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Lower Gastrointestinal bleeding in children

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Lower gastrointestinal bleeding (LGIB)

- Lower gastrointestinal (LGI) bleeding is defined as bleeding with an origin distal to the ligament of **Treitz**.
- Although the passage of blood rectally in a child is very alarming to parents and is therefore promptly brought to the physician's attention, blood losses are **usually mild to moderate and are self-limited.**
- Bleeding is severe enough to warrant hospital admission in **5 to 10** percent of cases
- The clinical presentation of LGI bleeding depends mainly on the rate and quantity of blood loss and may range from stools positive for fecal occult blood test to a life-threatening hemorrhage presenting with profound shock.

- Proper history-taking and thorough physical examination are of paramount importance to help differentiate the numerous diagnostic possibilities of LGI bleeding in children.
- The spectrum of disease to be considered is very different from that of adults. The pediatrician should never rush toward diagnostic work-up at the expense of basic care of the child.
- **Caution is necessary for the use of diagnostic tests, especially in very young children**. It should be emphasized that adequate history-taking and detailed clinical examination are two essential steps before performing any diagnostic investigation.

- The causes of LGI are numerous and depend strongly **on the age of the child**.

- Anal fissure secondary to constipation, intussusception, Meckel diverticulum, juvenile polyps, and inflammatory bowel disease (IBD) are the most commonly found causes of LGI in the pediatric patient.

- Many of the disorders are encountered in more than one of these age groups. In each age group, there are other disorders that are less common but important to identify because they may be life-threatening and/or require specific treatment. The spectrum of causes is different in **other parts of the world**.

LGI bleeding can be revealed in four ways:

- **Hematochezia,** which is the passage of bright red blood per rectum, either isolated or mixed with stools, indicating an origin low in the gastrointestinal tract, most commonly the colon.
- **Melena,** which is the passage per rectum of black, tarry, and foulsmelling stools, indicating a source of bleeding from above the ileocecal valve. Melena can also be seen in cases of bleeding from the proximal large bowel provided that the colonic transit time is slow.
- **Occult gastrointestinal bleeding** with symptoms limited to pallor or fatigue, detected by discovery of iron deficiency or iron deficiency anemia or by testing for the presence of fecal blood.
- **Symptoms of severe blood loss,** such as malaise, tachycardia, or even profound shock without any objective sign of bleeding.

- Differential diagnosis for the clinician should be approached with a focus on the following primary factors:

1. **age**, because many causes of LGI bleeding are specific to certain age groups
2. **location of the bleeding** in relation to the characteristics of the stools
3. **amount of blood passed**
4. **condition of the patient**: presence or absence of associated symptoms and physical signs

- Is It Blood?
- Is It Blood From the Child?
- Is It Blood From the Gastrointestinal Tract?
- Is It Blood From the LGI Tract?

Is it blood ?

- In most cases, the clinician should examine the stool directly and test it for blood.
- This is because **several foods and medicines** may give stool a bloody appearance

Red: candy, fruit punch, beets, laxatives, phenytoin, rifampin
Black: bismuth, activated charcoal, iron, spinach, blueberry, licorice

Common foods and drugs that can cause the stool to appear bloody

Red coloration, similar to fresh blood
Certain antibiotics*
Beets
Flavored gelatin (red colored)
Kool-Aid or fruit punch (red colored)
Red licorice
Red-dyed snack foods (eg, spicy "red-hot" snacks)
Black coloration, similar to melena
Bismuth preparations (Pepto-Bismol, Maalox, Kaopectate)
Iron supplements¶
Activated charcoal
Chocolate
Black licorice
Blueberries
Large quantities of some dark green foods
False-positive results to fecal occult blood test
Rare red meat
Peroxidase-containing vegetables (turnips, horseradish, broccoli, cauliflower, and cantaloupe)

Is the child hemodynamically stable?

- Children with evidence of hemodynamic instability (tachycardia, orthostasis, hypotension, poor peripheral perfusion) and/or altered sensorium should be managed emergently for shock.
- Sepsis should be considered in those with fever or conditions that predispose to infection.
- Laboratory tests for hemodynamically unstable patients include a complete blood count (CBC), routine chemistries, coagulation studies, and blood type and crossmatch (in case transfusion will be needed)

Clinical features suggesting a severe GI bleeding are:

- Melena or hematochezia
- Heart rate >20 beats per minute above the mean heart rate for age
- Prolonged capillary refill time
- Decrease in hemoglobin of more than 2 g/dL
- Need for fluid bolus
- Need for blood transfusion (given if hemoglobin <8 g/dL)

Is the blood from the lower GI tract?

- Red blood found in a child's stool is most often from the anus or lower GI tract but occasionally has an upper GI source. The appearance of the bloody stool helps to distinguish between these possibilities:
- **Hematochezia** (the passage of bright red blood per rectum) usually suggests **LGIB** and is typically from the colon or anus.
- Rarely, hematochezia can be caused by upper gastrointestinal bleeding (**UGIB**), especially in an infant or other individual with rapid intestinal transit time, or because of a massive UGIB in an older individual.
- Thus, the possibility of UGIB should be considered in an individual with hematochezia and hemodynamic compromise or in a child with risk factors for UGIB, such as underlying liver disease.

- **Melena** (black, tarry stools) usually suggests UGIB. It also may be caused by blood from the nose that is swallowed or bleeding from the proximal small bowel.
- Black-appearing stools also may be caused by certain medications (eg, bismuth or iron) or foods (large amounts of dark green leafy vegetables).
- These black stools can be distinguished from melena by testing the stool for blood.

What are the most likely causes of the LGIB in this patient?

- The diagnostic possibilities depend on the **patient's age** and **individual characteristics**, assessed by a focused history and physical examination.

NEONATES

- ***The most common diagnoses to consider in newborns presenting with LGIB are:***

- Swallowed maternal blood
- Anal fissures(trauma secondary to vigorous wiping, rectal therapy such as glycerin suppositories, thermometer-related injury, or rectal irrigations)
- Necrotizing enterocolitis (NEC)
- Malrotation with midgut volvulus
- Hirschsprung-associated enterocolitis

Swallowed maternal blood

- In a newborn infant with rectal bleeding, the rectal blood should be tested to determine whether it comes from the infant or whether it represents maternal blood, which may have been swallowed during delivery or ingested during breastfeeding from cracked nipples.
- This is accomplished using the **Apt test** (hemoglobin alkaline denaturation test), which detects fetal hemoglobin (HbF).

