Journal of Experimental and Clinical Medicine
https://dergipark.org.tr/omujecm

**Review Article**

J Exp Clin Med
2021; 38(S1): 23-32
**doi:** 10.52142/omujecm.38.si.gastro.3

# Lower gastrointestinal bleeding

**Serkan ÖCAL[1,*], Mehmet Mutlu ÇATLI[2]**

[1]Department of Gastroenterology, University of Health Sciences Antalya Training and Research Hospital, Antalya, Turkey
[2]Departmant of Internal Medicine, Antalya Training and Research Hospital, Antalya, Turkey

**Received:** 13.12.2020 • **Accepted/Published Online:** 09.01.2021 • **Final Version:** 18.03.2021

**Abstract**

Bleeding from the lower part of the digestive system that appears as hematochezia (fresh blood, clot or cherry-colored stool) or melena (dark-colored tarry stool) is called lower gastrointestinal tract bleeding (lower GI bleeding) (or colonic bleeding). In the traditional definition, lower GI bleeding was generally classified as bleeding distal to the Treitz ligament (duodenojejunal junction) as the border. In the last decade, GI bleeding has adopted three categories in some recent publications: Upper, middle, and lower. According to this category, bleeding from a source between the Treitz ligament and the ileocecal valve is classified as middle GI bleeding, bleeding from the distal of the ileocecal valve is classified lower GI bleeding. Lower GI bleeding and hospitalization rates increase with aging. Currently, physicians managing lower GI bleeding have many different diagnostic and therapeutic options ranging from colonoscopy and flexible sigmoidoscopy to radiographic interventions such as scintigraphy or angiography. Lower GI bleeding often stops spontaneously and less common than upper GI bleeding. Even though no modality has emerged as the gold standard in the treatment of lower GI bleeding, colonoscopy has several advantages and is generally considered as the preferred initial test in most of the cases.

**Keywords:** bleeding, colonoscopy, hematochezia, sigmoidoscopy

## 1. Introduction

Bleeding from the lower part of the digestive system that appears as hematochezia (fresh blood, clot or cherry-colored stool) or melena (dark-colored tarry stool) is called lower gastrointestinal tract bleeding (lower GI bleeding) (or colonic bleeding) (Ghassemi and Jensen, 2013; Khan and Mandiga, 2020). In the traditional definition, lower GI bleeding was generally classified as bleeding distal to the Treitz ligament (duodenojejunal junction) as the border. In the last decade, GI bleeding has adopted three categories in some recent publications: Upper, middle, and lower. According to this category, bleeding from a source between the Treitz ligament and the ileocecal valve is classified as middle GI bleeding, bleeding from the distal of the ileocecal valve is classified lower GI bleeding (Kim et al., 2014). Lower GI bleeding and hospitalization rates increase with aging. Currently, physicians managing lower GI bleeding have many different diagnostic and therapeutic options ranging from colonoscopy and flexible sigmoidoscopy to radiographic interventions such as scintigraphy or angiography (Davila et al., 2005). Lower GI bleeding often stops spontaneously and less common than upper GI bleeding. Even though no modality has emerged as the gold standard in the treatment of lower GI bleeding, colonoscopy has several advantages and is generally considered as the preferred initial test in most of the cases (Lhewa and Strate, 2012).

## 2. Epidemiology

### 2.1. Incidence

Acute lower GI bleeding is one of the most prevalent gastrointestinal hospitalization indications. The incidence of hospitalization due to lower GI bleeding is estimated at 20 to 30 per 100,000 people per year (Longstreth, 1995). This ratio increases dramatically as the age progresses. However, in the same population, the incidence of hospitalization for acute upper gastrointestinal bleeding is 100 per 100,000 people annually (Longstreth, 1995).

### 2.2. Demographic information

In most studies, lower GI bleeding predominantly affects the elderly population, on average over 65 years of age (Velayos et al., 2004). Simultaneously along with advanced age distribution, it is also an important burden of comorbidities. Studies indicate that at least 70% of patients with lower GI bleeding have at least one comorbidity (Schmulewitz et al., 2003). Males were significantly more frequently affected than

* Correspondence: serkanocal75@yahoo.com

females in Longstreth 's population-based lower GI bleeding study (Longstreth, 1995).

### 2.3. Disease course

Most patients with lower GI bleeding have positive results despite older age and comorbidities (Lewis and Ndsg, 2008). Mortality rates range from 0% to 25% (Ghassemi and Jensen, 2013). The main cause of most deaths is not directly the uncontrolled bleeding, but the worsening of an underlying condition or due to a nosocomial complication. Increasing age, length of stay at hospital, and several comorbid conditions are independent predictors of all-cause mortality (Longstreth, 1995). Advances in endoscopic and radiological hemostasis techniques seem to reduce surgical intervention and recurrent bleeding rates (Oakland, 2019). Interventional radiology and surgery are at high risk for morbidity and mortality these patients. (Bregenzer et al., 2002).

## 3. Initial evaluation and treatment of acute lower gastrointestinal bleeding

### 3.1. Clinical history

Initial evaluation of the patient with suspected acute lower GI bleeding consists of medical history, obtaining vitals, thorough physical examination including rectal touch, and also nasogastric lavage if necessary and can be performed simultaneously with resuscitation (Strate and Gralnek, 2016b). Risk factors such as drugs that may cause colon ulcers or bleed, previous large bowel surgery, and symptoms to help identify the source of bleeding should be carefully questioned (Kim et al., 2014). Symptoms can help identify the source of the bleeding or be misleading. For example, bright red or cherry rectal bleeding may unexpectedly originate from the upper gastrointestinal tract at 15% (Ghassemi and Jensen, 2013).

### 3.2. Physical examination

In the first evaluation, physical examination should be done in detail and systemically. The patient's vital signs should be recorded, focusing on hypovolaemia symptoms such as orthostatic symptoms, postural complaints, pallor, palpitations, fatigue, chest pain, dyspnea, tachypnea, hypotension. The abdominal examination should be examined in terms of the surgical scar, organ growth, tenderness with palpation, and masses. The patient's stool should be examined to identify the color; however, the definition of the color of the stool varies widely between patients and physicians. Rectal examination should be performed both for investigating the probable anorectal disease also to confirm the stool color described by the patient. Whether the rectum is empty, stool, and possible blood contamination, gaita density and color of the finger on the rectal touch should be noted.

### 3.3. Laboratory

Standard total blood count, biochemistry panel, and coagulation tests should be studied from the blood samples of the subject with acute lower GI hemorrhage. Blood should be collected in a separate tube for blood group typing and cross-matching to prepare erythrocyte suspension in risky patients.

Hematocrit and hemoglobin values may not accurately reflect blood loss on hematological evaluation after the onset of bleeding, because it takes more than 24 to 72 hours for the vascular space to stabilize with extravascular fluid. Hemodilution also occurs in subsequent intravascular fluid administration and the result may be lower than its value.

Total leukocyte count does not increase much in lower GI bleeding than upper GI bleeding. It may increase according to the accompanying inflammatory condition with severe bleeding. Decreased thrombocyte levels may increase the severity of bleeding. In patients with upper GI bleeding, due to higher absorption of urea after blood proteins from the intestines that are broken down by gut bacteria, blood urea nitrogen level generally raises to a greater extent compared to the serum creatinine level, whereas this rate is not seen with lower GI bleeding.

