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GI BLEEDING

Developed by Clarelle Gonsalves and Dr. Herbert Brill for PedsCases.com.
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Introduction:

Hi, my name is Clarelle Gonsalves and I am a third-year medical student at McMaster University. This podcast was developed in collaboration with Dr. Herbert Brill, a pediatric gastroenterologist at McMaster Children's Hospital and Associate Professor of Pediatrics at the University of Toronto.

Case:

Let's start with a case:

You are completing a Pediatric Emergency Medicine rotation when your preceptor asks you to see two patients. The first patient is Charlie, a 9-month-old boy who was brought into the emergency department by his mother for on and off abdominal pain and vomiting that suddenly appeared yesterday. She tells you that this morning, she noticed red-coloured jelly-like stool while changing Charlie's diaper.

The next patient is Bailey, a 14-year-old girl who was brought into the emergency department by her parents when she started vomiting what appeared to be coffee grounds. When talking to Bailey, you learn that she has been experiencing burning chest pain for a few weeks.

You immediately inspect each patient, obtain a full set of vitals, including orthostatic vitals and ensure that both patients are hemodynamically stable. Could both these patients have a GI bleed? If so, what is the most likely cause of the bleeding given their different ages and presentations?

Objectives

In this podcast, we will discuss an approach to gastrointestinal bleeding in children. After listening to this podcast, learners should be able to:

1. Define and classify gastrointestinal bleeding
2. State the signs and symptoms of a GI bleed in children, including red flag signs and symptoms that require immediate and emergent management.

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3. List common sources of bleeding and generate a differential diagnosis based on age and clinical presentation
4. Outline key considerations in the investigation and management of children with GI bleeding.

Understanding Gastrointestinal Bleeding

Gastrointestinal bleeding refers to blood that originates from the lumen of the GI tract and can be divided into two major categories based on location of the source of bleeding, upper and lower GI bleeding. Understanding these categories is important in order to help understand different presentations of GI bleeding, build your differential and better plan your approach for diagnosis and management.

Upper gastrointestinal bleeding refers to blood that originates from a source that is proximal to the ligament of Treitz, where the duodenum meets the jejunum. Common sources of upper GI bleeding include the esophagus, stomach and duodenum. Lower gastrointestinal bleeding refers to blood from a source distal to the ligament of Treitz such as the small bowel or colon.

Classification of Symptoms

Now that we understand the two major categories of GI bleeding, we can begin to look for symptom patterns that can help in identifying the source of the bleed and in organizing your differential.

Let's go through some of the major presenting symptoms in children with GI bleeding in order to understand how this can help in pointing towards the location of the bleeding:

Hematemesis – hematemesis refers to the vomiting of bright red blood. This points towards an upper GI source of bleeding but can be a result of blood that originated from outside of the GI tract, such as swallowed blood from dental trauma, epistaxis, maternal blood or hemoptysis mistaken as hematemesis.
Coffee Ground emesis – coffee ground emesis is the vomiting of blood which closely resembles coffee grounds as is formed as a result of the acidic environment of the stomach hemolyzing the blood, which darkens the colour. As a result, coffee ground emesis also points towards an upper GI source of bleeding.
Melena – melena refers to black, tarry, poorly formed stools and is produced as a result of blood being oxidized by intestinal bacteria, thus converting hemoglobin to hematin, as it passes through the intestine. As a result, melena is usually indicative of an upper GI source of bleeding.
Currant jelly stools – these are stools that are red or dark maroon in colour and indicate a lower GI source of bleeding that is usually due to an ischemic etiology such as intussusception and is often a late presentation of ischemic injury.
Mucous or diarrheal stools with blood – these are associated with inflammatory processes of the lower GI tract and point towards left sided or diffuse colitis, especially when associated with pain.
Hematochezia – refers to bright red or maroon-coloured blood from the rectum and indicates a distal lower GI source of bleeding such as anal fissures or colonic

polyps. However, since blood is a cathartic agent, hematochezia can also be present in the case of large volume or brisk upper GI bleeding as a result of decreased transit time of blood as it passes through the intestine.

It is worth noting that mixed upper and lower GI bleeding patterns also exist and often consist of hematemesis, hematochezia and/or melena.