- In addition, the following disorders can present during the **neonatal period** in addition to older age groups:

- Coagulopathy(Vitamin K-deficient bleeding , Neonatal immune-mediated thrombocytopenia)
- Brisk upper GI bleeding (UGIB)
- Vascular malformations
- Gastric or duodenal ulcer
- GI duplication cyst

BOX 13.8 Neonatal Differential Diagnosis

Hematemesis:
Swallowed maternal blood
Stress ulcer
Gastritis
Duplication cyst
Vascular malformation
Vitamin K deficiency
Hemophilia
Maternal idiopathic thrombocytopenic purpura
Maternal nonsteroidal antiinflammatory drug (NSAID)
Trauma (nasogastric tube, nasal suction)

Hematochezia:
Swallowed maternal blood
Dietary protein intolerance
Infectious colitis
Necrotizing enterocolitis
Hirschsprung disease and enterocolitis
Malrotation with volvulus
Duplication cyst
Vascular malformation
Hemophilia
Maternal idiopathic thrombocytopenic purpura
Maternal NSAID
Anal fissure
Intussusception

INFANTS, CHILDREN, AND ADOLESCENTS

- ***Common causes of LGIB after the neonatal period include***:

- Anal fissures (especially around the introduction of solid foods or cow's milk into the diet
- Toilet training
- School entry
- Food protein-induced proctocolitis (sometimes called allergic proctocolitis)
- Infectious colitis
- Inflammatory bowel disease (IBD)
- Intussusception

Food protein-induced proctocolitis

- Food protein-induced proctocolitis (sometimes called allergic proctocolitis) is an inflammatory reaction usually caused by ingestion of cow's milk or soy proteins and is a common cause of bloody stools in infants. It occurs almost exclusively in infants and usually resolves within 6 to 18 months of age.
- It can occur in infants who are formula fed or, less commonly, in breastfed infants because of cow's milk in the mother's diet. Affected infants have loose stools, often with occult or gross blood, but are otherwise healthy. Although cow's milk is the most common trigger in Western populations, up to 25 percent of patients with cow's milk protein intolerance will have a cross-reaction to soy protein and a few infants are sensitive to other food proteins.
- Treatment involves meticulous elimination of the causative protein from the mother's diet if the infant is breastfed or the use of a casein-hydrolysate formula. Approximately 10 percent of infants are sensitive to the casein-hydrolysate formula and require an amino acid-based formula. The intolerance usually resolves by 18 months of age, at which time, an unrestricted diet can be resumed.

Infectious colitis

- A number of pathogens can cause LGIB in preschool children; *Salmonella*, *Shigella*, *Campylobacter*, *Escherichia coli* 0157:H7, and *Clostridioides difficile* (the most common) parasites such as *Entamoeba histolytica*
- viruses such as adenovirus, cytomegalovirus, herpes simplex virus, and coronavirus disease 2019 (COVID-19)
- potential pathogens in immunocompromised children include *Mycobacteria* and *Aeromonas hydrophila*, although *Aeromonas* infection typically presents with nonbloody diarrhea (but can be associated with bloody diarrhea in some cases).
- *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, and *Plesiomonas shigelloides* also occasionally produce bloody stools.

Inflammatory bowel disease

- **Children and adolescents** – IBD often presents in school-aged children and adolescents.
- IBD is comprised of two major disorders: ulcerative colitis, which affects only the colon, and Crohn disease (CD), which can involve any portion of the GI tract.
- The most common presenting symptoms of IBD are abdominal pain, fever, and diarrhea, which occurs in approximately 80 percent of patients with CD.
- Approximately 20 percent of patients with CD and approximately 95 percent of patients with ulcerative colitis will have visible rectal bleeding.
- The peak incidence of IBD is in late adolescence and early adulthood.

Intussusception

- Intussusception is the most common cause of intestinal obstruction in infants between 6 and 36 months of age. Approximately 60 percent of affected children are younger than one year old, and 80 percent are younger than two years.
- In this age group, intussusception usually is idiopathic and occurs in the ileocecal region, in contrast with older children, in whom a polyp, Meckel diverticulum, or other lesion often serves as a lead point.
- The clinical presentation, diagnosis, and management of intussusception are discussed in detail in a separate topic review.

- The stool contains gross or occult blood in most but not all cases and sometimes has the appearance of "currant jelly."
- Ultrasonography is the method of choice to detect intussusception in most institutions. The diagnosis can also be established with an air or water-soluble contrast enema, which also can treat ("reduce") the intussusception in 75 to 90 percent of children in whom a lead point is not present.
- The choice of procedure varies with the experience of the radiologist.

Juvenile polyps

- Juvenile polyps are benign hamartomas, which typically occur between the ages of 2 and 10 years, with a peak at three to four years. Patients usually present with painless rectal bleeding, with or without mucus ; a few may have lower abdominal pain from traction on the polyp.
- Juvenile polyps tend to be pedunculated rather than sessile and may autoamputate, which results in significant bleeding. On occasion, polyps in the rectum present as prolapsed tissue.
- Polyps usually bleed after injury by fecal passage, and this usually results in **bright red blood** on the outside of the stool. If the polyp is located proximally, the blood will be darker and found in the core of the stool.
- In children and adolescents, approximately 85 percent or more of polyps are juvenile (hamartomas), 10 percent or less are adenomas, and 3 percent are hyperplastic. Adenomatous polyps occur more frequently in older children and adolescents or in the setting of a polyposis syndrome, and current guidelines for evaluation, management, and follow-up should be followed

- **Less common causes:**
- ***Coagulopathy***

  Vitamin K deficiency (disorders with fat malabsorption (eg, cystic fibrosis or cholestatic liver diseases such as biliary atresia or alpha-1 antitrypsin deficiency)

  Hemophilia

  von Willebrand disease

- ***Gastrointestinal duplication cyst***

GI duplication cysts can be found at any level of the GI tract and frequently do not communicate with the bowel lumen**. Gastric mucosa (present in approximately 50 percent of duplication cysts) can ulcerate, perforate, and form fistulas.** Formation of a gastric duplication-colonic fistula is unusual but can result in an LGIB . In addition, a duplication cyst that communicates with the intestine can result in bleeding into the GI tract. GI duplication cysts tend to present in infancy if they are symptomatic, but they may present in any age group and often remain asymptomatic.

- ***Hemolytic-uremic syndrome***

- HUS is characterized by the simultaneous occurrence of microangiopathic hemolytic anemia, thrombocytopenia, and acute kidney injury. The highest rates are in children under the age of five years. Most cases are associated with a prodromal infection with an enteropathogen producing a Shiga-like toxin, such as *E. coli* 0157:H7, in which case, diarrhea is a prominent feature and is frequently bloody. The HUS typically develops 5 to 10 days after the onset of the diarrhea. Thus, HUS can be considered a complication of infectious colitis rather than an independent cause of colitis.

