

GI Bleeds:

1. General Presentation

Gastrointestinal (GI) bleeding can be an emergency in children when the blood loss is large, but always requires further investigation. GI bleeds are classified into upper or lower in regards to the location of the bleeding. Upper Gastrointestinal bleeding is defined as blood loss proximal to the ligament of Treitz in the distal duodenum. Thus, this includes bleeding from the esophagus, stomach or duodenum. Lower Gastrointestinal bleeding is defined bleeding distal to the ligament of Treitz and consists of small bowel, the colon, the rectum and the anus. Upper GI bleeding is often more severe than lower GI bleeds. GI bleeding in pediatrics is a common problem that occurs due to various causes at different ages of infants and adolescents. GI Bleeding accounts for 10 – 15% of referrals to pediatric gastroenterologists. Not only can GI bleeding be categorized by location, but it can be broken down into age groups as follows:

2. Etiology

Table 1: Common causes of Gastrointestinal bleeding based on Age:

Age Group	Upper Gastrointestinal Bleeding	Lower Gastrointestinal Bleeding
Neonates	<ul style="list-style-type: none">- Swallowed maternal blood- Hemorrhagic disease of the newborn- Coagulopathy- Esophagitis- Stress Gastritis- Gastroduodenal ulcers- Duplication cyst	<ul style="list-style-type: none">- Swallowed maternal blood- Anorectal fissures- Necrotizing enterocolitis- Malrotation with midgut volvulus- Coagulopathy- Hirschsprung's disease
1 month to 2 years	<ul style="list-style-type: none">- Esophagitis- Gastritis- Gastroduodenal ulcer- NSAID-induced ulcer- Foreign body ingestion	<ul style="list-style-type: none">- Anorectal fissures- Allergic colitis (cow's milk protein allergy)- Intussusception- Meckel's diverticulum- Gastrointestinal duplication- Polyps- Ischemic bowel secondary to volvulus

Age Group	Upper Gastrointestinal Bleeding	Lower Gastrointestinal Bleeding
2 years and older	<ul style="list-style-type: none"> - Esophageal varices - Gastric varices - Mallory Weiss tears - Dieulafoy's lesions 	<ul style="list-style-type: none"> - Infectious diarrhea - Juvenile Polyps - Inflammatory bowel disease - Vascular lesions - Hemolytic uremic syndrome (HUS) - Henoch Schlonlein Purpura (HSP)

(Adapted from Arensman and Abramson 2006 and Up to Date 2009.)

a. Common causes of GI bleeding in Neonates:

Upper GI tract bleeding:

- Maternal blood ingestion - The most common cause of upper GI bleeding in neonates is due to maternal blood ingestion. This can also present as lower GI bleeding. This occurs when blood is swallowed during birth or from breast feeding. The Apt tests differentiates between maternal and fetal hemoglobin. An Apt test can be performed by placing the blood on a piece of filter paper and mixing it with 1% sodium hydroxide to determine whether the GI bleed is due to maternal blood ingestion that occurs during delivery. Maternal hemoglobin results in a brown-yellow color, while fetal hemoglobin will appear a pink - bright reddish colour. With lack of fetal hemoglobin, diagnosis for upper GI bleeding is irrelevant.
- Stress gastritis is found mainly in neonates who are in the neonatal intensive care unit and it is highly correlated with prematurity, neonatal distress, and mechanical ventilation. Diagnosis is made by upper endoscopy in order to determine signs of erythema, diffuse bleeding, erosions or ulcerations of the gastric mucosa. Gastroduodenal ulcers and esophagitis may develop as a result of chronic gastritis.
- Hemorrhagic disease of the newborn is caused by a deficiency in vitamin K. Levels of clotting factors II VII, IX and X decline rapidly after birth, reaching their nadir at 48-72 hours of life. In 0.25-0.5% of neonates, severe hemorrhage may result. If hemorrhagic disease occurs, administration of 1 mg of vitamin K intravenously generally stops the hemorrhage within 2 hours. If the condition worsens, fresh frozen plasma and packed red blood cells should be administered in addition to the vitamin K. Other coagulopathies can also present as both upper and lower GI bleeding.