An important point to remember is that as long as your patient is stable, a nasogastric lavage can be a simple method for differentiating between upper and lower GI bleeding. Taking the time to perform an NG lavage can help direct further investigations and management.

Sources of Bleeding

The differential diagnosis for upper and lower GI bleeding in children can be a long list. Narrowing down the source of the bleeding can be helpful in building your differential.

In the case of Upper GI bleeding, you can think of the source of the blood based on major categories of potential sources:

1. Non-GI sources – these can mimic GI bleeding but are not true GI bleeds. Examples of non-GI sources of blood include:
    - Swallowed blood which can be:
        i. maternal blood
        ii. oral or pharyngeal source such as tonsillitis or recent dental procedures
        iii. Epistaxis
    - Blood from a respiratory source such as hemoptysis that looks like it's been vomited out)
2. Trauma – swallowed foreign body, toxic/caustic ingestion, traumatic NG tube insertion, GI procedures such as previous surgeries, recent biopsies or endoscopy
3. Inflammation – esophagitis, gastritis, inflammatory bowel disease (IBD)
4. Ulcers – peptic ulcer disease
5. Vascular sources – varices, vasculitis, Delafoy Lesion
6. Mucosal – Mallory-Weiss tear
7. Coagulopathy – Vitamin K deficiency of the newborn
8. Hemobilia which is bleeding from the hepatobiliary tract

In cases of lower GI bleeding patterns, major categories of potential sources include:

1. Non-GI sources – again, these can mimic GI bleeding and therefore need to be ruled out
    a. For lower GI bleeding, non-GI sources include:
        i. Swallowed maternal blood
        ii. foods that mimic the appearance of blood, which include beets, spinach, blueberries, cranberries and licorice
        iii. vitamins and medications including iron supplements and bismuth as found in Pepto-Bismol, which can result in black and tarry stools

mimicking melena as well as the use of Cefdinir, a third-generation cephalosporin, which has been associated with red or maroon discolouration of the stool in children

iv. GU sources of blood

2. Inflammation – infectious gastroenteritis, milk/soy protein allergies, Celiac disease, IBD, HUS
3. Structural malformations – Meckel's diverticulum, necrotizing enterocolitis, malrotation with volvulus, intussusception, Hirschsprung's associated enterocolitis, and polyps
4. Vascular sources – vascular malformation, hemorrhoids, Henoch-Schoenlein purpura
5. Mucosal – anal fissures
6. Coagulopathy – Vitamin K deficiency of the newborn
7. Rapid Upper GI bleeding—remember that blood is a cathartic, so all causes of Upper GI bleeding, if large and brisk enough, can also present as lower GI bleeding

This is a not an exhaustive list of all etiologies that can result in GI bleeding. As a result, it is important to make note of true emergency etiologies when, if suspected, require immediate attention and referral. These include esophageal varices and most structural malformations resulting in ischemic injury and GI bleeding.

Remember that common things are common. The most common cause of bloody diarrhea in infants younger than 1 year is allergic (or non-specific) colitis, usually attributable to cow-milk based formula. The two most common causes of painless rectal bleeding in children are juvenile polyps and Meckel's diverticulum. The six most common causes of massive GI bleeding in children are: esophageal varices, Meckel's diverticulum, hemorrhagic gastritis, Chron's disease, peptic ulcer, and arteriovenous malformation.

Age Considerations

As with most things in pediatrics, the most common etiologies of GI bleeding vary with patient age. Let's quickly review how causes of GI bleeding differ between newborns and infants versus older children:

In neonates, important causes to consider are: swallowed maternal blood which can result from the delivery process or during breast feeding, vitamin K deficiency or other coagulopathies, necrotizing enterocolitis, stress gastritis or ulcers, vascular anomalies, and milk-protein sensitivity.

In infants, important causes to consider are: stress gastritis or ulcers, Mallory-Weiss tear, Vascular anomalies, GI duplications, gastric or esophageal varices, duodenal or gastric webs, and bowel obstruction. Structural causes in this age group include intestinal duplication, Meckel's diverticulum and intussusception.

