Gastrointestinal Bleeding

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INTRODUCTION

Presentation

- Upper gastrointestinal bleeding
    - Upper gastrointestinal bleeding (GI) is defined as bleeding proximal to the ligament of Treitz.
    - Melena (black, tarry stool) is a common manifestation of upper GI bleeding while hematochezia is more likely to be due to lower GI bleeding
    - The most common causes include peptic ulcer disease (55%), gastroesophageal varices (10%), erosive esophagitis/gastritis/duodenitis (23%), Mallory Weiss tear (7%), neoplasm (2.9%), Dieulafoy's lesion (1%), aortoenterteric fistula (rare, but cannot afford to miss) and marginal ulcer (less than 1%).
    - Bleeding peptic ulcer disease is the most common pathology to require operative intervention (5-10% of patients).
    - Patients may complain of abdominal pain, emesis, abdominal distension, dysphagia, early satiety, or be asymptomatic depending on the etiology of the bleeding.
    - Melena (black, tarry stool) is a common manifestation of upper GI bleeding while hematochezia is more likely to be due to lower GI bleeding.
    - Patients may present in hemorrhagic shock. Physical exam reveals melena, hematemesis, abdominal tenderness; laboratory tests may show elevated blood urea nitrogen to creatinine ratio (>30) with normal or abnormal hemoglobin levels depending on the rate of bleeding

- Lower gastrointestinal bleeding:
    - Lower GI bleeding is defined as bleeding distal to the ligament of Treitz.
    - The most common causes include colon cancer, diverticulosis, angiodysplasia, ischemic colitis, infectious, post-polypectomy and inflammatory bowel disease.
    - Patients with lower GI bleeding typically present with hematochezia. Bleeding stops spontaneously (i.e. 80% of patients) and mortality is reported to be between 2-4%.
    - Clinical presentation may overlap upper GI bleeding.

Initial Treatment and Workup

- Upper gastrointestinal bleeding
    - Patients should receive intravenous fluids or colloid resuscitation initially depending on their level of shock and any coagulopathy (including hepatic dysfunction, oral/intravenous anticoagulation) should be corrected.
    - A hemoglobin level of >7 is adequate for most patients. 1 unit of packed red blood cells should raise hemoglobin by 1 gram.

- Patients should be empirically started on intravenous proton pump inhibitor twice daily and vasopressin can be added in cases of massive upper GI bleed (0.2 – 0.4 units/min IV, and titrate by doubling the dose q 30 min until bleeding responds). Prophylactic antibiotics (ceftriaxone 1g/day or norfloxacin/levofloxacin 750mg/day for 5-7 days) and octreotide 25 micrograms/h for 24 should be added in cases of variceal bleeding.
- IV erythromycin 250 mg or metoclopramide 10 mg administered 20–120 min before endoscopy in patients with acute UGIB decreases the need for a repeat endoscopy to determine the site and cause of bleeding.[1]
- Gastroenterology, surgery and interventional radiology services should be involved in the care of the patient.
- The initial evaluation should include history, physical examination (including rectal exam), laboratory tests including complete blood count, coagulation studies (including TEG, if available), basic metabolic panel, liver function tests and type & cross, placement of large bore intravenous catheters and assessment of the airway, breathing, and circulation in the critically ill patient.
- The history should identify key risk factors for portal hypertension (heavy alcohol use, liver disease, obesity, auto-immune disease, jaundice, bleeding), peptic ulcer disease (smoking, non-steroidal anti-inflammatory drugs, *Helicobacter.pylori*, family history of ulcer disease, alcohol usage), malignancy, past surgical history (including gastric-bypass or aortic graft) and history of anticoagulation.
    - A history of peptic ulcer disease, as well as prior treatment, may be useful in guiding decision-making intra-operatively, such as option for an antrectomy and vagotomy over Graham patch if the patient has failed prior therapies.
- Nasogastric tube placement with lavage is unlikely to be helpful in patients with melena or hematochezia, but lavage with room temperature water (until bile returns) that reveals blood or coffee-ground material implies upper GI bleeding.
- Upper endoscopy should be performed within 12 hours after ensuring the patient has a secure airway (with intubation if necessary) and is hemodynamically stable.
- National Institute for Health and Care Excellence (NICE) guidelines recommend that all patients should have a Glasgow Blatchford Score (GBS)[2] calculated pre-endoscopy followed by a full Rockall Score post-endoscopy. The Rockall Score[3] attempts to predict risk of rebleeding and mortality and requires endoscopy for full calculation. The GBS can be calculated prior to endoscopy and has been shown to predict the need for intervention (blood transfusion, endotherapy and surgery) or death. A GBS >12 has been suggested to identify patients who would benefit from early endoscopy.