- ***Immunoglobulin A vasculitis***

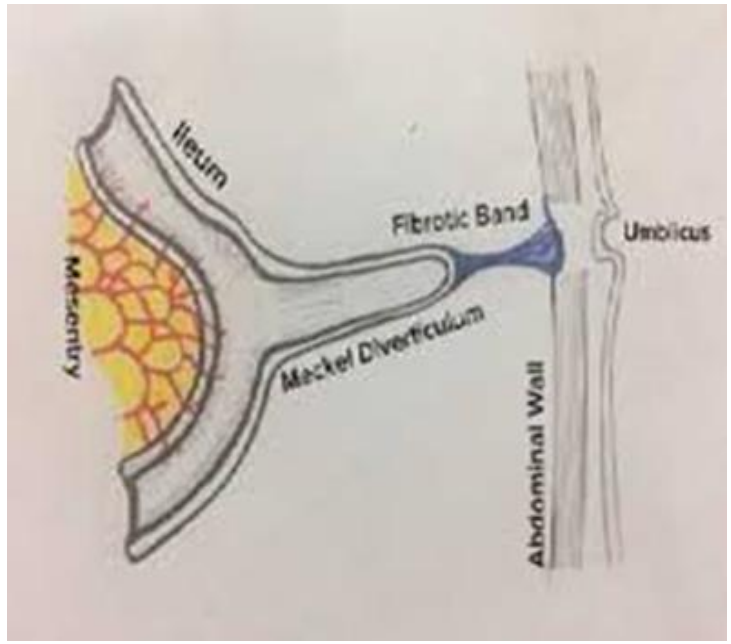
- Immunoglobulin A (IgA) vasculitis (formerly called Henoch-Schönlein purpura [HSP]) is a systemic vasculitis of unclear etiology characterized by palpable cutaneous purpura (picture 1), abdominal pain, and arthralgias. It is primarily a childhood disease that occurs between the ages of 3 and 15 years. Up to 50 percent of patients develop gross or occult GI bleeding, and up to 50 percent develop kidney disease. The abdominal pain in this disorder is due to the presence of purpuric lesions within the GI tract or may be caused by intussusception, in which the involved bowel serves as a lead point.

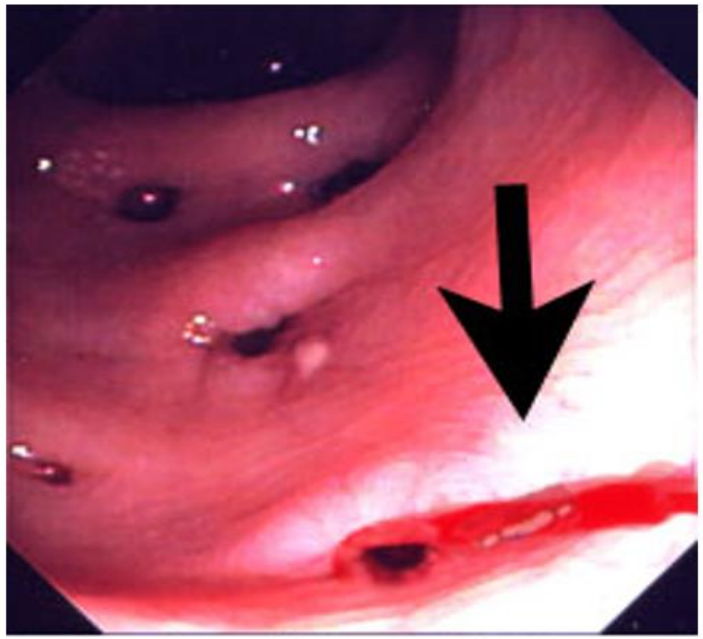
Lymphonodular hyperplasia

- Lymphonodular hyperplasia of the distal colon is a common finding in infants and young children who undergo endoscopy or radiographic studies of the intestinal tract . The etiology is unknown. Many consider it to be a normal finding , whereas others believe it to be an immunologic response to a variety of stimulants. It occurs frequently in children with food protein-induced colitis, in whom it may be an abnormal finding at colonoscopy.

- Lymphonodular hyperplasia may lead to mucosal thinning and predisposes to ulceration, which may cause hematochezia . Blood loss is usually minimal and painless but is present in multiple stools . The use of stool softeners may help to reduce blood loss and minimize parental anxiety. Lymphonodular hyperplasia resolves spontaneously over time and is an unlikely source of bleeding in older children.

- ***Meckel diverticulum***
- Meckel diverticulum results from incomplete obliteration of the omphalomesenteric duct.
- It is usually asymptomatic but may cause painless rectal bleeding, which may be chronic and insidious, or acute and massive. The bleeding is often caused by mucosal ulceration of adjacent small bowel tissue due to acid produced by ectopic gastric tissue within the diverticulum.
- Other complications associated with a Meckel diverticulum are obstruction, perforation, diverticulitis, and intussusception. Sixty percent of pediatric patients having complications from a Meckel diverticulum are younger than two years of age.





Bleeding diverticulosis

Meckel's diverticulum

An asymptomatic Meckel's diverticulum (M) found during an open abdominal wall reconstruction.

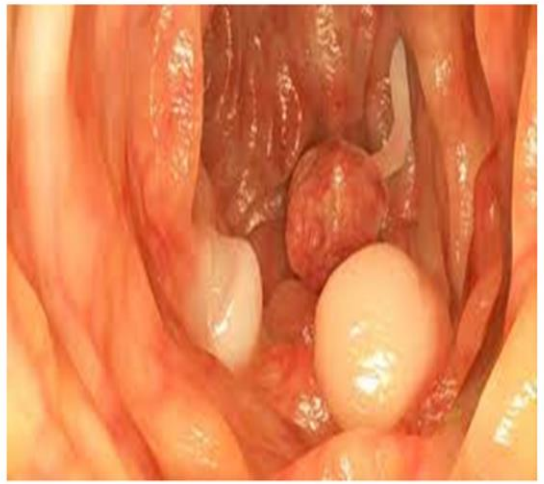
- **Solitary rectal ulcer syndrome**

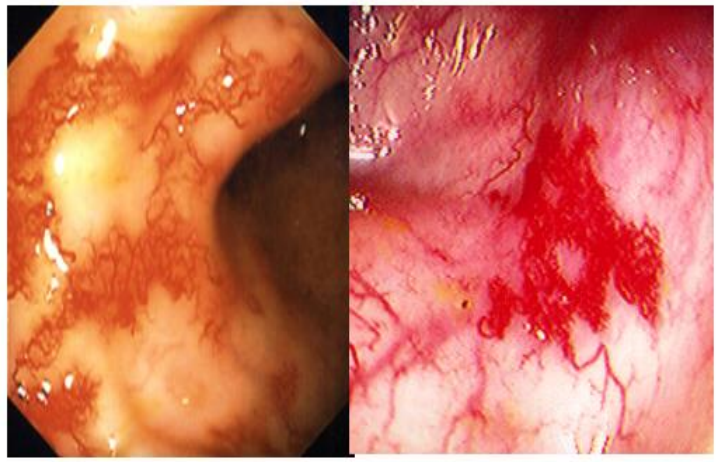
- Solitary rectal ulcer syndrome is a benign but potentially chronic ulcerative disease of the rectum that is infrequent in childhood. Pediatric cases usually present in school-age children or adolescents .
- It tends to present with **bleeding, passage of mucus, straining during defecation, and a sense of incomplete evacuation .**
- Treatment of associated constipation and strategies to avoid dysfunctional stooling or excessive straining may help alleviate this condition

Rare causes

- Vascular malformations – eg, associated with hereditary hemorrhagic telangiectasia (Osler-Weber-Rendu syndrome) or blue rubber bleb nevus syndrome .