Prothrombin time (PT) and INR levels may indicate if a subject has disruption in the extrinsic coagulation pathway. Increased values may be seen in chronic hepatic disease or due to warfarin, and may change the severity of bleeding and treatment approach

### 3.4. Clinical determination of the bleeding area

The duration, frequency, and colour of blood passing through the bowel can help distinguish the severity and probable location of bleeding. While melena mostly indicates an upper GI origin, it can also be present in the small intestine or proximal colon bleeding. Hematocesia usually means a colorectal or anal origin of hemorrhage if the patient is not hypotensive (rapid blood loss). The presence of hypovolemic findings may indicate severe upper GI bleeding with the rapid passage of blood through the digestive system. In addition to stool colour, various tools are available to distinguish whether the bleeding is from upper- or lower-part GI tract. This step is important because 2% to 15% of patients who are presumed to have lower GI bleeding will have upper GI bleeding.

### 3.5. Hospitalization

Cases with severe GI bleeding should be hospitalized and closely followed and treated in the hospital. Those presenting only with mild bleeding (self-limiting hematochezia or rare melena) and those who are hemodynamically stable, with normal blood tests and that can be certain about returning to the hospital in case of recurrence of symptoms may be followed up in an outpatient setting rather than directly in the hospital. These patients may be suitable candidates for elective outpatient clinic examination and endoscopy. If there is abundant red-coloured blood from the rectum and large amounts of hematochezia, unstable vital signs, or other serious illnesses that may worsen the underlying medical conditions, patients should be monitored at the intensive care unit, followed by treatment.

## 4. Diagnostic procedures and endoscopic imaging

### 4.1. Colonoscopy

New improvements in endoscopic technologies have made

colonoscopy the leading modality in lower GI bleeding in the last 30 years. Following a rapid bowel cleaning, emergency colonoscopy is the first procedure for almost all patients presenting with suspected acute lower GI bleeding. It has both diagnostic and therapeutic intervention. After bowel preparations such as polyethene glycol (PEG) cleaning, in most cases initial evaluation is required before colonoscopy, but in selected ones, anoscopy or flexible sigmoidoscopy can be performed without prior bowel cleansing or following only enema (Hassan et al., 2019; Niikura et al., 2018).

One of the most important issues in diagnostic colonoscopy for acute lower GI hemorrhage is to identify the stigmata of recent hemorrhage, including active bleeding, visible vessel without bleeding, and adherent clot.

The best time to do emergency bowel cleansing and colonoscopy is unknown. Emergency colonoscopy for lower GI bleeding is usually planned approximately 6-24 hours following the patient's admission to the hospital.

In theory, the earlier the endoscopic procedure is performed, the more likely it is to find a stigmatic lesion (e.g., bleeding diverticula, a polyp stalk) which may be available to endoscopic intervention. One prospective study revealed no difference between urgent (12 hours after admission) and elective (36 to 60 hours after admission) colonoscopy in terms of more bleeding, blood transfusion, hospital days, or hospital costs (Laine and Shah, 2010).

Appropriate medical resuscitation in these patients not only allows more secure endoscopy but also provides an improved diagnostic evaluation for volume-dependent lesions and provides more effective hemostasis due to correction of coagulopathy.

Patients who are hemodynamically stable, whose general condition is better able to tolerate colonoscopy without any finding of active bleeding, can usually undergo an emergency colonoscopy (within 24 hours) in the GI endoscopy department instead of the ICU.

### 4.2. Anoscopy

Anoscopy with a slotted tool may be beneficial for patients suspected of ongoing bleeding due to internal haemorrhoids or any other anorectal diseases (e.g., fissures, fistulas, proctitis). Emergency treatment with rubber band ligation is recommended for internal haemorrhoids (Oakland et al., 2019).

### 4.3. Flexible sigmoidoscopy

Flexible sigmoidoscopy is used to examine the rectum and left colon for the possible hemorrhage, and it may be in an enema, or even an unprepared colon (Papagrigoriadis et al., 2004). Even though it's not sufficient for the examination of the anal canal, flexible sigmoidoscopy itself can be successful in diagnosing nearly 9% of patients (Ferguson, 2005).

In cases that the distal colon may be cleaned sufficiently with enema, urgent flexible sigmoidoscopy may be performed depending on the aetiology of bleeding such as solitary rectal ulcer, inflammatory bowel disease, radiation proctitis, post-polypectomy procedure bleeding (in rectosigmoid flexure)) or internal hemorrhoids. Therapeutic hemostasis can be achieved via endoscopy (Asge Technology et al., 2009).

Conventionally, colonoscopic examination for lower GI bleeding was postponed due to the required adequate bowel preparation and hesitation of increased procedural risks (Caos et al., 1986).

### 4.4. Computed tomography and computed tomography colonography

Using computed tomography (CT) in patients with acute bleeding has been extremely attractive due to its rapid and widespread availability and comprehensive evaluation capability. Multidetector CT (MDCT) is able to detect lesions in the colon which may be the origin of the hemorrhage (diverticula, colitis, masses, or varicose veins) (Wells et al., 2018). If there are hematochezia and abdominal pain available, CT is often performed. Fluoroscopic angiography and CT angiography are both useful in cases which do not respond well to resuscitation or who are unlikely to achieve appropriate bowel cleansing and have ongoing bleeding.

CTA has the advantage of ability to pinpoint the source of arterial and/or venous GI bleeding and identify the etiology that may cause the bleeding to guide subsequent treatment (Mortimer et al., 2011). Among the handicaps of CTA are reduced sensitivity compared to radionuclide imaging, relatively high radiation exposure, and development of iv contrast-induced renal damage. Due to the short scanning time, false-negative results may be seen if the patient is not bleeding during the imaging process.

### 4.5. Radionuclide imaging

Gastrointestinal bleeding study is a non-invasive diagnostic radionuclide imaging study to examine patients with an obvious suspicion of GI bleeding, particularly involving the middle and lower GI tracts (Dam et al., 2014). It is performed with erythrocytes with technetium-99m (99mTc-RBC) and helps to interpret the bleeding status (active or intermittent), also the gross localization, and quantitation (Dam et al., 2014). Radionuclide imaging in lower GI bleeding implies injecting 99mTc-RBC intravenously and obtaining serial scintigraphy to identify focal collections of radiolabeled material. This radionuclide imaging is reported to identify blood loss as low as 0.04 mL / min. In this examination, it was reported that the overall positive diagnosis rate was approximately 45%. Additionally, it detected with an accuracy of 78% to localize the actual bleeding site (Dam et al., 2014). False-positive results most probably occur if the passage of blood in the lumen is fast, so that the radiolabeled blood is identified in the lower GI tract even if the blood has exited the upper GI tract (Khan and Mandiga, 2020).

### 4.6. Angiography

Mesenteric angiography is most likely to identify a bleeding area during the arterial blood loss is minimum 0.5 mL/min to

identify extravasation in the intestine (Rasuli et al., 2014). One of the benefits of this procedure is that when the bleeding site is identified, therapeutic interventions are available with the same method. Mesenteric angiography is usually planned following positive technetium 99mTc-RBC scintigraphy or following positive CT in conditions of intermittent bleeding. The rate at which angiography detects an active bleeding site has been shown to depend on the bleeding rate, with the required bleeding rate of minimum 0.5 mL/min (Strate, 2005; Yoon et al., 2006). With technological improvements in super selective embolization of distal artery branches in interventional angiography, it has become an effective method for controlling upper GI bleeding quickly and safely (Hreinsson et al., 2016; Lv and Gu, 2019). However, significant complications may be seen in 3% of cases. These may be due to contrast agent reactions, hematoma formation, bowel ischemia, acute kidney injury, femoral artery thrombosis, and transient ischemic attacks (Wortman et al., 2017).