Lower GI tract bleeding:

- Anorectal Fissures are among the most common causes of lower GI bleeding in neonates. Stooling is often painful and in infants is characterized by straining, grunting and arching while passing a bowel movement. They produce bright red blood that streaks the stool or causes spots of blood in the diaper that is caused by a tear at the mucocutaneous line. Anal fissures can be diagnosed with a thorough anal examination by stretching the perineal skin to evert the anal canal.
- Necrotizing enterocolitis (NEC) usually develops within 10 to 16 days after birth most commonly in premature infants, though can present in 13% of term infants. Although the pathophysiology is currently unclear, it is believed to occur when the immature immune and digestive systems. Symptoms of this condition include abdominal distension, poor feeding, vomiting, diarrhea, frank or occult bloody stools, lethargy and apneas. The classic finding on abdominal radiograph is that of pneumatosis intestinalis, appearing as bubbles of gas in the bowel wall.
- Malrotation with midgut volvulus is diagnosed with the sudden onset of melena in combination with bilious emesis and abdominal distention in a previously healthy neonate. Immediate upper GI contrast study should be performed to confirm diagnosis of malrotation with midgut volvulus. Immediate laparotomy reveals the anomaly and allows derotation of the bowel, assessment of intestinal viability, possible bowel resection, and performance of a Ladd procedure.

b. Common causes of bleeding in children (1 Month to 1 Year):

Upper GI tract bleeding:

- Esophagitis (Peptic esophagitis) is the most common cause of bleeding in children aged 1 month to 1 year. This condition is caused by gastroesophageal reflux and is present in infants with regurgitation, dysphasia, odynophagia and failure to thrive.
- Gastritis can be distinguished as primary or secondary in etiology. Primary gastritis is correlated with *Helicobacter pylori* infection and is the most common cause of gastritis in children. Other causes of primary gastritis are non steroidal anti-inflammatory drug use, Zollinger-Ellison syndrome, and Crohn disease.

Lower Gastrointestinal tract bleeding:

- Anal fissures produce bright red blood that streaks the stool or causes spots of blood in the diaper that is caused by a tear at the mucocutaneous line. Anal fissures can be diagnosed with an anal examination and on occasion with a nasal speculum.

- Intussusception is the most common cause of lower GI bleeding in infants ranging from 6-18 months of age. Symptoms include cramping, abdominal pain, vomiting, a palpable sausage shaped mass, and currant jelly stools are common in patients with intussusception.
- Gangrenous bowel is the second most common cause of lower GI bleeding of this age group. Causes include malrotation with volvulus, omphalomesenteric remnant with volvulus, internal hernia with strangulation, segmental small-bowel volvulus, and on rarely, sigmoid volvulus.
- Milk protein allergy causes a colitis that may be correlated with occult or gross lower GI bleeding. It is caused by an adverse immune reaction to cow's milk and have additional symptoms that can include diarrhea, weight loss, vomiting, and irritability.

c. Common causes of bleeding in children (1 to 2 years):

Upper GI tract bleeding:

- Peptic ulcer disease is most common in children greater than 1 year old and is the most common cause of hematemesis. Peptic ulcer disease occurs when the protective mucus layer wears away allowing damage to occur from the natural acids of the stomach. The cause is similar to that of gastritis in which Primary gastritis is correlated with helicobacter pylori infection and is the most common cause of gastritis in children. Other causes of primary gastritis are non steroidal anti-inflammatory drug use, Zollinger-Ellison syndrome, and Crohn disease.
- Gastritis can be distinguished as primary or secondary in etiology. Primary gastritis is correlated with Helicobacter pylori infection and is the most common cause of gastritis in children. Other causes of primary gastritis are non steroidal anti-inflammatory drug use, Zollinger-Ellison syndrome, and Crohn disease.

Lower GI tract bleeding:

- Polyps are mainly found in the juvenile type of this age group and are located throughout the colon. These are benign hamartomas and usually require no treatment because they autoamputate. Children present with painless bleeding per rectum, which often streaks the stool with fresh blood. Colonoscopy is the diagnostic evaluation of choice because it allows examination of the entire colon and potential excision of bleeding polyps when they are identified.
- Meckel diverticulum consists of a small pouch that is a remnant of tissue from prenatal development in the wall of the intestine located close to the junction of the small and large intestines. The remnant tissue produces acid similar to the tissue of the stomach which can lead to ulcers unless treated. If remained untreated, the ulcer can rupture,

causing waste products from the intestine to leak into the abdominal cavity. Peritonitis can result in a serious abdominal infection and can ultimately lead to a blocked intestine which inhibits the passage of digested food resulting in intestinal obstruction.

d. Common causes of bleeding in children (2 years and above):

Upper Gastrointestinal tract bleeding:

- Esophageal and gastric varices

- Esophageal varices are caused by portal hypertension which occurs when there is increased resistance to blood flow through the portal system that is due to prehepatic, intrahepatic, and suprahepatic obstruction, but the most common causes of portal hypertension in children are portal vein thrombosis and biliary atresia.
- Gastric varices are most commonly found in the fundus and are characterized as dilated blood vessels.