Glasgow Blatchford Score[2]

Admission risk marker	Score component value
Blood urea (mmol/L)	
⩾6·5 <8·0	2
⩾8·0 <10·0	3
⩾10·0 <25·0	4
⩾25	6
Haemoglobin (g/L) for men	
⩾120 <130	1
⩾100 <120	3
<10·0	6
Haemoglobin (g/L) for women	
⩾100 <120	1
<100	6
Systolic blood pressure (mm Hg)	
100–109	1
90–99	2
<90	3
Other markers	
Pulse ⩾100 (per min)	1
Presentation with melaena	1
Presentation with syncope	2
Hepatic disease	2
Cardiac failure	2

Rockall Score[3]

	Score			
Variable	*0*	*1*	*2*	*3*
Age	<60 Years	60–79 Years	>=80 Years	
Shock	'No shock', systolic BP >=100, pulse <100	'Tachycardia', systolic BP >=100, pulse >=100	'Hypotension', systolic BP <100	
Comorbidity	No major comorbidity		Cardiac failure, ischaemic heart disease, any major comorbidity	Renal failure, liver failure, disseminated malignancy
Diagnosis	Mallory-Weiss tear, no lesion identified and no SRH	All other diagnoses	Malignancy of upper GI tract	
Major SRH	None or dark spot only		Blood in upper GI tract, adherent clot, visible or spurting vessel	

Maximum additive score prior to diagnosis=7. Maximum additive score following diagnosis=11.

- Lower gastrointestinal bleeding
  - Initial evaluation is similar to upper GI bleeding.
  - Consider prothrombin complex concentrate in patients therapeutic on warfarin.
  - Reversal for patients with indications for ongoing anticoagulation should be considered on a case-by-case basis, in a multidisciplinary fashion.
  - Polypharmacy is common in the elderly population and this increases morbidity and mortality from GI bleeding.
  - Once a lower GI bleed is suspected and initial resuscitation begun, additional diagnostic studies should be obtained including colonoscopy. Initial resuscitation is similar to patients with upper GI bleed.

Techniques for Difficult Localization

- Upper gastrointestinal bleeding
  - Upper endoscopy is the initial diagnostic and therapeutic modality for upper GI bleeding. Patients with high risk of aspiration, multiple comorbidities, hemodynamic instability and obscured exposure due to blood may require early intubation. Early endoscopy (within 12 hours) is recommended in most patients after adequate resuscitation.
  - Other diagnostic tests include angiography, small bowel enteroscopy, tagged red blood cell scan, deep enteroscopy and computed tomography angiography (CTA). CTA performed before therapeutic angiogram leads to faster selective catheterization of bleeding vessels.
  - In the absence of small bowel obstruction, capsule endoscopy is useful to guide deep enteroscopy or surgical intervention.
  - If there is continued upper GI bleeding after angioembolization, consider collateralization of gastroduodenal artery through the pancreaticoduodenal arcade, which may also require embolization.
    - The patient's physiologic status may determine whether repeat angioembolization or surgical intervention is indicated.
  - Forrest classification predicts rebleeding incidence, surgical requirement and incidence of death based on EGD findings:
    - Active bleed (spurting bleed or oozing bleed) carries a 55% chance of rebleeding, 35% surgical requirements and 11% incidence of death.
    - Recent bleed (non-bleeding visible vessel or adherent clot) carries a 40% chance of rebleeding, 10-34% surgical requirement and 7% chance of death.
    - Lesion without bleeding (flat spot or clean base) carries a 5-10% chance of rebleeding, 0.5% surgical requirement and 2% chance of death.