### 4.7. Barium enema

The role of double-contrast barium enema (DCBE) is decreasing in examination of lower GI bleeding (Farrell and Friedman, 2005). Emergency DCBE is not beneficial in subjects with lower GI hemorrhage. This imaging technique is not usually diagnostic due to its inability to show vascular lesions and can be misguiding when only diverticula are present (Iwamoto et al., 2008).

### 4.8. Surgery

Surgical treatment for lower GI hemorrhage is rarely required in subjects as majority of these cases are self-limiting or easily managed with medical or endoscopic treatment modalities (Ghassemi and Jensen, 2013). Surgical intervention may be needed when diffuse bleeding that cannot be stopped by medical therapy (such as ischemic colitis or bleeding due to inflammatory bowel disease), absent or ineffective angiography in the unstable cases, ongoing bleeding despite repeated endoscopic and/or angiographic interventions in the stable cases, or definite resection-managed etiology such as the neoplasm (Whitehurst, 2018; Yi et al., 2012). Conventional surgical indications include hemodynamic instability despite giving six units of blood, bleeding that persists for more than 72 hours, or re-bleeding 24 hours after admission.

## 5. Causes and management

Lower GI bleeding may present as an acute and mortal event or as chronic bleeding that can present as iron deficiency anemia, positive fecal occult blood test, or intermittent hematochezia (Barnert and Messmann, 2009). In cases where lower GI bleeding does not stop spontaneously, urgent intervention is required to determine the origin of the bleeding and to stop the bleeding. Colonoscopy allows detection of stigmata of recent hemorrhage (SRH) (visible vessels, adhering clot and/or spots) and provides information on location of the lesions and risk stratification, although active bleeding may not be always visible during colonoscopy (Aoki et al., 2019). A bleeding lesion can generally be diagnosed accurately when there is ongoing bleeding, a visible vessel, or a clot (Strate and Gralnek, 2016a).

### 5.1. Diverticular bleeding

The pseudo diverticulosis of the colon is defined as the mucosal and submucosal layers that penetrate through the intramural blood vessels from the weak points of the muscle layer (Wedel et al., 2015). Histologically, diverticula of the colon are in fact pseudo diverticulosis as they do not include all layers of the colon wall (Maykel and Opelka, 2004). Diverticula are typically seen as the colonic tissue is pushed out due to intraluminal pressure at spots of entry of the small arteries (vasa recta) (Schieffer et al., 2018). These spots of the vasa recta are places that are relatively weak so that the mucosa and submucosa may herniate when intraluminal pressure is raised (Wedel et al., 2015). Diverticula vary in size from a few millimeters to several centimeters and are mostly in the left colon (Brian West, 2006).

Most colonic diverticula remain asymptomatic and uncomplicated. Diverticular disease is the fifth most critical gastrointestinal condition in terms of healthcare costs in Western countries and its incidence increases with advanced age as being up to 60 % in people over 70 years (Violi et al., 2018).

Of the many different causes of lower GI bleeding, diverticular bleeding remains the most common reason (Laine et al., 2012). Diverticular bleeding of the colon usually presents as brisk hematochezia accounting for 30% to 50% of massive rectal hemorrhage cases (Rustagi and McCarty, 2014). The site of bleeding in a diverticulum may be bleeding from the veins in the diverticulum neck or base. Definitive diverticular hemorrhage, the site of the hemorrhage was the base in 52% and the neck in 48% of diverticula (Mohammed Ilyas and Szilagy, 2018). According to colonoscopy, CT angiography or surgical findings, diverticular bleeding should be classified carefully and rapidly (Mohammed Ilyas and Szilagy, 2018). Advanced age, tobacco and/or alcohol consumption, use of several medications (nonsteroidal anti-inflammatory medications (NSAIDs), aspirin, antithrombic drugs), and presence of bilateral diverticulosis and atherosclerosis-related diseases such as hypertension, diabetes mellitus, ischemic heart disease, and obesity have been proposed as possible risk factors for colonic diverticular bleeding. In addition, it has been suggested to increase the risk of prolonged recurrent hemorrhage (Rustagi and McCarty, 2014).

Diverticular hemorrhage generally manifests as painless, intermittent, and large volume lower GI hemorrhage. Although the nature or the color of the hemorrhage differs according to the severity of the hemorrhage, it can be seen in right-sided diverticular bleeding, clinically dark, burgundy blood, or bleeding resembling melena. Diverticular bleeding spontaneously ceases in 70-80% of cases with the rebleeding rate reported to range between 22% to 38% (Mohammed Ilyas

and Szilagy, 2018).

About one-third of patients with true diverticular hemorrhage (presumptive or definitive) during urgent colonoscopy following adequate cleansing have an SRH bleeding, such as ongoing bleeding, a visible vessel, an adherent clot, or a flat spot in a single diverticulum (Jensen, 2018).

Immediately after the appearance of SRH, the accepted standard management for diverticular hemorrhage is endoscopic intervention, which is endoscopic band ligation (EBL), injection therapy, clipping, endoscopic detachable snare ligation therapy (EDSL), or thermal contact. (Bloomfeld et al., 2001; Jensen et al., 2000; Kishino et al., 2020).

The hemostatic powder as topical sprays (hemospray, EndoClot, Ankaferd) is not a preffered hemostatic treatment modality for diverticular hemorrhage.

The over-the-scope clip (OTSC) system (Ovesco Endoscopy AG, Tübingen, Germany) is developed for a full-thickness tight closure by using the saw-like teeth of a shark and can treat a GI perforation or post-surgery leakage or fistula (Kato, 2019).

After the endoscopically identification and treatment of diverticulum bleeding is achieved, a permanent submucosal tattoo should be made throughout the lesion. Because it makes it easy to locate the colonoscopy in case of repetition or surgery for recurrent bleeding.

Arterial embolization is recommended for massive colon diverticular bleeding that is difficult to achieve with colonoscopy and in persistent or recurrent colon diverticular bleeding where it is difficult to determine the bleeding site. (Nagata et al., 2019). Surgical intervention for diverticular hemorrhage is rarely needed that cannot otherwise be stopped or if the bleeding vessel cannot be located, laparotomy and total colectomy can be recommended (Wilkins et al., 2009).

**5.2. Colitis bleeding**

The term colitis indicates any form of inflammation of the colon. Causes of severe lower GI hemorrhage may include ischemic colitis, inflammatory bowel disease, or infectious colitis. Ischemic colitis is cause of ischemic damage in the gastrointestinal tract, the following most common cause of inpatient hematosis, and the third most common colonic cause of severe hematochezia (Dimitrijevic et al., 2008; Washington and Carmichael, 2012). The blood supply of the colon is abundant. It is where anastomoses between the upper and lower mesenteric arteries are most prone to ischemia as there is less vascularia normally supplied by 10-35% of cardiac output, and ischemia may be seen when blood supply reduces by more than 50% (Salsano et al., 2018).