- Adenomatous polyps – Patients with adenomatous polyps should be further evaluated for familial adenomatous polyposis or one of its variants because of a higher lifetime risk of developing colorectal cancer. Adolescents with isolated or nonfamilial adenomatous polyposis associated colonic adenomas should undergo careful evaluation of their family history for possible Lynch syndrome/hereditary nonpolyposis colorectal cancer and also require follow-up surveillance colonoscopy .





Colonic angiodysplasia

- ***GI stromal tumors (GIST):***
- GIST are often associated with Carney syndrome (GIST, pulmonary chondromas, paraganglioma, adrenal cortical adenoma, and esophageal leiomyoma) and are located most frequently in the stomach, especially in the antrum in pediatric patients.
- GIST have been reported more frequently over the course of a patient's lifetime in patients with neurofibromatosis type 1, but, in this condition, they tend to have a more benign course and can be located in the small intestine rather than in the stomach.
- GIST in pediatric patients are frequently associated with metastatic disease at a higher frequency than in adults.

- ***Typhlitis***

- Typhlitis is an enterocolitis of the ileocecal region that occurs in patients with neutropenia, most commonly in children with hematologic malignancies. It presents with fever, abdominal pain, and, sometimes, bloody diarrhea.

- ***Malignancies***

- Malignancies of the GI tract occur infrequently in pediatric-aged patients. They may present with rectal bleeding with or without other associated symptoms such as weight loss, abdominal pain, and symptoms of obstruction. Malignancies may be primary (eg, GIST, lymphoma, adenocarcinoma) or represent metastatic disease from a variety of primary sites.

- Patients with polyposis syndromes and IBD among other conditions are at higher risk of small bowel or colonic malignancy, depending on the underlying condition, and current screening guidelines should be followed.

- ***Stercoral colitis***

- This is a rare form of colitis that can occur in children with severe chronic constipation in whom the colon becomes distended with impacted and desiccated fecal material (sometimes called fecaloma).

- Fecalomas can lead to focal pressure necrosis and perforation, while colonic distension and increased intraluminal pressure can lead to compromise of the vascular supply and ischemic colitis.

BOX 13.10 Child and Adolescent Differential Diagnosis

Hematemesis/Melena

Esophagitis
Gastritis
Peptic ulcer disease
Mallory Weiss tear
Esophageal varices/duodenal varices
Portal hypertensive gastropathy
Pill ulcerations
Button battery/Foreign body ingestion
Nonsteroidal anti-inflammatory drug use

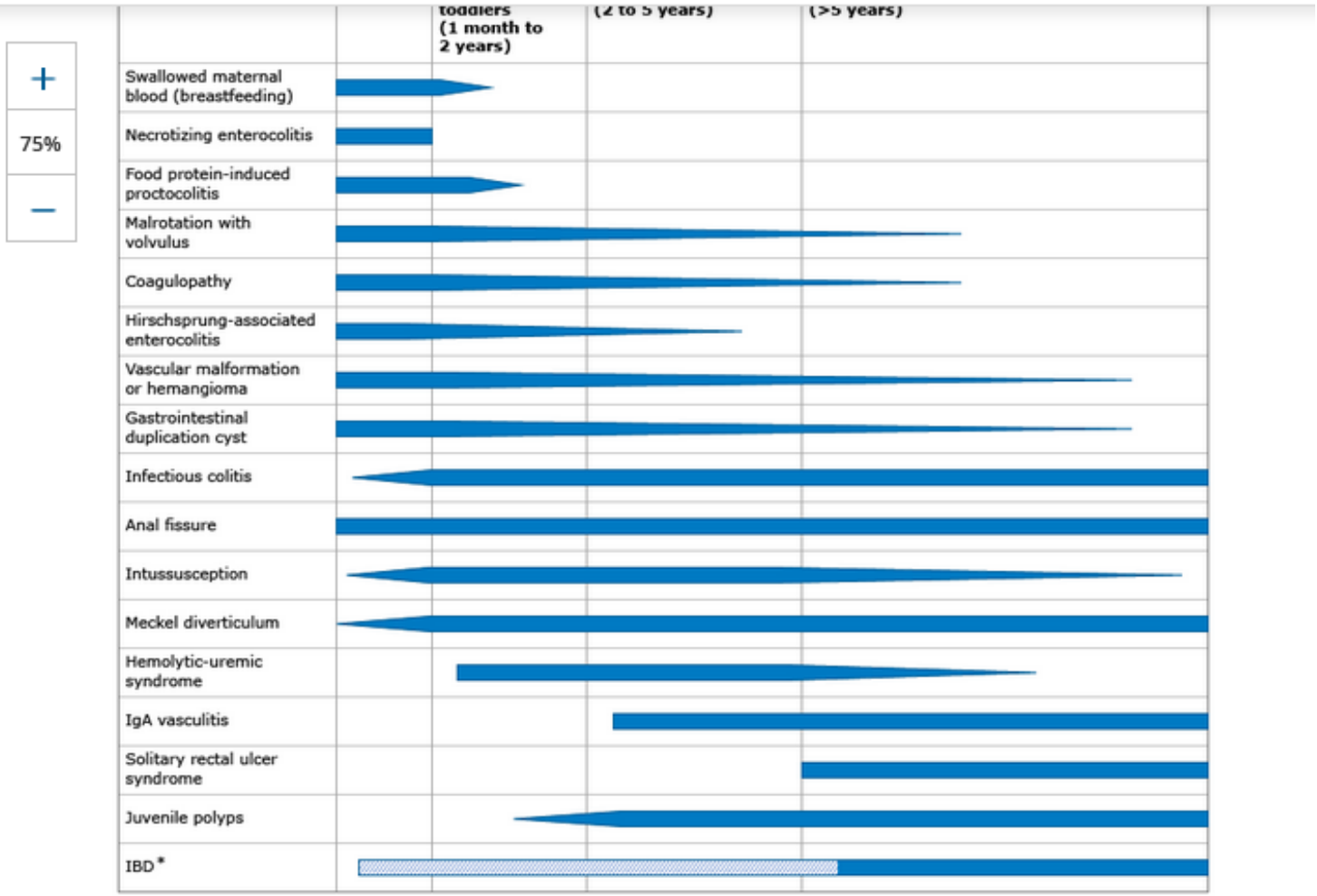
Hematochezia

Anal fissure
Infectious colitis
Polyp
Lymphoid nodular hyperplasia
Inflammatory bowel disease
Solitary rectal ulcer syndrome
Henoch-Schönlein purpura
Intussusception
Meckel diverticulum
Hemolytic uremic syndrome
Vascular malformation
Ischemic colitis
Typhlitis/Neutropenic colitis
Duplication cyst
Dieulafoy lesion