- Lower gastrointestinal bleeding:

- 10-15% of patients with severe hematochezia will have an upper GI source.
- If the source is identified on colonoscopy, endoscopic treatment may be attempted. If a source is not found, additional workup should be pursued to identify the bleeding before any attempt at operative management, including upper endoscopy or angiogram/CTA. Attempts at localization should occur before operative intervention.
- If no source of bleeding is identified on colonoscopy and bleeding persists, options to investigate the small bowel include capsule enteroscopy, angiography (with or without embolization), tagged red blood cell scan and/or segmental resection.
- Intraoperative endoscopy, small bowel resection or subtotal colectomy with ileorectal anastomosis may be necessary in an patient requiring ongoing transfusions with unlocalized bleeding.
- If a source is still not identified, additional testing may include a nuclear medicine Meckel's scan, laparoscopy/laparotomy with intraoperative enteroscopy, or a provocative angiogram.
- Superselective angioembolization is an effective rescue treatment modality after failed endoscopic management with low rates of ischemic complications.
- Provocative angiography results in successful definitive treatment of recurrent bleeding in 31% of cases.
    - It is performed by adding systemic anticoagulation with 5000 units of heparin followed by selective transcatheter injection of a vasodilator (such as 100 micrograms of nitroglycerin) and 10 mg of tissue plasminogen activator.
    - If extravasation if visualized but bleeding is not controlled, the catheter can be left in place distal in the vessel. In the operating room, 0.5 ml methylene blue injection through the catheter will help to localize the segment for resection and hence limit the length of resection. If methylene blue is injected during initial angiography, rather than intraoperatively as advocated, it may appear diffusely in the operative field.

Operative Considerations

- All possible attempts should be made to identify a clear bleeding point before operative intervention. Surgery should be considered as a last resort in patients with either recurrent bleeding, or hemodynamically unstable patients, without a source.

Upper gastrointestinal bleeding

- Indications for operative intervention include:
    - hemodynamically unstable patients refractory to resuscitation (see below)
    - 2 attempts at endoscopic therapy with failure of angioembolization
    - unstable patients without local access to endoscopy or angiography.
- Patient mortality increases with transfusion requirements. Bender et al noted a reduced mortality (7%) for patients requiring less than 10 units of blood, while the mortality increased to 27% for patients receiving more than 10 units. Therefore, patients with ongoing hemorrhage who require more than 6–7 units of blood during 24 hours of resuscitation should be considered for surgical intervention.

- Only 5-10% of patients require operative intervention.
- The literature does not define any specific amount of transfused packed red blood cells as an indication for transfusion.

- Indications for operative intervention and operative technique by disease etiology:

1. Peptic ulcer disease:
    - life-threatening hemorrhage not responsive to resuscitation
    - failure of medical therapy and endoscopic hemostasis after two attempts at endoscopy
    - coexisting reason for surgery such as perforation, obstruction or malignancy.
    - n the authors' practice, the common indication for operative intervention is inability to control hemorrhage after angiogram with possible intervention and 2 attempts at endoscopy.
    - **Operative Techniques:**
    - 3-point ligation of gastroduodenal artery (GDA): For bleeding duodenal ulcers, an upper midline incision and Kocher maneuver is used to mobilize the duodenum. The pyloric vein of Mayo indicates the anterior surface of the inferior pylorus. Two silk sutures are placed astride the anterior pylorus, parallel to each other. A longitudinal pyloric incision is made through the pyloric muscles extending 2-3 cm proximally into the stomach and distally into the duodenum to expose the ulcer. The GDA is ligated proximally and distally to the bleeding site using figure-of-eight sutures at the cephalic and caudal aspect of the ulcer and deep enough to occlude the GDA. A third horizontal mattress is place to control hemorrhage from the transverse pancreatic branch of the GDA. Avoid injury to the common bile duct during suture placement. Heineke-Mikulicz pyloroplasty (described below) is performed.
    - Vagotomy and pyloroplasty: Vagotomy is added to type 2 (combined gastric and duodenal ulcers) or type 3 (prepyloric ulcers) gastric ulcers. Vagotomy and pyloroplasty is also indicated for patients who have failed medical management or who are non-compliant.
        i. Biopsy of these ulcer types is performed, with over sewing or excision of the ulcer in combination with vagotomy and drainage procedure. Vagotomy is performed by retracting the left lobe of the liver to the patient's right to expose and incising the pars flaccida. Dissection is continued toward the right diaphragmatic crura and the esophagogastric junction is identified and encircled with a Penrose drain. The left and right vagus nerves may be found anteriorly and posteriorly along the intra-abdominal esophagus. Palpation of these structures is often described like a 'bowstring' or 'guitar string.' The right vagus nerve is clipped above and below and

a 1 cm segment of nerve must be sent to pathology for frozen section to confirm presence of the nerve. The dissection continues towards the lesser gastric curve to identify the left vagus nerve within the musculature of the distal esophagus. The left vagus is larger and easier to identify more proximally and feels like a "bowstring" on palpation. Pyloroplasty is then performed most commonly via Heineke-Mikulicz pyloroplasty, which divides the sphincter longitudinally and closes it transversely.

- Vagotomy and antrectomy: Vagotomy is performed as above. Begin by identifying the proximal resection margin at the incisura angularis, best identified at the confluence of the gastroepiploic vessels. Identify the pylorus and mark it with a suture, then ligate and divide the right gastric and gastroepiploic vessels. Transect the duodenum distal to the pylorus using a stapler, avoiding the portal triad. Over-sewing of the duodenal stump, using running 3-0 PDS suture, is at the surgeon's discretion. Transect the proximal stomach margin using a stapler. Reconstruct using Billroth I gastroduodenostomy if the duodenum is healthy and able to be mobilized, otherwise consider a BII or Roux-en-Y reconstruction.
- Highly selective vagotomy: Preserving the main vagal nerve innervations by maintaining small branches innervating the pylorus avoids the need for a drainage procedure (i.e. pyloroplasty). This procedure should be considered in patients with ulcer disease with irreversible risk factors, such as patients with rheumatoid arthritis who cannot be taken off non-steroidal medications. The greater curvature of the stomach is retracted to the patient's left. The omentum is incised close to the lesser curve and the nerves going toward the stomach wall are ligated proximal to the cardia to the incisura angularis. The terminal three branches of gastric nerve of Latarjet must be preserved to supply the antrum and pylorus.

2. Mallory-Weiss tear: These lesions rarely require surgical intervention and can be managed with over sewing the lesion with a running suture by exposure through an anterior gastrostomy.

3. Dieulafoy's lesion: In the event of endoscopic failure, Dieulafoy's lesions can be treated with surgical wedge resection guided by clips or India ink placed during endoscopy to improve localization. Rarely, gastrectomy is needed.

4. Gastritis: Surgical options for gastritis should only be considered as a last resort after all other measures have failed and include gastrostomy with ligation (58% rebleeding), subtotal gastrectomy (48% rebleeding), truncal vagotomy-pyloroplasty (28% rebleeding) and total gastrectomy. The literature suggests consideration of total gastrectomy if conservative surgery has failed.

5. Neoplasm: Malignancies should be resected using distal gastrectomy or total gastrectomy if there is no evidence of widespread metastasis. Consider palliative care consultation and transition to comfort measures if there is distant disease.