Ischemic colitis may present as a wide spectrum of injury and clinical severity ranging from mild reversible mucosal injury to life-threatening, irreversible, transmural involvement (Chavalitdhamrong et al., 2011). Risk factors related to ischemic colitis have been suggested to include advanced age, shock, cardiovascular surgery, cardiac failure, chronic obstructive lung disease, ileostomy, colorectal malignancy, abdominal surgery, constipation, use of laxative, oral contraceptive and/or use of an H2 receptor blockers (Cubiella Fernandez et al., 2010). Most of the patients (75-85 percent) have self-limited ischemic colitis and generally respond to medical treatment (Green and Tendler, 2005; Tadros et al., 2013). As with other ulcers, focal ischemic ulcers with bleeding marks, which can be seen as a result of endoscopic epinephrine injection and hemoclip, can also be seen (Chavalitdhamrong et al., 2011). Rapid recognition and surgical intervention are critical in gangrenous colitis and bleeding that cannot be stopped endoscopically. Inflammatory colitis encompasses chronic inflammatory bowel disease which accounts for up to 6-30% of all patients with lower GI bleeding (Frost et al., 2017). Inflammatory bowel disease that involves the colon does not usually cause critical acute lower GI hemorrhage. Most of those cases had Crohn's disease, and majority of them responded well to medical treatment.

Infectious colitis should be excluded in all patients with severe lower GI hemorrhage and colitis. Infections such as *Campylobacter jejuni, Salmonella, Shigella, enterohemorrhagic Escherichia coli* (O157: H7), *Cytomegalovirus* or *Clostridioides difficile* can cause lower GI bleeding. Other causes of lower GI bleedings include opportunistic infections associated with HIV, such as lymphoma and Kaposi sarcoma (Navaneethan and Giannella, 2011). Substantial blood loss is unusual except in cases with severe bleeding diathesis. Stool cultures and flexible sigmoidoscopy or colonoscopy may be useful for diagnosis. Medical management is the main treatment; preference of antibiotics depends on the causative organism. Endoscopic intervention usually has no benefit in infectious colitis.

**5.3. Post-polypectomy bleeding**

Polypectomy via colonoscopy has become a valuable modality for eliminating the precursors of colorectal malignancies. However, complications such as bleeding, perforation and pain may occur. The most prevalent complication after following the procedure is bleeding, which is reported to range from 1% to 6% and that can be instantly or delayed (Kim and Lim, 2011). Early bleeding occurs instantly after resection and delayed bleeding occurs in a few hours to a few days after the procedure in approximately 2% of all patients (Kim, 2011). Polyp size (large), thick stalk, shape (pedunculated), use of anticoagulants, use of aspirin or another NSAIDs, and location (right Hemi-colon) stood for important risk factors for the development of delayed bleeding following colonoscopic polypectomy (Kim et al., 2013; Kwon et al., 2015). In cases with severe bleeding in whom an SRH is found in the ulceration, a doppler endoscopic probe can be used to determine underlying arterial blood flow and the need for endoscopic hemostasis include endoscopic clips, direct thermal

therapy, performed with bipolar cautery, snare tip, or thermal probes with or without epinephrine injection (Gutta and Gromski, 2020; Ma and Bourke, 2016).

### 5.4. Colon neoplasia bleeding

Colon polyps and cancer may manifest as acute lower GI bleeding. Hematochezia is a symptom that should be considered carefully. Colonic neoplasia was the eighth most prevalent cause of severe hematochezia. Studies pointed out that 7-10% of patients with chronic overt rectal bleeding did actually have colorectal cancer (Carlo et al., 2006). Typically, microcytic iron deficiency anemia consistent with gradual GI blood loss before overt hemorrhage occurs (Jensen and Machicado, 1988). Acute lower GI bleeding due to colorectal neoplasia generally is a consequence of superficial ulcerations of an advanced tumor (Committee et al., 2014). Epinephrine may be injected intralesionally to slow ongoing bleeding during colonoscopy, and hemoclips may be applied to treat SRH on ulcerated lesions that are unresectable endoscopically (Raju et al., 2007) Hemostatic powder may have a palliative role. Surgical intervention is generally needed to avoid rebleeding from a large, ulcerated sessile lesion (Anderloni et al., 2014).

### 5.5. Radiation proctitis bleeding

Radiation proctitis generally results in mild chronic hematochezia but rarely may cause acute severe lower GI hemorrhage. Radiation therapy may result in acute and chronic injury of the normal colorectal mucosa when aimed to treat pelvic tumors—gynecologic, prostatic, bladder, or rectal (Kennedy and Heise, 2007). Tenesmus, diarrhea, abdominal cramping, and, infrequently, hemorrhage may be seen for a few weeks in approximately 75% of cases who have received a radiation dose of 4000 cGy (Do et al., 2011). Chronic radiation effects arise 6-18 months following the end of radiotherapy and present as fresh red blood in the stool. Most of the cases are diagnosed following colonoscopy or sigmoidoscopy indicating pallor, friability, and telangiectasias (Do et al., 2011).

Treatment involves avoidance of aspirin and other NSAIDs, a high-fiber diet, and iron replacement therapy if the subject has iron deficiency anemia. For noninvasive management of chronic radiation proctitis, oral, rectal or gaseous drugs or agents are used initially. These agents consist of anti-inflammatory drugs (steroids or various 5-aminosalicylic acid (5-ASA) preparations, sucralfate, short-chain fatty acids, misoprostol, hyperbaric oxygen treatment, 4% formalin, metronidazole, and antioxidant agents. Various endoscopic ablation therapies including the Nd: YAG and argon lasers are available for the management of chronic proctitis-related hemorrhage resulting from local telangiectasias.

### 5.6. Angioectasia

Colonic angioectasia are the most prevalent vascular lesion in the gastrointestinal tract in the elderly and is one of the most frequent causes of chronic or recurrent lower gastrointestinal hemorrhage (Diggs et al., 2011). Estimated prevalence differ from 2% to 50% in studies of colonoscopy performed for various indications (Diggs et al., 2011). Colonic angioectasia is suggested to be a consequence of chronic, intermittent, low-grade occlusion of submucosal vessels. Endoscopic procedures are performed for both diagnostic and therapeutic purposes of vascular malformations. In a significant number of patients, the patient's age, comorbidities, clinical severity of anemia and blood loss, as well as size, location, and accompanying lesions prevent this therapeutic approach (Garcia-Compean et al., 2019; Gifford et al., 2012). There are many endoscopic treatment methods involving different techniques, all of which aim the eradication of the mucosal abnormality. Nevertheless, recurrent hemorrhage following endoscopic procedure is not rare; frequently requiring more than one intervention (Garcia-Compean et al., 2019). with several methods which, are argon plasma coagulation, monopolar electrocoagulation, and bipolar electrocoagulation as well as photocoagulation with Nd: YAG and argon. The laser has been available for a long time (Garcia-Compean et al., 2019). Embolization with high selective angiography has a successful hemostatic efficacy, increasing from 80% to 90%. Hormonal drugs (a mixture of estrogen and progestogens), somatostatin analogs (octreotide and lanreotide), and thalidomide are not currently suitable for clinical use as effective prophylactic therapy. However, the most effective rescue treatment is surgical intervention (Gifford et al., 2012).

### 5.7. Internal hemorrhoid bleeding

Hemorrhoids are common and are estimated to affect 4% to 38% of the adult population (Krebs et al., 2020). An important proportion of people who have hemorrhoids may have complaints such as bleeding, pain, and itching (Lohsiriwat, 2012). The most common presentation of hemorrhoids is rectal bleeding during defecation without pain that may be associated with prolapsing anal tissue (Aigner et al., 2009). In hemorrhoid bleeding, the blood does not mix with the stool, it covers the outer surface of the stool or may be noticed during cleaning following defecation. The blood is usually bright red since the hemorrhoid plexus has direct arteriovenous communication (Aigner et al., 2009). typically, bleeding is mild, intermittent, and self-limited but, rarely, severe transfusion-requiring bleeding may occur due to hemorrhoids (Krebs et al., 2020). Hemorrhoids are seldom life threatening. Usually, these patients are treated to improve the quality of life. (Riss et al., 2011).