Common causes

- -**Anal fissures** – A common cause of low-volume rectal bleeding in all age groups. They are often triggered by constipation, which is more common during periods of dietary change (introduction of solid food or cow's milk), toilet training, or school entry. In older children, anal fissures also may be associated with inflammatory bowel disease (IBD).
- -**Food protein-induced proctocolitis** – A common cause of bloody stools in infants, usually triggered by ingestion of cow's milk or soy protein. It can occur in infants who are formula fed or in breastfed infants because of cow's milk in the mother's diet. Affected infants have loose stools, often with occult or gross blood, but are usually otherwise healthy, and the disorder usually resolves by 12 months of age.
- -**Juvenile polyps** – These benign hamartomas typically occur between the ages of 2 and 10 years, with a peak at three to four years. Patients usually present with painless rectal bleeding. Most polyps in children are solitary and benign, but children with multiple polyps may have a polyposis syndrome and require surveillance.
- -**IBD** – IBD includes ulcerative colitis and Crohn disease (CD) and can present at any age but is more common in early adolescence. Common symptoms are abdominal pain, fever, weight loss, growth failure, and bloody or nonbloody diarrhea. Many patients have iron deficiency, elevated fecal calprotectin, and/or an elevated erythrocyte sedimentation rate or C-reactive protein.

Major causes of lower gastrointestinal bleeding in children by age group



Diagnosis

- History
- Physical examination
- Laboratory studies and imaging

History

- Family History
- Child History
- Age at Onset of LGI Bleeding
- Characteristics of LGI Bleeding
- Symptoms Associated With LGI Bleeding

INITIAL ASSESSMENT(w)

- The most important step in the initial management of a child with LGI
- bleeding is the rapid assessment of the degree of volume loss and the
- initiation of fluid resuscitation if needed.
- Therefore, hemodynamics is the initial focal point.
- Vital signs are taken, and the child's skin and mucous membranes are inspected for pallor and signs of shock.
- If the child looks healthy and has no past history of disease that could lead to LGI bleeding, and if blood loss is minor and hemodynamic condition is unquestionably normal, admission to hospital is not necessary, and a diagnostic work-up can be performed on an outpatient basis.
- However, close follow-up is necessary in cases of worsening or recurrence of bleeding.

- **Tachycardia** is a very sensitive indicator of severe blood loss, whereas **slow capillary refill** and **hypotension** are ominous signs of hypovolemia and shock.
- **Symptoms of hemodynamic instability** should prompt urgent placement of two large-bore intravenous catheters and may lead to transferring the patient to the intensive care unit. Supplemental oxygen is provided if necessary.
- Blood is drawn for a complete blood count (hemoglobin, hematocrit, and platelet count), clotting studies, and routine chemistry.
- Blood typing and crossmatching should also be performed so that transfusion can be given without delay if needed.

Differential diagnosis of the pediatric patient with small to moderate rectal bleeding (hemodynamically stable)

Primary diagnostic possibilities	Typical age group					Key clinical features	Initial diagnostic steps
	Neonates	Infants and toddlers	Preschool period	School-aged	Adolescents		
Swallowed maternal blood	X	X				Breastfed; mother's nipples are cracked or bleeding	Apt test (hemoglobin alkaline denaturation test)
Necrotizing enterocolitis (especially if premature)	X					Acutely ill (vomiting, abdominal distension, diarrhea, and/or constipation)	Imaging, surgical consultation
Food protein-induced proctocolitis (typically due to milk and/or soy proteins)	X	X*				Well-appearing; stools with low-moderate blood; with or without diarrhea	Assess diet and perform trial of eliminating milk and soy from the diet
Malrotation with volvulus	X	X					
Coagulopathy (eg, vitamin K-deficient bleeding, hemophilia, von Willebrand disease, maternal immune thrombocytopenia)	X	X				Other bleeding symptoms (cephalohematoma, mucocutaneous bleeding, petechiae)	Coagulation work-up

Differential diagnosis of the pediatric patient with small to moderate rectal bleeding (hemodynamically stable)

Hirschsprung-associated enterocolitis	X	X				Ill, with abdominal distension, fever, vomiting, diarrhea, in patient with known or suspected Hirschsprung disease	Abdominal plain film[¶]
Vascular malformation or **hemangioma**	X	X	X	X	X	Typically in child with other vascular lesions (eg, HHT or infantile hemangiomatosis); may have epistaxis or iron deficiency	Upper endoscopy and colonoscopy; wireless capsule endoscopy
Gastrointestinal duplication cyst	X	X	X	X		Variety of presentations, including gastrointestinal bleeding, infection or intussusception; more common in infants, but may present later	Imaging; most are in the small bowel
Infectious colitis	X	X*	X*	X*	X	Loose, bloody stools; abdominal pain; fever	Culture of stool for enteric pathogens; *C. difficile* testing (toxin or PCR); fecal leukocytes
Anal fissure	X*	X*	X*	X*	X*	Well-appearing; stools with low-moderate blood; often	Examine anus closely

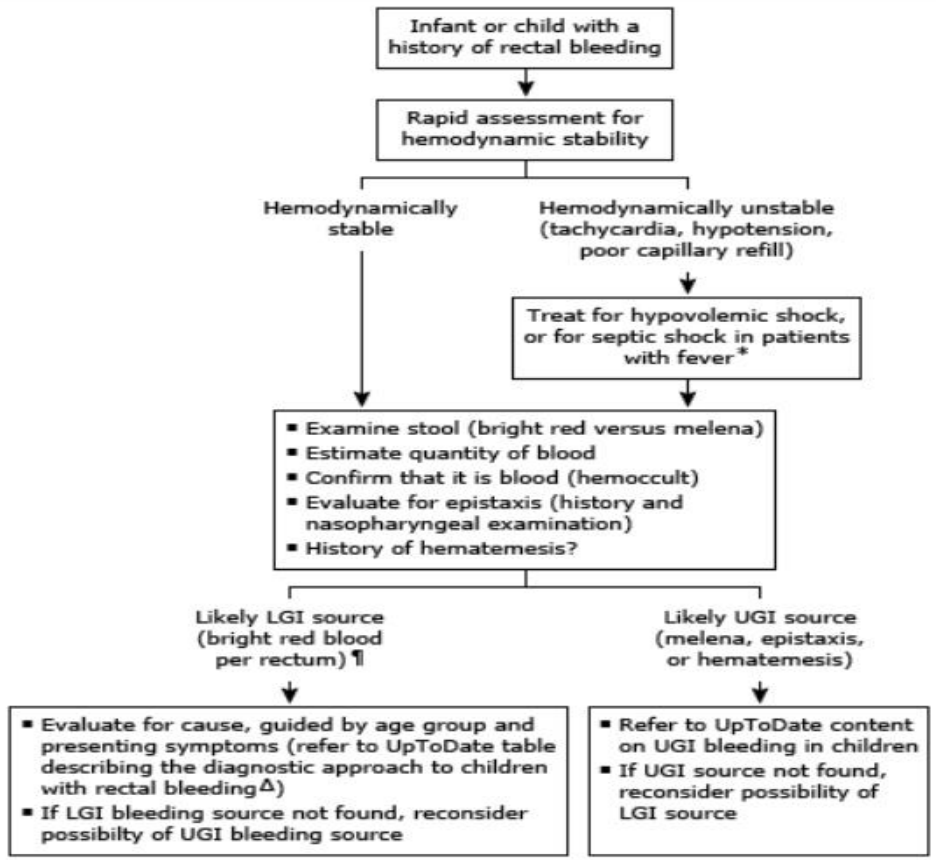
Differential diagnosis of the pediatric patient with small to moderate rectal bleeding (hemodynamically stable)

