
Eyes	Normal	Sunken	Markedly sunken
Skin turgor	Normal	Reduced	Tenting
Skin	Normal	Cool	Cool, mottled, acrocyanosis
Urine output	Normal or mildly reduced	Markedly reduced	Anuria
Systemic signs	Increased thirst	Listlessness, irritability	Grunting, lethargy, coma