In children over the age of one-year, important causes to consider are anal fissures, infectious colitis, Henoch-Sholein purpura and IBD. Structural causes in this age group include juvenile polyps, intestinal duplication, Meckel's diverticulum, intussusception, volvulus and Delafoy malformations.

Approach to the Patient

ABCs

When presented with any patient in which you suspect the possibility of GI bleeding, the first thing that must be done is ensure the patient is stable. This includes monitoring vitals and reviewing the patient's ABCs, making sure airways are patent and protected, breathing is stable, that the patient is hemodynamically stable and good IV access is secured.

Vital signs are vital and in the case of suspected GI bleeding, can help you gauge the volume of blood loss. Tachycardia without orthostasis indicates a 5-10% blood volume loss while the presence of orthostatic changes indicates blood loss greater than 10%. Hypotension with resting tachycardia is indicative of a 30% loss in blood volume. Finally, non-palpable pulses indicate a loss greater than 40% of total blood volume. As a result, it is important to obtain a good set of orthostatic vitals while the patient is lying down and then again while standing, after a one-minute period to allow for acclimatization. Remember that children have greater physiologic reserve when compared to adults which can help them maintain normal vitals even in the presence of acute blood loss. As a result, heart rate, capillary refill time (CRT), and pulse pressure can be sensitive markers of hemodynamic status in children.

History

When presented with a case in which you suspect GI bleeding, in addition to a thorough pediatric history, it is crucial that you take a detailed history surrounding the bleeding.

A thorough history should include history of the presenting illness, past medical history including chronic illnesses especially as they pertain to liver/biliary disease. Gestational history and birth history can also provide important clues. Past surgical history, medications, allergies, family history especially as it pertains to GI and bleeding disorders and social history including recent travel will also provide important information that may help narrow down the source of the bleed. In children, it is always important to also obtain a good nutritional history to understand the types of food the child is consuming, the presence of any GI bleeding mimickers in the diet, any feeding difficulties as well as sources of potential allergens such as soy or wheat.

Be sure to ask about specific details surrounding the bleeding itself such as site of blood, volume and colour as well as a history of NSAID use and accompanying symptoms such as dysphagia, epigastric or abdominal pain, retrosternal pain.

Other important items in this patient's history include:

- Witnessed or suspected foreign body ingestion

- Preceding events including recent dental or GI procedures such as tonsillectomies, endoscopies, biopsies or past surgeries.
- Temporally associated symptoms such as pain, vomiting, diarrhea, fever and weight changes

Physical Exam

Upon physical examination of the child, you want to start with vitals and physical appearance in order to determine the stability of the patient. Whenever faced with potential bleeding in children, it is crucial that an accurate assessment of orthostatic changes be carried out provided the patient is stable. Let's review how to obtain a good measurement for orthostatic hypotension. First, obtain a blood pressure and heart rate after the child has been lying down for 5-10 minutes. Then assist the patient to a standing position and wait one minute before measuring blood pressure and heart rate again. Orthostatic changes are indicated by a decrease in systolic pressure by 30mmHg, a decrease is diastolic pressure by 20 mmHg, or if the heart rate increases by 10 beats per minute. Resultant syncope or presyncope are also signs of orthostatic hypotension.

If the patient is stable, continue with a thorough physical examination. On inspection you are looking for skin changes such as signs of chronic liver disease, coagulopathy, vascular dysplasias, vasculitis or dermatological manifestations of inflammatory bowel disease.

When examining the head and neck, be sure to look for signs of epistaxis, any hyperpigmented areas on the lips or gums, or a Webbed neck suggestive or Turner's disease which can be associated with both IBD and gastrointestinal vascular malformations.

On respiratory and cardiac examination, look for signs of hemoptysis which can indicate a respiratory source of bleeding and listen for any murmurs, such as a flow murmur, and be sure to check perfusion status through capillary refill time both centrally at the sternum as well as peripherally at the fingers and toes.

On abdominal exam, be sure to exam for splenomegaly and hepatomegaly which is suggestive of portal hypertension and a resultant esophageal variceal source of bleeding. Also examine for ascites and any tenderness or distention of the bowel.