Intussusception		X	X			Sudden-onset abdominal pain and lethargy, with or without grossly bloody stools ("currant jelly" appearance); may occur at any age in a patient with a lead point	Abdominal ultrasonography, water-soluble contrast enema, or air enema (for diagnosis and non-operative reduction)
Meckel diverticulum		X	X	X	X	Painless rectal bleeding, especially if recurrent and an anal fissure is excluded; bleeding may be profuse	Meckel scan
Hemolytic-uremic syndrome			X	X	X	Hemolytic anemia, thrombocytopenia, elevated creatinine, onset 5 to 10 days after diarrheal illness	CBC, BUN, creatinine, peripheral blood smear, stool culture
IgA vasculitis			X	X	X	Cutaneous purpura (palpable), abdominal pain, arthralgias	Clinical diagnosis if typical features are present; skin or renal biopsy if atypical presentation; abdominal ultrasonography if intussusception is

Differential diagnosis of the pediatric patient with small to moderate rectal bleeding (hemodynamically stable)

Solitary rectal ulcer syndrome			X	X	X	Rectal blood and mucus, tenesmus, sense of incomplete evacuation	Colonoscopy with biopsy; evaluation to rule out inflammatory bowel disease and infectious proctitis
Juvenile polyps			X*	X*	X	Painless rectal bleeding, often intermittent	Examine anus closely to rule out fissure; digital rectal examination for polyp; colonoscopy
Infantile and very early-onset inflammatory bowel disease (VEO-IBD)	X	X	X			Diarrhea (with or without blood), poor weight gain and growth, severe perianal disease, recurrent infections, atypical endoscopy or histology findings, skin lesions, and associated autoimmune diseases	Immunodeficiency evaluation; consider whole-exome sequencing (in addition to tests listed under "inflammatory bowel disease" below)
Inflammatory bowel disease				X*	X*	Diarrhea (with or without blood) and abdominal pain, often with growth failure or delayed puberty; may have weight loss or	CBC, ESR, or CRP, albumin; imaging; colonoscopy and upper endoscopy Additional tests – PT/PTT, AST, ALT,

Algorithm for the initial evaluation of an infant or child with rectal bleeding



Acute abdominal crisis

- Acute abdominal crisis with rectal bleeding can be caused by:

- -**Malrotation with midgut volvulus** – Usually in newborn infants but may be seen in children of any age.

- **Hirschsprung disease** – Complicated by obstruction (usually in newborns) or by enterocolitis (usually in infants or those with known Hirschsprung disease).

- **Intussusception** – Usually in infants or preschool-aged children.

Physical Examination

- Findings in the physical examination are very helpful in elucidating the cause of the LGI bleeding. Failure to properly examine the anus, perineum, and rectum, as well as the skin and mucous membranes, will result in missing many obvious causes of LGI bleeding and performing unnecessary tests.

- Fever suggests the presence of an infectious disease or inflammatory disorder.

- Carefully assessing growth and pubertal development is necessary because failure to thrive and/or pubertal delay may be suggestive of an underlying chronic disease such as IBD.

BOX 13.1 Historical Information

Open Ended Questions:

Describe the location, quantity, and appearance of the bleeding.
What are the physical appearance and vital signs of the patient (if available)?
What medical conditions does the child have? (Liver disease, inflammatory bowel disease, etc.)
What medication is the child on? (Anticoagulants, nonsteroidal antiinflammatory drugs [NSAIDs], etc.)

History:

Description of onset, location, duration, occurrence.
Exposure to raw food, reptiles, travel, or toxins.
Foreign body ingestion.
Exposure to others with such symptoms.
Ingestion of specific foods or medications.
Other associated symptoms (sores, pains, rashes, vomiting, swelling, headaches, neck pain, chest pain, diarrhea, fevers, bruising, infections).
Medications (NSAIDS, warfarin, hepatotoxins, antibiotics use).

Review of Systems:

Gastrointestinal disorders
Liver disease
Bleeding diatheses
Anesthesia reactions

Family History:

Gastrointestinal disorders (polyps, ulcers, colitis)
Liver disease
Bleeding diatheses
Anesthesia reactions

BOX 13.3 Targeted Physical Exam

Vital Signs: orthostasis, pulse pressure, instability, urine output
General: appearance (well or ill), fever, mental status
Head, eyes, ears, nose, and throat: trauma, scleral injection, petechiae, lip pigmentation, epistaxis, erythema or burns to posterior pharynx, bleeding
Chest/Cardiovascular: tachycardia, murmur, capillary refill
Abdomen: tenderness, splenomegaly, hepatomegaly, caput medusa, distention, ascites
Genitourinary: fistula, swelling
Rectal: gross blood, melena, tags, tenderness, fissure, fistula, swelling, warmth
Dermatological: pallor, jaundice, rash, arteriovenous malformations, bruising, petechiae

BOX 13.4 Possible Laboratory Studies

Complete blood count
Prothrombin time/international normalized ratio/partial thromboplastin time
Complete metabolic profile (electrolytes, liver function tests)
Type and screen
If massive loss: Type and cross and fibrinogen
Stool culture for E. coli O157:H7 assay (Shigella, Salmonella, Yersinia, Campylobacter), *Clostridium difficile* toxins A&B, Cryptosporidium and Giardia assay, and ova and parasite smear if indicated by history
Erythrocyte sedimentation rate, C-reactive protein, Gamma-glutamyl transpeptidase if indicated by history
Heme occult and gastro occult testing
Serial complete blood counts, electrolyte studies, and fibrinogen depending rate of bleeding

INDICATIONS FOR SPECIALTY REFERRAL

- Where available, specialty referral or consultation may be appropriate for the following groups of patients:

- **Acute abdomen** – Refer to surgery or, if intussusception is suspected, refer to radiology with pediatric surgery backup.
- **Bloody diarrhea** – Refer to pediatric gastroenterology to evaluate for inflammatory bowel disease (IBD) or infectious diarrhea.
- **Persistent or intermittent blood in the stool** – Refer to pediatric gastroenterology to evaluate for polyps, colitis, Meckel diverticulum, etc, depending on frequency, associated symptoms, and duration.
- **Meckel diverticulum identified** – Refer to pediatric surgery.
- **Abnormal bleeding or concern for coagulopathy** – Refer to hematology.