Lower GI tract bleeding:

- Polyps are the most common cause of lower GI bleeding in children older than 2 years. They are located throughout the colon and are characterized as benign hamartomas and usually require no treatment because they autoamputate. Children present with painless bleeding per rectum, which often streaks the stool with fresh blood. Colonoscopy is the diagnostic evaluation of choice because it allows examination of the entire colon and potential excision of bleeding polyps when they are identified.

- Inflammatory bowel disease refers to ulcerative colitis and Crohn's disease, which are chronic diseases that result in inflammation of the intestines. Although bleeding may be less common in individuals diagnosed with Crohn's disease compared to ulcerative colitis, both may consist of bloody diarrhea which can lead to acute or persistent bleeding resulting in anemia.

- Infectious diarrhea is suspected when lower GI bleeding occurs in association with profuse diarrhea. Recent antibiotic use raises suspicion for antibiotic-associated colitis and Clostridium difficile colitis.

- Vascular lesions consist of a variety of malformations that include hemangiomas, arteriovenous malformations, and vasculitis. Lesions located in the colon can be diagnosed with colonoscopy. However, bleeding can cause this to be challenging making localizing the bleeding practically impossible. Arteriography can be applied to assist in localizing the source of bleeding to diagnose the correct source.

3. Questions to Ask

Good history taking is crucial in order to determine the source of bleeding. It is important to ask questions that relate to the patient's age as well as etiology-specific questions. Questions that may assist in diagnosing underlying problems such as organ dysfunction are also important to determine a proper diagnosis. The following, adapted from Hsia et al. 2008, is a list of questions to ask in regards to GI bleeds in children:

Age- and etiology-specific symptoms to be aware of:

- Ask about acuteness or chronicity of bleeding, color and quantity of the blood in stool or emesis, antecedent symptoms, history of straining, abdominal pain, or trauma.
- Anorectal disorders, fissures, and distal polyps produce bright red blood.
- Melena rather than bright red blood per rectum is usually a sign of bleeding that comes from a source proximal to the ligament of Treitz.
- Massive upper GI bleeding, however, can produce bright red blood per rectum if GI transit time is rapid.
- Blood mixed in stool or dark red blood implies a proximal source with some degree of digestion of the blood.
- A history of vomiting, diarrhea, fever, ill contacts, or travel suggests an infectious etiology.
- Bloody diarrhea and signs of obstruction suggest volvulus, intussusception, or necrotizing enterocolitis, particularly in the ex-premature infant.
- Recurrent or forceful vomiting is associated with Mallory-Weiss tears.
- Familial history or nonsteroidal anti-inflammatory drug (NSAID) use may suggest ulcer disease. Ingested substances, such as NSAIDs, tetracyclines, steroids, caustics, and foreign bodies, can irritate the gastric mucosa enough to cause blood to be mixed with the vomitus.

Undiagnosed organ dysfunction possibilities to be aware of:

- Recent jaundice, easy bruising, and changes in stool color may signal liver disease.
- Other evidence of coagulation abnormalities elicited from the history may also point to disorders of the kidney or reticuloendothelial system.
- For complaints of bloody stool, make sure to elicit on history foods or drugs that may give a stool bloody appearance. This list includes certain antibiotics, iron supplements, red licorice, chocolate, Kool-Aid, flavored gelatin, or bismuth-containing products (eg, Pepto-Bismol).