A careful history and detailed physical examination, including digital rectal examination and anoscopy, are essential for the diagnosis of hemorrhoids (Lohsiriwat, 2013). If bright red blood is not clearly visible in the anal canal, flexible sigmoidoscopy or colonoscopy should be planned after colonic cleansing preparation for every patient with rectal bleeding, especially those with colorectal cancer risk (Lohsiriwat, 2013).

The management of internal hemorrhoids begins with

medical approach involving fiber supplementation, stool softeners, lubricant rectal suppositories (with or without glucocorticoids), and warm sitz baths (Hollingshead and Phillips, 2016). Anoscopic intervention may also be used and involves injection sclerotherapy (5% phenol almond oil, aluminum potassium sulfate- tannic acid), rubber band ligation, cryosurgery, manual anal dilatation (Lord's procedure), the harmonic ultrasonic scalpel hemorrhoidectomy, infra-red photocoagulation, radiofrequency ablation, MPEC, and direct current electrocoagulation (Agbo, 2011; Tomiki et al., 2015). When recurrent mild hemorrhoidal bleeding and severe bleeding fail with a rubber band or some other endoscopic treatment, surgery is ultimately required (Agbo, 2011).

### 5.8. Anal fissures bleeding

An anal fissure defines a linear tear or ulcer of the lining mucosa of anus (Nelson et al., 2012). Anal fissures are one of the most prevalent perianal conditions presenting with bleeding, itching, and pain of varying severity (Gupta, 2005). The hematochezia is usually mild and is noticed with cleansing; infrequently, moderate to severe hematochezia may be seen. Treatment aims to heal the anal fissure, rather than using specific hemostasis techniques. Management of anal fissures begins with conservative treatment involving stool softeners, fiber supplementation, sitz baths, and topical lidocaine gel for pain relief (Gardner et al., 2020). Surgical treatment is preferred in chronic fissures. (Gardner et al., 2020).

### 5.9. Rectal variceal bleeding

Rectal varices are one of the portosystemic shunts that may be seen due to portal hypertension (Al Khalloufi and Laiyemo, 2015). Endoscopy is the main modality for diagnosing rectal varicose veins. They are seen as blue-tinted submucosal elevations located near the anus (Philips et al., 2016; Tajiri et al., 2010) The management of variceal rectal bleeding is like esophageal varices (Garcia-Tsao et al., 2007). Treatment of bleeding rectal varices mainly involves prophylactic antibiotic, vasoactive drugs such as vasopressin, terlipressin or octreotide, while endoscopic therapies (endoscopic injection sclerotherapy, endoscopic band ligation, cyanoacrylate injection), interventional radiology (transjugular intrahepatic portosystemic shunt placement, balloon-occluded retrograde transvenous obliteration). (Al Khalloufi and Laiyemo, 2015). Surgery may be considered for the management of rectal varices especially when endoscopic intervention has failed with sclerotherapy, band ligation, or a portosystemic shunt (Al Khalloufi and Laiyemo, 2015).

### 5.10. Rectal dieulafoy lesions bleeding

Dieulafoy's lesion, also known as "caliber persistent artery", is a rare cause of gastrointestinal hemorrhage (Jeon and Kim, 2015). It accounts for approximately 6% of gastrointestinal nonvariceal hemorrhages, and 1% to 2% of all acute gastrointestinal hemorrhages (Wang et al., 2017). Dieulafoy lesions bleeding in the rectum, can be treated successfully with endoscopic hemostasis such as regional injection therapy, thermal coagulation, mechanical therapy (hemostatic clipping, band ligation, OTSC, EUS-guided treatment) (Jeon and Kim, 2015; Wang et al., 2017).

### 5.11. Rectal ulcers bleeding

Acute Hemorrhagic Rectal Ulcer Syndrome (AHRUS) is defined as acute onset, painless, and massive bleeding from rectal ulcer(s) in subjects with serious underlying conditions (Tseng et al., 2004). The lesions typically lie 3- 10 cm superior to the dentate line, and lead to venous congestion, poor blood flow, and edema in the mucosal lining of the rectum, and ischemic changes causing ulceration (Komai et al., 2018). As elderly population and the survival of critically ill patients increase, the incidence of "acute hemorrhagic rectal ulcer syndrome" recently has been increasing in the whole world (Maneerattanaporn et al., 2012).

Clinical features of AHRUS patients include rectal hemorrhage, profuse mucus discharge, prolonged excessive straining, perineal and abdominal pain, feeling of incomplete emptying after defecation, constipation (Tseng et al., 2004). Most of the AHRU cases (88%) could be treated with endoscopy. Urgent endoscopy may be beneficial in the early diagnosis and proper management of AHRU patients because their prognosis relies on the accurate diagnosis and management of underlying diseases (Jung et al., 2017). The treatment of AHRU includes gauze tamponade, cauterization, pure ethanol injection, transanal suture ligation, visceral angiography, and, OTSC is recommended with hemoclips in the treatment of stigmatized large, hard ulcers.

### Conflict of interest

None.

### Acknowledgments

None.

### References

1. Agbo, S.P., 2011. Surgical management of hemorrhoids. J Surg Tech Case Rep. 3, 68-75.
2. Aigner, F., Gruber, H., Conrad, F., Eder, J., Wedel, T., Zelger, B., Engelhardt, V., Lametschwandtner, A., Wienert, V., Bohler, U., Margreiter, R., Fritsch, H., 2009. Revised morphology and hemodynamics of the anorectal vascular plexus: Impact on the course of hemorrhoidal disease. Int. J. Colorectal. Dis. 24, 105-113.
3. Al Khalloufi, K., Laiyemo, A.O., 2015. Management of rectal varices in portal hypertension. World J. Hepatol. 7, 2992-2998.
4. Anderloni, A., Jovani, M., Hassan, C., Repici, A., 2014. Advances, problems, and complications of polypectomy. Clin. Exp. Gastroenterol. 7, 285-296.
5. Aoki, T., Hirata, Y., Yamada, A., Koike, K., 2019. Initial management for acute lower gastrointestinal bleeding. World J. Gastroenterol. 25, 69-84.
6. Asge Technology, C., Conway, J.D., Adler, D.G., Diehl, D.L., Farraye, F.A., Kantsevoy, S.V., Kaul, V., Kethu, S.R., Kwon, R.S., Mamula, P., Rodriguez, S.A., Tierney, W.M., 2009. Endoscopic hemostatic devices. Gastrointest. Endosc. 69, 987-996.

**7.** Barnert, J., Messmann, H., 2009. Diagnosis and management of lower gastrointestinal bleeding. Nat. Rev. Gastroenterol. Hepatol. 6, 637-646.

**8.** Bloomfeld, R.S., Rockey, D.C., Shetzline, M.A., 2001. Endoscopic therapy of acute diverticular hemorrhage. Am. J. Gastroenterol. 96, 2367-2372.

**9.** Bregenzer, N., Messmann, H., Holstege, A., 2002. [Role of urgent colonoscopy in the diagnosis and treatment of severe diverticular bleeding. Z. Gastroenterol. 40, 483-485.