Perianal examination should look for perianal abscesses, ulcerations, skin tags, fissures, hemorrhoids or rectal masses.

Be sure to examine the patient's joints for arthritis which can be associated with Henoch-Scholen purpura.

Also be sure to assess the patient's growth as failure to thrive or a stunted growth trajectory can be indicative of an underlying cause such as IBD or Hirschsprung's disease.

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Red Flags

Red flag signs and symptoms that indicate significant blood loss and the potential need for resuscitation include pallor, diaphoresis, lethargy, abdominal pain, tachycardia, tachypnea, prolonged capillary refill time, hypotension, altered mental status and metabolic acidosis. Tachypnea and tachycardia are often the first to present in the context of a significant GI bleed, followed by increased capillary refill time and decreased urine output, metabolic acidosis and altered mental status. Orthostatic changes in heart rate and blood pressure and the absence of pulses also indicate significant blood volume loss.

Investigations

Lab work:

When suspicious of GI bleeding, your initial investigation should begin with lab tests including a CBC, INR, PT and PTT. Anemia can indicate both the severity and chronicity of the bleed. Recall that a microcytic anemia is associated with chronic blood loss while in the case of acute and sudden onset of bleeding, a normocytic anemia may be present. Low platelets or thrombocytopenia can suggest portal hypertension which increases suspicion for varices. However, it is important to note that absence of anemia does not exclude the possibility of iron deficiency because iron depletion is relatively advanced before anemia develops. An Apt-Downey test can be used to distinguish between fetal and maternal blood when suspected. Remember than hemoglobin measurements are a much less reliable indicator of volume depletion compared to vital signs.

Additional investigations can be added to lab work depending on the clinical context:

- Liver function tests can be considered in the case of suspected variceal bleeding
- Markers of inflammation such as erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP) can be added in the context of known or suspected IBD or other inflammatory etiologies
- BUN and creatinine if investigating a potential hemolytic uremic syndrome. Note that a BUN to creatinine ratio of more than 30 is more suggestive of an upper GI bleed due to catabolism of amino acids from RBCs in the intestine
- Stool samples can also be obtained to assess for occult blood loss and enteric pathogens

Guaiac testing is a method of confirming the presence of blood in either stool or vomit samples, however, these results must be interpreted with caution and while considering conditions that may lead to either false positives or false negatives.

Imaging

When considering the appropriate imaging to order, consider the most likely differential diagnoses. Plain x-rays of the abdomen are usually of little help in cases of suspected GI bleeding but can be helpful in assessing for signs of obstruction or pneumatosis in infants. Air or water-soluble contrast enema is recommended for children under the age of 2 whose history and physical exam is suggestive of intussusception. Further imaging

and investigations including ultrasound, endoscopy or a Meckel scan can be considered based on patient stability and clinical suspicion for an underlying etiology.

An endoscopy or colonoscopy is often the imaging modality of choice and is indicated in most children with suspected GI bleeding in order to locate the source of the bleeding as well as for potential management. Emergent endoscopy is reserved for children with severe hemodynamic compromise who are refractory to resuscitation with blood products due to the increased risk profile of emergent endoscopy as a result of challenges with anesthetic management in hemodynamically unstable children as well as additional factors such as other comorbidities and risk of aspiration.

Remember that a colonoscopy is contraindicated in cases of suspected perforation, toxic megacolon, recent abdominal surgery, unstable medical illness including abnormal vital signs or severe anemia, inadequate bowel preparation, coagulopathy and massive lower GI bleeding.

Video capsule endoscopy (VCE) is an emerging technique for imaging GI bleeding as it allows for visualization of the small bowel in the absence of distension and therefore, in its natural state.

Management

The treatment and management of pediatric cases of gastrointestinal bleeding can vary dramatically based on underlying etiology of the bleeding source and can require can extensive teams of pediatricians, gastroenterologists and in some cases, surgeons.

General Principles

Some general principles of treatment are, first and foremost, fluid resuscitation in order to maintain patient stability. Depending on the amount of blood loss, replacement with blood products may be required as well as correcting any underlying coagulopathy. Whenever faced with potential GI bleeding in a children, be sure to be prepared to resuscitate the patient if needed, ensuring proper equipment and supports are available.