4. Physical Exam

Vital signs used to evaluate signs of shock are important when performing a physical examination for GI bleeds in children. The following, adapted from Hsia et al. 2008, will assist you during your physical examination to obtain a proper diagnosis:

- Look for signs of shock, and document findings such as heart rate, blood pressure, capillary refill, and orthostatic changes.
- During examination of the head, ears, eyes, nose, and throat, look for causes such as epistaxis, nasal polyps, and oropharyngeal erosions from caustics and other ingestions.
- Examine abdominal surgical scars and elicit the reason for the surgery.
- Specifically include bowel sound frequency in the abdominal examination. Hyperactive bowel sounds are more common in upper GI bleeding.
- Abdominal tenderness, with or without a mass, raises the suspicion of intussusception or ischemia.
- Hepatomegaly, splenomegaly, jaundice, or caput medusae suggests liver disease and subsequent portal hypertension.
- Inspection of the perianal area may reveal fissures, fistulas, skin breakdown, or evidence of trauma.
 - Gentle digital rectal examination may reveal polyps, masses, or occult blood.
 - Looking for evidence of child abuse, such as perianal tearing, tags, or irregularities in anal tone and contour, is also important.
- Examination of the skin may reveal evidence of systemic disorders, such as inflammatory bowel disease, Henoch-Schönlein purpura, and Peutz-Jeghers polyposis.
- Anoscopy can be performed (if required in an infant) by gently placing a lubricated redtop or purple-top test tube into the anus to enable visualization of the inner anal anatomy.

5. Differential Diagnosis:

Anal fistulas - An inflammatory tract between the anal canal and skin.

Anal fissures - A superficial linear tear in the anoderm usually caused by passage of a large, hard stool.

Epistaxis - An acute hemorrhage from the nostril, nasal cavity, or nasopharynx.

Bacteremia and Sepsis - Bacteria in the bloodstream

Gastroenteritis - Inflammation of the stomach and the intestines which can cause nausea and vomiting and/or diarrhea.

Salmonella infection - A bacterial infection of the intestinal tract that causes diarrhea, fever and abdominal cramps.

Portal hypertension - An increase in blood pressure in the veins of the portal system caused by obstruction in the liver.

6. Appendix

Medications for Pediatric - gastrointestinal bleeding:

Ranitidine (Zantac) - Inhibits histamine stimulation of H2 receptor in gastric parietal cells, which reduces gastric acid secretion, gastric volume, and hydrogen ion concentrations:

Pediatric dosage:

- Prophylaxis for stress induced gastric ulcers
- Neonates: 5 mg/kg/d PO/IV divided into 3 doses for 4 d
- Duodenal ulcers (1 month to 16 years): 1 mg/kg IV q6-8h (dilute to 2 mg/mL with sodium chloride 0.9%) or 2-4 mg/kg/d PO in 2 divided doses: not to exceed 300 mg/d

Famotidine (Pepcid) - Competitively inhibits histamine at H2 receptor of gastric parietal cells, reducing gastric acid secretion, gastric volume and hydrogen concentrations.

Pediatric dosage:

- 1-16 years: 0.5 mg/kg/d PO bid or 0.25 mg/kg IV q12h; not to exceed 40 mg/d for both PO and IV forms

Aluminum and magnesium hydroxide (Maalox) - A drug combination that neutralizes gastric acidity and increases pH of stomach and duodenal bulb. Aluminum ions inhibit smooth muscle contraction and gastric emptying. Magnesium-aluminum antacid mixtures used to avoid changes in bowel function.

Pediatric dosage:

- 0.5 mL/kg PO qid prn

Octreotide (Sandostatin) - Synthetic polypeptide; acts as natural somatostatin but more resistant to enzymatic degradation and has longer half-life in circulation than somatostatin, making it easier to use clinically.

Pediatric dosage:

- Safety and dosing has not yet been established. Current literature for GI bleeding suggests 1 mcg/kg IV bolus, then 1 mcg/kg/h continuous IV infusion; infusion rate should be titrated to response; dose should be tapered by 50% q12h when no active bleeding occurs for 24 h; can be discontinued when dose is 25% initial dose.

Vasopressin (Pitressin) - At high doses, can cause vasoconstriction, with many other effects (eg. promoting water resorption, increasing peristaltic activity). Effective in reducing portal pressure.

Pediatric dosage:

- Unlabeled use for GI hemorrhage in children: 0.002-0.005 U/kg/min IV initially with titration; not to exceed 0.01 U/kg/min; continued at same dosage (if bleeding stops) for 12 h; can discharge patient home over next 24-48 hour use 0.1-1 U/ml concentration (diluted in 0.9% NaCl or D5W).

References

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