**10.** Brian West, A., 2006. The pathology of diverticulosis: classical concepts and mucosal changes in diverticula. J. Clin. Gastroenterol. 40 (3), 126-131.

**11.** Caos, A., Benner, K.G., Manier, J., McCarthy, D.M., Blessing, L.D., Katon, R.M., Gogel, H.K., 1986. Colonoscopy after Golytely preparation in acute rectal bleeding. J. Clin. Gastroenterol. 8, 46-49.

**12.** Carlo, P., Paolo, R.F., Carmelo, B., Salvatore, I., Giuseppe, A., Giacomo, B., Antonio, R., 2006. Colonoscopic evaluation of hematochezia in low and average risk patients for colorectal cancer: A prospective study. World. J. Gastroenterol. 12, 7304-7308.

**13.** Chavalitdhamrong, D., Jensen, D.M., Kovacs, T.O., Jutabha, R., Dulai, G., Ohning, G., Machicado, G.A., 2011. Ischemic colitis as a cause of severe hematochezia: risk factors and outcomes compared with other colon diagnoses. Gastrointest. Endosc. 74, 852-857.

**14.** Committee, A.S.o.P., Pasha, S.F., Shergill, A., Acosta, R.D., Chandrasekhara, V., Chathadi, K.V., Early, D., Evans, J.A., Fisher, D., Fonkalsrud, L., Hwang, J.H., Khashab, M.A., Lightdale, J.R., Muthusamy, V.R., Saltzman, J.R., Cash, B.D., 2014. The role of endoscopy in the patient with lower GI bleeding. Gastrointest. Endosc. 79, 875-885.

**15.** Cubiella Fernandez, J., Nunez Calvo, L., Gonzalez Vazquez, E., Garcia Garcia, M.J., Alves Perez, M.T., Martinez Silva, I., Fernandez Seara, J., 2010. Risk factors associated with the development of ischemic colitis. World. J. Gastroenterol. 16, 4564-4569.

**16.** Dam, H.Q., Brandon, D.C., Grantham, V.V., Hilson, A.J., Howarth, D.M., Maurer, A.H., Stabin, M.G., Tulchinsky, M., Ziessman, H.A., Zuckier, L.S., 2014. The SNMMI procedure standard/EANM practice guideline for gastrointestinal bleeding scintigraphy 2.0. J. Nucl. Med. Technol. 42, 308-317.

**17.** Davila, R.E., Rajan, E., Adler, D.G., Egan, J., Hirota, W.K., Leighton, J.A., Qureshi, W., Zuckerman, M.J., Fanelli, R., Wheeler-Harbaugh, J., Baron, T.H., Faigel, D.O., Standards of Practice, C., 2005. ASGE Guideline: the role of endoscopy in the patient with lower-GI bleeding. Gastrointest. Endosc. 62, 656-660.

**18.** Diggs, N.G., Holub, J.L., Lieberman, D.A., Eisen, G.M., Strate, L.L., 2011. Factors that contribute to blood loss in patients with colonic angiodysplasia from a population-based study. Clin. Gastroenterol. Hepatol. 9, 415-420; quiz e49.

**19.** Dimitrijevic, I., Micev, M., Saranovic, D., Markovic, V., Petrovic, J., Antic, S., Sekulic, A., Krivokapic, Z., 2008. Ischaemic colitis--review. Acta. Chir. Iugosl. 55, 89-95.

**20.** Do, N.L., Nagle, D., Poylin, V.Y., 2011. Radiation proctitis: current strategies in management. Gastroenterol. Res. Pract. 2011, 917941.

**21.** Farrell, J.J., Friedman, L.S., 2005. Review article: The management of lower gastrointestinal bleeding. Aliment. Pharmacol. Ther. 21, 1281-1298.

**22.** Ferguson, M.A., 2005. Office evaluation of rectal bleeding. Clin. Colon. Rectal. Surg. 18, 249-254.

**23.** Frost, J., Sheldon, F., Kurup, A., Disney, B.R., Latif, S., Ishaq, S., 2017. An approach to acute lower gastrointestinal bleeding. Frontline. Gastroenterol. 8, 174-182.

**24.** Garcia-Compean, D., Del Cueto-Aguilera, A.N., Jimenez-Rodriguez, A.R., Gonzalez-Gonzalez, J.A., Maldonado-Garza, H.J., 2019. Diagnostic and therapeutic challenges of gastrointestinal angiodysplasias: A critical review and viewpoints. World. J. Gastroenterol. 25, 2549-2564.

**25.** Garcia-Tsao, G., Sanyal, A.J., Grace, N.D., Carey, W., Practice Guidelines Committee of the American Association for the Study of Liver, D., Practice Parameters Committee of the American College of, G., 2007. Prevention and management of gastroesophageal varices and variceal hemorrhage in cirrhosis. Hepatology. 46, 922-938.

**26.** Gardner, I.H., Siddharthan, R.V., Tsikitis, V.L., 2020. Benign anorectal disease: hemorrhoids, fissures, and fistulas. Ann. Gastroenterol. 33, 9-18.

**27.** Ghassemi, K.A., Jensen, D.M., 2013. Lower GI bleeding: epidemiology and management. Curr. Gastroenterol. Rep. 15, 333.

**28.** Gifford, S.M., Peck, M.A., Reyes, A.M., Lundy, J.B., 2012. Methylene blue enteric mapping for intraoperative localization in obscure small bowel hemorrhage: report of a new technique and literature review: combined intraoperative methylene blue mapping and enterectomy. J. Gastrointest. Surg. 16, 2177-2181.

**29.** Green, B.T., Tendler, D.A., 2005. Ischemic colitis: a clinical review. South. Med. J. 98, 217-222.

**30.** Gupta, P.J., 2005. A review of conservative and surgical management of anal fissure. Acta. Gastroenterol. Belg. 68, 446-450.

**31.** Gutta, A., Gromski, M.A., 2020. Endoscopic Management of Post-Polypectomy Bleeding. Clin. Endosc. 53, 302-310.

**32.** Hassan, C., East, J., Radaelli, F., Spada, C., Benamouzig, R., Bisschops, R., Bretthauer, M., Dekker, E., Dinis-Ribeiro, M., Ferlitsch, M., Fuccio, L., Awadie, H., Gralnek, I., Jover, R., Kaminski, M.F., Pellise, M., Triantafyllou, K., Vanella, G., Mangas-Sanjuan, C., Frazzoni, L., Van Hooft, J.E., Dumonceau, J.M., 2019. Bowel preparation for colonoscopy: European Society of Gastrointestinal Endoscopy (ESGE) Guideline - Update 2019. Endoscopy. 51, 775-794.

**33.** Hollingshead, J.R., Phillips, R.K., 2016. Haemorrhoids: modern diagnosis and treatment. Postgrad. Med. J. 92, 4-8.

**34.** Hreinsson, J.P., Palsdottir, S., Bjornsson, E.S., 2016. The association of drugs with severity and specific causes of acute lower gastrointestinal bleeding: A Prospective Study. J. Clin. Gastroenterol. 50, 408-413.

**35.** Iwamoto, J., Mizokami, Y., Shimokobe, K., Matsuoka, T., Matsuzaki, Y., 2008. Therapeutic barium enema for bleeding colonic diverticula: Four case series and review of the literature. World. J. Gastroenterol. 14, 6413-6417.

**36.** Jensen, D.M., Machicado, G.A., 1988. Diagnosis and treatment of severe hematochezia. The role of urgent colonoscopy after purge. Gastroenterology. 95, 1569-1574.