Principal Findings Related to Underlying Causes of LGI bleeding in Children

Location	Physical Finding	Underlying Disease
Abdomen	Hepatosplenomegaly, ascites, dilated venous channels on the abdomen, caput medusa	Portal hypertension
	Abdominal mass	Intussusception, IBD, intestinal duplication
Perianal area	Anal fissure	Constipation, Crohn disease
	Skin tag, fistula, abscess	Crohn disease, chronic granulomatous disease, immunodeficiency syndromes
	Hemorrhoids, rectal varicosities	Portal hypertension, constipation (adolescent)
	Rectal mass at digital rectal examination	Polyp
Skin and mucous membranes	Eczema	Food allergy

Skin and mucous membranes	Eczema	Food allergy
	Purpura	Henoch-Schönlein purpura, hemorrhagic disease, hemolytic uremic syndrome
	Jaundice, palmar erythema, spider angioma	Liver cirrhosis
	Digital clubbing	Liver cirrhosis, IBD
	Pyoderma gangrenosum	Ulcerative colitis
	Erythema nodosum	Crohn disease

	Telangiectasia	Hereditary hemorrhagic telangiectasia
	Soft tissue tumor (skull, mandible)	Gardner syndrome
	Café au lait spots	Turcot syndrome
	Pigmentation of the lips, buccal mucosa, face	Peutz-Jeghers syndrome
	Alopecia, onychodystrophy, hyperpigmentation	Cronkhite-Canada syndrome
	Breast hypertrophy	Cowden disease
	Bluish soft nodules	Blue rubber bleb nevus syndrome
	Soft tissue hypertrophy	Klippel-Trénaunay syndrome
Eye	Iritis	IBD
Joint	Arthritis	Henoch-Schönlein purpura, IBD
Growth	Failure to thrive	IBD, Hirschsprung disease
	Very short stature, webbed neck, widespread nipples	Turner syndrome

disease of the newborn	diverticulum	Schönlein purpura	bowel disease
	Lymphonodular hyperplasia	Hemolytic uremic syndrome	Lymphonodular hyperplasia
	Malrotation with volvulus	Lymphonodular hyperplasia	
	Hirschsprung disease enterocolitis		
	Intestinal duplication		

- Laboratory Investigation
- Radiographic Examination
- Ultrasonography
- Anoscopy
- Proctosigmoidoscopy
- Colonoscopy
- Enteroscopy: Push, Double-Balloon, Intraoperative or Laparoscopic-Assisted Enteroscopies and Video Capsule Endoscopy

- **Radionuclide Scanning**
- **Angiography**
- **Computed Tomography and Magnetic Resonance Imaging**

BOX 13.5 Imaging Studies

Chest and abdominal x-ray: foreign body, constipation, vomiting

Upper gastrointestinal series: dysphagia, odynophagia, drooling, obstruction, vomiting

Barium enema: suspected stricture, intussusception, Hirschsprung disease (late)

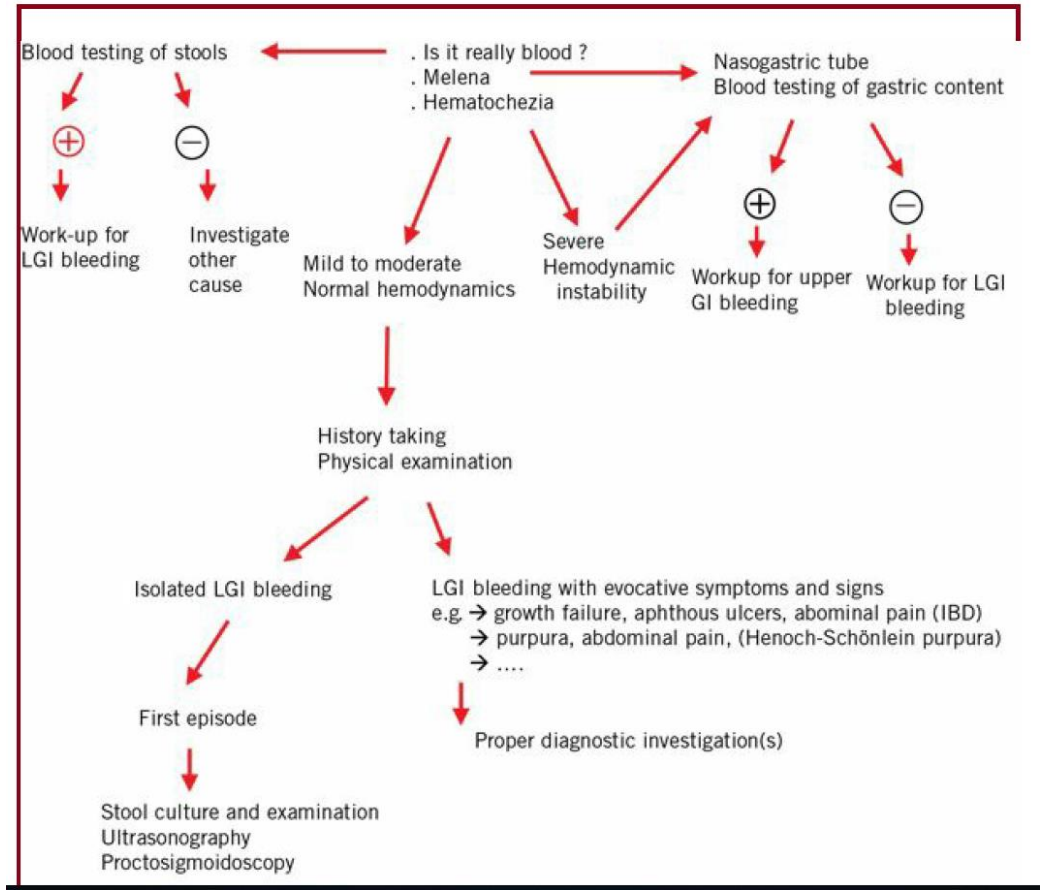
Ultrasound (Doppler recommended for liver disease): portal hypertension, intussusception, possible inflammatory bowel disease