Medical Management

Medical management is initiated with the goal of reducing the risk of rebleeding and can be achieved with acid-suppressing agents, which stabilize clot formation, and vasoconstrictive agents. Acid-suppressing agents including H2 receptor agonists such as Ranitidine and proton pump inhibits such as omeprazole, esomeprazole, or pantoprazole. Proton pump inhibitors are generally started when Upper GI Bleeding is suspected, though their usefulness relates mostly to ulcer related bleeding as in the case of peptic ulcer disease and reflux. Vasoconstrictive agents include Octreotide, which is a synthetic somatostatin analogue and works by decreasing blood flow to the GI tract by inhibiting glucagon mediated vasodilation. It has been shown to be a safe and effective therapeutic agent in nonarterial severe GI bleeding in the pediatric population, however, is associated with a small risk of hyperglycemia and bowel ischemia. Lastly, depending on the etiology, antibiotics may be indicated such as in the

case of H pylori infections, where a combination of a proton pump inhibitor, amoxicillin, and clarithromycin or metronidazole are considered first-line therapy.

Endoscopic Management
Imaging is generally indicated in order to identify the source of the blood and can also be therapeutic, allowing to directly access and stop the bleeding and can be extremely effective in controlling the bleeding.

Endoscopy can play a role in identifying the source of bleeding and possibly allowing a therapeutic intervention to stop the bleeding. When significant GI bleeding is suspected, consultation with a Gastroenterologist is a part of the management plan.

Surgical management may be required depending on severity and extent of the underlying etiology, as in the case of Meckel's diverticulum and advanced cases of intussusception in order to prevent intestinal ischemia.

Case
Now let's get back to our cases. After obtaining a detailed history from both patients, performing a thorough physical exam, constantly re-assessing vitals and patient stability, and given what you know about pediatric GI bleeding, you are able to categorize the symptom presentation for each of your patients.

Charlie is presenting with vomiting, hematochezia and abdominal pain which you believe is likely a lower GI bleed. Given the colicky abdominal pain and vomiting that were sudden in onset, you are concerned about intussusception as this, along with the onset of currant-jelly stool, represents a true surgical emergency. Also, on your differential given age and history are common causes such as anal fissures, milk/soy protein allergies or infectious gastroenteritis. Along with your preceptor, you decide to order an abdominal ultrasound and consult pediatric surgery for further investigation. A diagnosis of intussusception is confirmed and options for reduction are discussed with the family.

Bailey is presenting with hematemesis or coffee-ground emesis accompanied by burning retrosternal chest pain which you categorize as a likely upper GI bleed. You learn that she has been prescribed antacids. You know that the differential diagnosis for this constellation of symptoms is long, however, given Bailey's family history for peptic ulcer disease and lab work showing a microcytic anemia indicative of chronicity of blood loss, a gastric ulcer is suspected, and Bailey is referred to gastroenterology for an esophagogastroduodenoscopy (EGD).

Take Home Points
Let's recap. GI bleeding in children can represent a long list of potential etiologies and an approach can help narrow down the source and underlying cause.

1. First things first, whenever you are dealing with a potential bleed in a child, be sure the patient is stable. Continuously reassessing for patient stability and

being prepared to initiate ABCs of resuscitation by having the right equipment and support around you are crucial.
    a. Red flag signs that may indicate a hemodynamically unstable patient include pallor, diaphoresis, lethargy, tachycardia, tachypnea, prolonged capillary refill time, hypotension, and altered mental status

   A thorough physical exam is crucial for assessing patient stability and in helping you manage your patient.
2. Recall that upper and lower GI bleeds often present differently and early differentiation between the two can help narrow down the anatomical areas that may be affected as well as your next steps. A thorough history including details surrounding the bleeding can be immensely helpful in narrowing down potential sources of the bleed.
3. Remember that bleeding from other sources can mimic GI bleeds. Ruling out blood from epistaxis, oropharyngeal and respiratory sources, swallowed blood from breast feeding and blood from GU sources are important when it comes to management.
4. Although treatment was not discussed in this podcast, treatment should be chosen in order to treat the underlying cause and minimize risk of recurrence.

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