**37.** Jensen, D.M., Machicado, G.A., Jutabha, R., Kovacs, T.O., 2000. Urgent colonoscopy for the diagnosis and treatment of severe diverticular hemorrhage. N. Engl. J. Med. 342, 78-82.

**38.** Jensen, D.M., 2018. Diagnosis and treatment of definitive diverticular hemorrhage (DDH). Am. J. Gastroenterol. 113, 1570-1573.

**39.** Jeon, H.K., Kim, G.H., 2015. Endoscopic Management of Dieulafoy's Lesion. Clin Endosc. 48, 112-120.

**40.** Jung, J.H., Kim, J.W., Lee, H.W., Park, M.Y., Paik, W.H., Bae, W.K., Kim, N.H., Kim, K.A., Lee, J.S., 2017. Acute hemorrhagic rectal ulcer syndrome: Comparison with non-hemorrhagic rectal ulcer lower gastrointestinal bleeding. J. Dig. Dis. 18, 521-528.

**41.** Kato, M., 2019. Endoscopic Therapy for Acute Diverticular Bleeding. Clin. Endosc. 52, 419-425.

**42.** Kennedy, G.D., Heise, C.P., 2007. Radiation colitis and proctitis. Clin. Colon. Rectal. Surg. 20, 64-72.

**43.** Khan, A.U., Mandiga, P., 2020. Gastrointestinal Bleeding Scan. In StatPearls. Vol., ed.^eds., Treasure Island (FL).

**44.** Kim, B.S., Li, B.T., Engel, A., Samra, J.S., Clarke, S., Norton, I.D., Li, A.E., 2014. Diagnosis of gastrointestinal bleeding: A practical guide for clinicians. World. J. Gastrointest. Pathophysiol. 5, 467-478.

**45.** Kim, D.H., Lim, S.W., 2011. Analysis of delayed postpolypectomy bleeding in a colorectal clinic. J. Korean. Soc. Coloproctol. 27, 13-16.

**46.** Kim, H.S., 2011. Delayed postpolypectomy bleeding. J. Korean. Soc. Coloproctol. 27, 3.

**47.** Kim, J.H., Lee, H.J., Ahn, J.W., Cheung, D.Y., Kim, J.I., Park, S.H., Kim, J.K., 2013. Risk factors for delayed post-polypectomy hemorrhage: A case-control study. J. Gastroenterol. Hepatol. 28, 645-649.

**48.** Kishino, T., Kanemasa, K., Kitamura, Y., Fukumoto, K., Okamoto, N., Shimokobe, H., 2020. Usefulness of direct clipping for the bleeding source of colonic diverticular hemorrhage (with videos). Endosc. Int Open. 8, E377-E385.

**49.** Komai, T., Omata, F., Shiratori, Y., Kobayashi, D., Arioka, H., 2018. Risk Factors for Acute Hemorrhagic Rectal Ulcer Syndrome and Its Prognosis: A Density Case-Control Study. Gastroenterol Res. Pract. 2018, 8179890.

**50.** Krebs, E.D., Zhang, A.Y., Hassinger, T.E., Suraju, M.O., Berry, P.S., Hoang, S.C., Hedrick, T.L., Friel, C.M., 2020. Preoperative bleeding requiring transfusion: An under-reported indication for hemorrhoidectomy. Am. J. Surg. 220, 428-431.

**51.** Laine, L., Shah, A., 2010. Randomized trial of urgent vs. elective colonoscopy in patients hospitalized with lower GI bleeding. Am. J. Gastroenterol. 105, 2636-2641; quiz 2642.

**52.** Laine, L., Yang, H., Chang, S.C., Datto, C., 2012. Trends for incidence of hospitalization and death due to GI complications in the United States from 2001 to 2009. Am J Gastroenterol. 107, 1190-1195; quiz 1196.

**53.** Lewis, M., Ndsg, 2008. Bleeding colonic diverticula. J. Clin. Gastroenterol. 42, 1156-1158.

**54.** Lhewa, D.Y., Strate, L.L., 2012. Pros and cons of colonoscopy in management of acute lower gastrointestinal bleeding. World. J. Gastroenterol. 18, 1185-1190.

**55.** Lohsiriwat, V., 2013. Approach to hemorrhoids. Curr. Gastroenterol Rep. 15, 332.

**56.** Longstreth, G.F., 1995. Epidemiology of hospitalization for acute upper gastrointestinal hemorrhage: A population-based study. Am. J. Gastroenterol. 90, 206-210.

**57.** Lv, L.S., Gu, J.T., 2019. Super-selective arterial embolization in the control of acute lower gastrointestinal hemorrhage. World. J. Clin. Cases. 7, 3728-3733.

**58.** Ma, M.X., Bourke, M.J., 2016. Complications of endoscopic polypectomy, endoscopic mucosal resection and endoscopic submucosal dissection in the colon. Best Pract. Res. Clin. Gastroenterol. 30, 749-767.

**59.** Maneerattanaporn, M., Pongpaibul, A., Pongprasobchai, S., Kachintorn, U., Manatsathit, S., 2012. Acute hemorrhagic rectal ulcer syndrome: the first case series from Thailand. J. Med. Assoc. Thai. 95 Suppl 2, S48-55.

**60.** Maykel, J.A., Opelka, F.G., 2004. Colonic diverticulosis and diverticular hemorrhage. Clin. Colon. Rectal. Surg. 17, 195-204.

**61.** Mohammed Ilyas, M.I., Szilagy, E.J., 2018. Management of diverticular bleeding: Evaluation, stabilization, intervention, and recurrence of bleeding and indications for resection after control of bleeding. Clin. Colon. Rectal. Surg. 31, 243-250.

**62.** Mortimer, A.M., Wallis, A., Planner, A., 2011. Multiphase multidetector CT in the diagnosis of haemobilia: A potentially catastrophic ruptured hepatic artery aneurysm complicating the treatment of a patient with locally advanced rectal cancer. Br. J. Radiol. 84, e95-e98.

**63.** Nagata, N., Ishii, N., Manabe, N., Tomizawa, K., Urita, Y., Funabiki, T., Fujimori, S., Kaise, M., 2019. Guidelines for Colonic Diverticular Bleeding and Colonic Diverticulitis: Japan Gastroenterological Association. Digestion. 99 (1), 1-26.

**64.** Navaneethan, U., Giannella, R.A., 2011. Infectious colitis. Curr. Opin. Gastroenterol. 27, 66-71.

**65.** Nelson, R.L., Thomas, K., Morgan, J., Jones, A., 2012. Non-surgical therapy for anal fissure. Cochrane Database Syst. Rev. CD003431.

**66.** Niikura, R., Nagata, N., Yamada, A., Doyama, H., Shiratori, Y., Nishida, T., Kiyotoki, S., Yada, T., Fujita, T., Sumiyoshi, T., Hasatani, K., Mikami, T., Honda, T., Mabe, K., Hara, K., Yamamoto, K., 2018. A multicenter, randomized controlled trial comparing the identification rate of stigmata of recent hemorrhage and rebleeding rate between early and elective colonoscopy in outpatient-onset acute lower gastrointestinal bleeding: study protocol for a randomized controlled trial. Trials. 19, 214.

**67.** Oakland, K., 2019. Changing epidemiology and etiology of upper and lower gastrointestinal bleeding. Best Pract. Res. Clin. Gastroenterol. 42-43, 101610.