6. Aorto-enteric fistula (control and take down fistula): If the patient is hemodynamically stable, consider angiography with endovascular stent placement. Otherwise, the patient may require open repair and extra-anatomic bypass (axillobifemoral bypass). For open operative approach, begin by obtaining proximal and distal control of the aorta around the fistula, clamping above the renal arteries if necessary. This may be performed through the lesser sac, though more commonly via retroperitoneal approach. An aortic balloon catheter may also be utilized for proximal control. Debride back to healthy tissue and remove the aortic graft. The infrarenal aortic stump is over sewn, reinforcing with an omental flap and prevertebral fascia to avoid stump blowout. Culture the necrotic tissue to guide antimicrobial therapy. The intestinal defect is usually managed with primary repair, resection with primary anastomosis or ostomy depending on the size of the defect and health of the tissue.

7. Variceal bleeding:
    - Consider balloon tamponade with a Sengastaken-Blakemore tube or Minnesota tube in the event of refractory bleeding.
        i. The Sengastaken-Blakemore tube is placed by inserting the tube through the mouth or nose at least 50 cm then checking gastric placement with a plain radiograph. Once confirmed within the stomach, the gastric balloon is inflated with a total of 250 ml of air. Next, the tube is pulled forward so the balloon abuts the gastroesophageal junction, until resistance is met. The tube is secured to either a pulley or football helmet and weighed down with a 500 ml intravenous fluid bag. If bleeding continues, the esophageal balloon is inflated to 30-45 mmHg. The tube can be left in place for 24-48 hours, checking for rebleeding and possible deflation every 12 hours.
    - Self-expanding metal stents can also help provide hemostasis in patients with acute variceal bleeding or as a bridge to transjugular intrahepatic portosystemic shunt (TIPS).
    - Surgical indications include refractory bleeding after medical, interventional/endovascular, and endoscopic management and may include distal splenorenal shunt in patients with Child-Pugh A cirrhosis or liver transplant in patients with Child-Pugh B/C cirrhosis.

Lower gastrointestinal bleeding

- Intraoperative endoscopy can help determine the source of bleeding but may be technically difficult.

- Resection of the colon or small bowel should be directed toward the established site of bleeding.
- Subtotal colectomy with ileorectal anastomosis or end ileostomy/Hartmann's procedure is considered in the absence of preoperative localization, but is associated with higher morbidity and mortality. Subtotal colectomy may fail to stop the bleeding in a more proximal lesion in the small bowel and should be considered a last resort in an unstable patient.
- Blind segmental colectomy has a high rate of rebleeding (up to 75%) and mortality (up to 50%).

1. Diverticulosis: Surgery is indicated for bleeding refractory to colonoscopic and angiographic intervention. Although diverticula are more common in the left colon, bleeding occurs in the right colon 50% of the time. Segmental resection with anastomosis or colostomy, depending on the hemodynamic stability of the patient, should be performed after localization by endoscopy or angiography.

2. Angiodysplasia: These lesions can be treated endoscopically or with embolization. If unsuccessful, localized lesions can be managed with segmental resection, but capsule endoscopy should be performed prior to resection if possible, as there may be multiple lesions.

3. Colon cancer: Surgical oncologic principals should be followed in a stable patient who is responding to resuscitation. In unstable patients with uncontrolled bleeding after colonoscopy and angiography, surgical treatment with segmental resection based on localization is required, even in patients who would typically receive neoadjuvant therapy.

4. Inflammatory bowel disease: The site of bleeding is likely to mimic the distribution of the disease; for Crohn's disease this is the terminal ileum) and for Ulcerative Colitis this is the rectum. Pre-operative localization and intervention should be attempted as above. Segmental resection should be performed as dictated by localization. Chronic malnutrition may provide additional anastomotic challenges in addition to inflammatory bowel disease.

5. Unidentified bleeding: If unable to localize bleeding by the above methods and the patient requires exploratory laparotomy, begin by running the entire small bowel to rule out any palpable lesions. Colonoscopy and/or enteroscopy may be performed to attempt to localize the lesion. If unable to identify any source, consider "blind" subtotal colectomy with ileostomy or ileoproctostomy which is associated with 4% rebleeding rate and mortality ranging from 20-50%

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