Meckel's scan: Meckel diverticulum

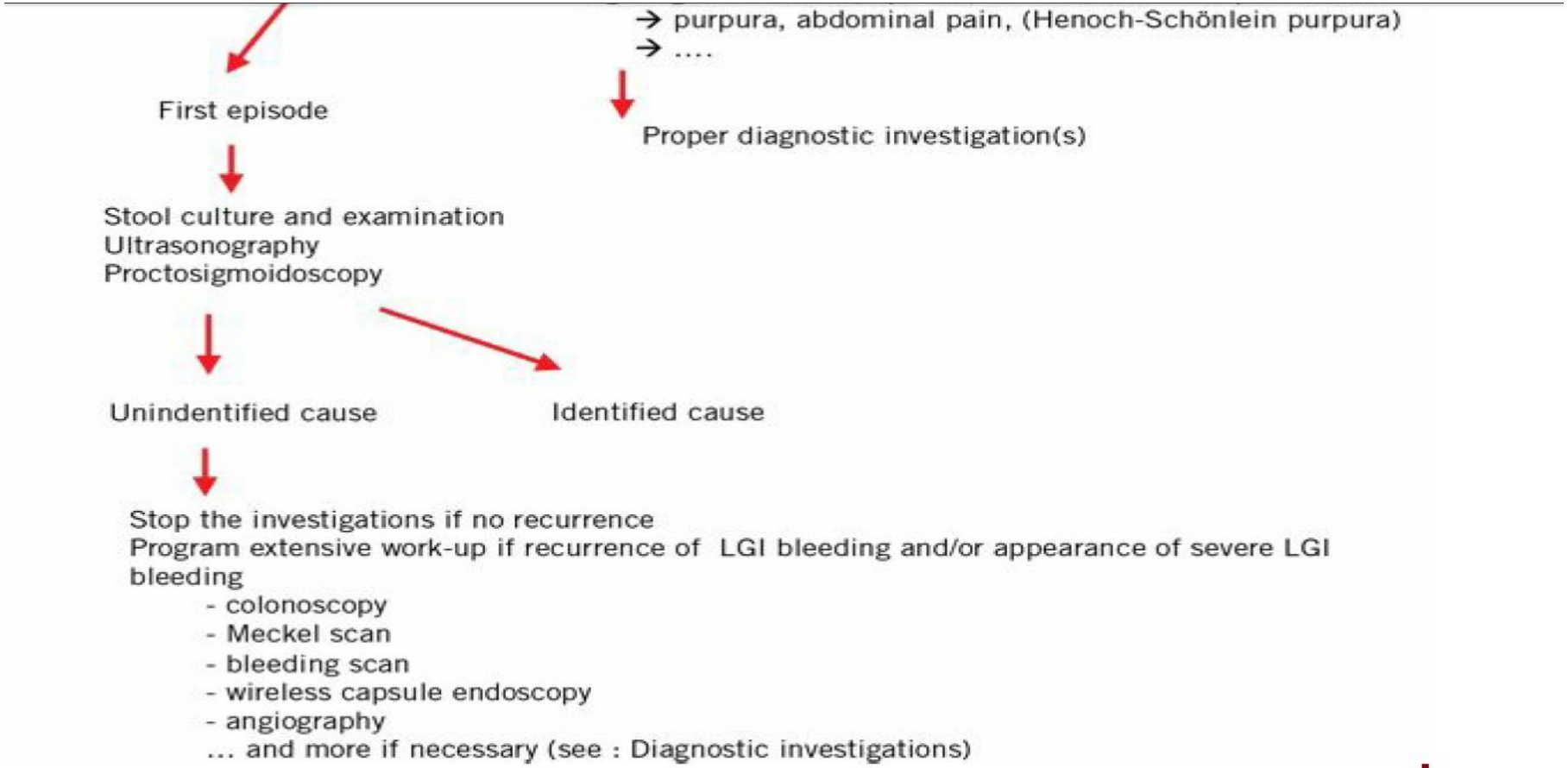
Tagged RBC scan: obscure gastrointestinal bleeding

MR/CT/direct angiography: obscure gastrointestinal bleeding, suspected arteriovenous malformation

Algorithm for managing lower gastrointestinal (LGI) bleeding in children



Algorithm for managing lower gastrointestinal (LGI) bleeding in children



Testing for blood in the stool

- In most cases of suspected GI bleeding, **the clinician should examine the stool directly and test it for blood.**
- This is because several foods and medicines may give stool a bloody appearance that may be misinterpreted by the child or their parent(s).
- **Red-colored stools** resembling hematochezia may be caused by foods with red dyes (eg, Kool-Aid or fruit punch), beets, red licorice, or rifampin.
- **Black-colored stools** resembling melena may be caused by ingestion of bismuth, activated charcoal, or iron and, occasionally, by consumption of large quantities of chocolate, blueberries, black licorice, or dark green foods.
- **Testing is particularly important in children with equivocal symptoms, such as a well-appearing child with small amounts of red material in the stool.**

- The most common assays can be performed at the bedside and are **guaiac based**.
- This test identifies hemoglobin by the presence of a peroxidase reaction that turns guaiac-impregnated paper blue
- Occasionally, **false-positive results** may occur if the patient has ingested rare red meat or peroxidase-containing vegetables (eg, turnips, horseradish, broccoli, cauliflower, cantaloupe).
- Whether iron supplements cause false-positive results is controversial .
- **False-negative results** can be obtained if the patient is ingesting large doses of ascorbic acid (vitamin C) or if intestinal bacteria have degraded the hemoglobin to porphyrin.

OCCULT LGI BLEEDING

- Large amounts of blood can be lost into the gastrointestinal tract and remain occult. In most cases, occult LGI bleeding is revealed by symptoms limited to pallor or fatigue or failure to thrive.
- It is further detected by
- discovery of iron deficiency or iron deficiency anemia and is confirmed by
- repeated positive testing for the presence of fecal blood. A very careful
- history taking and thorough physical examination is of crucial importance
- to resolve adequately the differential diagnosis.

OCCULT LGI BLEEDING

- In the absence of any clinical clues, that is, associated symptom and/or physical finding suggesting a precise cause for LGI bleeding, esogastroduodenoscopy, and colonoscopy are performed.

- If endoscopy fails to identify a source of bleeding, abdominal scintigraphy with Tc 99 m pertechnetate or Tc 99 m pertechnetate red blood cell scan and angiography will not be helpful because in cases of occult LGI bleeding, the bleeding rate is very unlikely to be **0.5 mL/min or higher.**

OCCULT LGI BLEEDING

- Ultrasonography and small bowel MRI or CT may help to find abnormalities suggestive of Crohn disease, especially in adolescents presenting with occult LGI bleeding and an elevated erythrocyte sedimentation rate or C-reactive protein.
- Wireless capsule endoscopy is a very effective tool for the diagnosis of occult LGI bleeding of presumed small bowel origin, as early as at 2.5 years of age.

BOX 13.7 Therapy

Supportive Care
- Intravenous fluids (Isotonic)
- Blood products (packed red blood cells, fresh frozen plasma)
- Pressors (dopamine, etc.)

Specific Care
- Proton pump inhibitors (omeprazole, lansoprazole, pantoprazole)
- Prokinetics (metoclopramide, erythromycin)
- Somatostatin analogue (octreotide)

Endoscopic Therapy
- Injection (sclerosant, epinephrine, normal saline, hypertonic saline)

Coagulation (bipolar, monopolar, heater probe, laser, argon plasma)
- Variceal injection and ligation
- Band ligation
- Polypectomy
- Endoscopic clip
- Endoscopic loop
- Hemospray powder