**68.** Oakland, K., Chadwick, G., East, J.E., Guy, R., Humphries, A., Jairath, V., McPherson, S., Metzner, M., Morris, A.J., Murphy, M.F., Tham, T., Uberoi, R., Veitch, A.M., Wheeler, J., Regan, C., Hoare, J., 2019. Diagnosis and management of acute lower gastrointestinal bleeding: guidelines from the British Society of Gastroenterology. Gut. 68, 776-789.

**69.** Papagrigoriadis, S., Arunkumar, I., Koreli, A., Corbett, W.A., 2004. Evaluation of flexible sigmoidoscopy as an investigation for "left sided" colorectal symptoms. Postgrad. Med. J. 80, 104-106.

**70.** Philips, C.A., Arora, A., Shetty, R., Kasana, V., 2016. A Comprehensive Review of Portosystemic Collaterals in Cirrhosis: Historical Aspects, Anatomy, and Classifications. Int. J. Hepatol. 2016, 6170243.

**71.** Raju, G.S., Kaltenbach, T., Soetikno, R., 2007. Endoscopic mechanical hemostasis of GI arterial bleeding (with videos). Gastrointest. Endosc. 66, 774-785.

**72.** Rasuli, P., Doumit, J., Boulos, M., Rizk, C., Doumit, G., 2014. Factors influencing the yield of mesenteric angiography in lower gastrointestinal bleed. World. J. Radiol. 6, 218-222.

**73.** Riss, S., Weiser, F.A., Riss, T., Schwameis, K., Mittlbock, M., Stift, A., 2011. Haemorrhoids and quality of life. Colorectal. Dis.

13, e48-e52.

**74.** Rustagi, T., McCarty, T.R., 2014. Endoscopic management of diverticular bleeding. Gastroenterol. Res. Pract. 2014, 353508.

**75.** Salsano, A., Salsano, G., Spinella, G., Palombo, D., Santini, F., 2018. Acute Mesenteric Ischemia: Have the Guidelines of the World Society of Emergency Surgery Analyzed All the Available Evidence? Cardiovasc. Intervent. Radiol. 41, 358-359.

**76.** Schieffer, K.M., Kline, B.P., Yochum, G.S., Koltun, W.A., 2018. Pathophysiology of diverticular disease. Expert. Rev. Gastroenterol. Hepatol. 12, 683-692.

**77.** Schmulewitz, N., Fisher, D.A., Rockey, D.C., 2003. Early colonoscopy for acute lower GI bleeding predicts shorter hospital stay: a retrospective study of experience in a single center. Gastrointest. Endosc. 58, 841-846.

**78.** Strate, L.L., 2005. Lower GI bleeding: epidemiology and diagnosis. Gastroenterol. Clin. North. Am. 34, 643-664.

**79.** Strate, L.L., Gralnek, I.M., 2016a. ACG Clinical Guideline: Management of patients with acute lower gastrointestinal bleeding. Am. J. Gastroenterol. 111, 459-474.

**80.** Strate, L.L., Gralnek, I.M., 2016b. ACG Clinical Guideline: Management of patients with acute lower gastrointestinal bleeding. Am. J. Gastroenterol. 111, 755.

**81.** Tadros, M., Majumder, S., Birk, J.W., 2013. A review of ischemic colitis: is our clinical recognition and management adequate? Expert. Rev. Gastroenterol. Hepatol. 7, 605-13.

**82.** Tajiri, T., Yoshida, H., Obara, K., Onji, M., Kage, M., Kitano, S., Kokudo, N., Kokubu, S., Sakaida, I., Sata, M., Tajiri, H., Tsukada, K., Nonami, T., Hashizume, M., Hirota, S., Murashima, N., Moriyasu, F., Saigenji, K., Makuuchi, H., Oho, K., Yoshida, T., Suzuki, H., Hasumi, A., Okita, K., Futagawa, S., Idezuki, Y., 2010. General rules for recording endoscopic findings of esophagogastric varices (2nd edition). Dig. Endosc. 22, 1-9.

**83.** Tomiki, Y., Ono, S., Aoki, J., Takahashi, R., Ishiyama, S., Sugimoto, K., Yaginuma, Y., Kojima, Y., Goto, M., Okuzawa, A., Sakamoto, K., 2015. Treatment of Internal Hemorrhoids by Endoscopic Sclerotherapy with Aluminum Potassium Sulfate and Tannic Acid. Diagn. Ther. Endosc. 2015, 517690.

**84.** Tseng, C.A., Chen, L.T., Tsai, K.B., Su, Y.C., Wu, D.C., Jan, C.M., Wang, W.M., Pan, Y.S., 2004. Acute hemorrhagic rectal ulcer syndrome: a new clinical entity? Report of 19 cases and review of the literature. Dis. Colon Rectum. 47, 895-903.

**85.** Velayos, F.S., Williamson, A., Sousa, K.H., Lung, E., Bostrom, A., Weber, E.J., Ostroff, J.W., Terdiman, J.P., 2004. Early predictors of severe lower gastrointestinal bleeding and adverse outcomes: a prospective study. Clin. Gastroenterol. Hepatol. 2, 485-490.

**86.** Violi, A., Cambie, G., Miraglia, C., Barchi, A., Nouvenne, A., Capasso, M., Leandro, G., Meschi, T., De' Angelis, G.L., Di Mario, F., 2018. Epidemiology and risk factors for diverticular disease. Acta. Biomed. 89, 107-112.

**87.** Wang, M., Bu, X., Zhang, J., Zhu, S., Zheng, Y., Tantai, X., Ma, S., 2017. Dieulafoy's lesion of the rectum: A case report and review of the literature. Endosc. Int. Open. 5, E939-E942.

**88.** Washington, C., Carmichael, J.C., 2012. Management of ischemic colitis. Clin. Colon. Rectal Surg. 25, 228-235.

**89.** Wedel, T., Barrenschee, M., Lange, C., Cossais, F., Bottner, M., 2015. Morphologic Basis for Developing Diverticular Disease, Diverticulitis, and Diverticular Bleeding. Viszeralmedizin. 31, 76-82.

**90.** Wells, M.L., Hansel, S.L., Bruining, D.H., Fletcher, J.G., Froemming, A.T., Barlow, J.M., Fidler, J.L., 2018. CT for Evaluation of Acute Gastrointestinal Bleeding. Radiographics. 38, 1089-1107.

**91.** hitehurst, B.D., 2018. Lower Gastrointestinal Bleeding. Surg. Clin. North. Am. 98, 1059-1072.

**92.** Wilkins, T., Baird, C., Pearson, A.N., Schade, R.R., 2009. Diverticular bleeding. Am. Fam. Physician. 80, 977-983.

**93.** Wortman, J.R., Landman, W., Fulwadhva, U.P., Viscomi, S.G., Sodickson, A.D., 2017. CT angiography for acute gastrointestinal bleeding: what the radiologist needs to know. Br. J. Radiol. 90, 20170076.

**94.** Yi, W.S., Vegeler, R., Hoang, K., Rudnick, N., Sava, J.A., 2012. Watch and wait: conservative management of lower gastrointestinal bleeding. J. Surg. Res. 177, 315-319.

**95.** Yoon, W., Jeong, Y.Y., Shin, S.S., Lim, H.S., Song, S.G., Jang, N.G., Kim, J.K., Kang, H.K., 2006. Acute massive gastrointestinal bleeding: detection and localization with arterial phase multi-detector row helical CT. Radiology. 239, 160-167.